



INDIANA COMMISSION *for*  
HIGHER EDUCATION

# Transfer Single Articulation Pathways (TSAPs)

THIRD ROUND - 2018



# INDIANA COMMISSION *for* HIGHER EDUCATION

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## INDIANA COMMISSION *for* HIGHER EDUCATION

### Introduction

In 2013 the Indiana legislature enacted Senate Enrolled Act 182, thereby establishing the requirements for a Statewide Transfer General Education Core (STGEC) of at least 30 credit hours. The statute states that each educational institution, in collaboration with the Commission for Higher Education, shall, no later than July 1, 2014, work together to create a single articulation pathway for each programmatic area and implement the single articulation pathways no later than May 15, 2015, for students entering state educational institutions in the fall of 2015. The areas for development must be in those which significant numbers of students first achieve an associate of science or an associate of arts degree with the intent of obtaining a related baccalaureate degree.

The degrees that constitute the breadth of the Transfer Single Articulation Pathways (TSAP) are a limited number of the degree programs and articulations between the public 2-year and public 4-year institutions. While the TSAPs have certain guarantees for students who complete the associate degree at the public 2-year institution and who are admitted to the corresponding baccalaureate degree program at a public 4-year campus, the student should be aware of the array of transferrable degrees that are available to them.

TSAPs are competency-based degree tracks designed to promote seamless transfer from a public 2-year to a public 4-year degree program. However, successfully completing a public 2-year TSAP degree track is neither a guarantee of admission to a public 4-year institution nor a guarantee of admission to an aligned degree program and the public 4-year institution, since individual public 4-year degree program requirements are not covered by the TSAP agreements. Students are responsible for working with advisors of the public 4-year program into which they hope to transfer and with their public 2-year advisors in order to increase their chances for successful transfer.

The following TSAPs are available for students in fall 2018:

1. Secondary Education – Biology
2. Secondary Education – Math



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# Secondary Education - Biology

## TSAP

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**Secondary Education: Biology Faculty Panel**

**02.02.2018**

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INDIANA COMMISSION *for*  
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**Pathway: Secondary Education Biology**

**Approved: 9.14.2018**

**Preamble:**

The courses mapped for this Transfer Single Articulation Pathway (TSAP) associate's degree are based upon a set of competencies agreed upon across all of the public institutions and are the minimum competencies for transfer in this major.

After a statewide review process, some four-year universities may have specific competencies required that are not included in this mapping and **may limit the admission options for TSAP students**. To increase the likelihood of student success, TSAP advisors in the two-year programs are encouraged to contact the academic advising offices in the major area of the TSAPs at the four-year institutions to discuss the minimum criteria for admission.

It is important that individual students review the published TSAP admission criteria at the specific university/campus to which they wish to transfer. This should be done at the beginning of their enrollment as a TSAP student at either Ivy Tech or Vincennes University. Understanding admission and degree requirements will facilitate student success. The universities in the state of Indiana are committed to the success of TSAP students, and student success is a three-way partnership among students and the academic advisors at both institutions.

A lack of communication after students enroll in a TSAP could result in a misunderstanding of the admission requirements to a specific four-year institution and/or TSAP program, such as minimum grades, specific course sequences, etc., and such misunderstanding could affect the time to graduation.

To be eligible, a student must:

- Have met the TSAP and STGEC eligibility guidelines as defined by Indiana Code
- Have graduated with the TSAP associate degree,
- Have met all the admission requirements (e.g., minimum GPA, minimum course grades, etc.) of the TSAP program at the 4-year institution, and
- Have been admitted to the campus AND into the degree program as a TSAP student.



### **Required Major-Specific Content Areas**

This agreement requires that any Associates Degree must include competencies from four primary content areas:

#### **1. Secondary Education Competency Areas**

- A. Adolescent Development
- B. Instructional Technology
- C. Diversity/Multicultural Issues
- D. Roles and Responsibilities of Educators
- E. Educational Learning Theory
- F. History and Philosophy of Education
- G. Clinical Experiences

(See section 9: For a comprehensive description of the Secondary Education Competencies and Learning Outcomes)

*Example of core education courses that a TSAP student would take at Ivy Tech Community College:*

1. EDUC 101 Introduction to Education – 3 credits
2. EDUC 121 Child and Adolescent Development – 3 credits
3. EDUC 255 Multicultural Education – 3 credits
4. EDUC 250 Educational Psychology (includes capstone) – 3 credits
5. EDUC 201 Educational Technology – 2 credits

#### **2. Biology – Four Semesters of Classes**

##### **A. Introductory Biology – Two Semesters**

1. Students must meet the lecture and laboratory competencies covered in a two semester sequence of Introductory Biology for science majors.
2. See Section 1: Introductory Biology Competencies

##### **B. Program-Specific Content Areas – Two Semesters**

1. Students must take Molecular Biology and meet the lecture and laboratory Competencies in one of the two remaining areas:
  - Molecular Biology: See Section 2: Molecular Biology Competencies
  - Genetics: See Section 3: Genetics Competencies
  - Ecology: See Section 4: Ecology Competencies



**3. Physical Science (Chemistry & Physics) – Three Semesters of Classes. Students must complete section A and either section B or C of the three sections below.**

A. General Chemistry – Two Semesters

1. Students must meet the lecture and laboratory competencies covered in a two semester sequence of General Chemistry for science majors.
2. See Section 5: General Chemistry Competencies

B. Organic Chemistry – One Semester

1. Students must meet the lecture and laboratory competencies covered in the first semester of a two-semester sequence of Organic Chemistry for science majors.
2. See Section 6: Organic Chemistry Competencies

C. General Physics – One Semester

1. Students must meet the lecture and laboratory competencies covered in the first semester of a two-semester sequence of Algebra-based, General Physics for science majors.
2. See Section 7: General Physics Competencies

**4. Mathematics – One Semester of Class**

- A. Students must meet or exceed the lecture competencies covered in General Calculus I. See Section 8: General Calculus I Competencies



The competencies and outcomes established below should be met at the associate level so that students who graduate with the TSAP associate degree will be prepared to begin work at the upper level of the baccalaureate program (this does not restrict lower level coursework from being completed at the four-years when necessary).

## **Section 1. Introductory Biology Competencies and Learning Outcomes**

### **1.1: *Scientific investigation***

- 1.1. a. Define, describe, and implement the scientific method.
- 1.1. b. Describe implications of scientific or technological developments on ethical questions in biology.

### **1.2: *Basic biochemistry***

- 1.2. a. Describe the fundamental properties of water in biological systems.
- 1.2. b. Describe the four major biomolecules: carbohydrate, lipid, nucleic acid, and protein, and explain their functions and importance in biological systems.
- 1.2. c. Draw and describe basic synthesis and degradation reactions of the four major biomolecules.
- 1.2. d. Describe basic enzyme structure and function.
- 1.2. e. Describe how biological systems are constrained by chemical and physical processes.

### **1.3: *Cell structure and function***

- 1.3. a. Describe the basic structure of a cell and define the functions of the organelles.
- 1.3. b. Describe the fluid mosaic model structure of biological membranes and the relationships between the membranes, the cytoskeleton, and the extracellular matrix.
- 1.3. c. Describe the functions of biological membranes, including transport, signal transduction, cell-cell recognition, enzymatic activity, and intercellular joining.
- 1.3. d. Explain the biochemistry of and factors involved in membrane transport.
- 1.3. e. Describe the transfer of molecules within a cell and between cells.
- 1.3. f. Describe the difference between prokaryotic and eukaryotic cell structure.
- 1.3. g. Describe the structure and function of chromosomes and their role in cell division.
- 1.3. h. Explain the concept of the cell cycle, how it is controlled, and how it relates to cell division.
- 1.3. i. Describe and differentiate between the mechanisms of mitosis and meiosis.



1.3. j. Explain the concepts of independent assortment, crossing over, and random fertilization, and relate these to the production of genetic variation within a population.

**1.4: *Energy transfer within biological systems***

- 1.4. a. Explain the first and second laws of thermodynamics.
- 1.4. b. Explain the concept of free energy.
- 1.4. c. Define chemical reaction and contrast exergonic and endergonic reactions.
- 1.4. d. Explain the concepts of oxidation and reduction.
- 1.4. e. Describe the structure of ATP and explain how it powers cellular work.
- 1.4. f. Describe the processes of glycolysis, the citric acid cycle, and electron transport.
- 1.4. g. Describe the processes of anaerobic respiration/fermentation.
- 1.4. h. Describe the steps of the light dependent and light independent reactions of photosynthesis.
- 1.4.i. Discuss the role and molecular details of photosystems and light-harvesting pigments.
- 1.4.j. Discuss the role of CO<sub>2</sub> metabolism during photosynthesis.

**1.5: *Introduction to molecular genetics***

- 1.5. a. Explain the processes controlling gene expression: gene regulation, transcription, and translation.
- 1.5. b. Describe the process of DNA replication in prokaryotes and eukaryotes.
- 1.5. c. Describe the concept of mutation and explain the various kinds of mutations.

**1.6: *Basic principles of inheritance***

- 1.6. a. Explain Mendelian genetics and the expression of traits through the solution of simple monohybrid and dihybrid genetics problems.
- 1.6. b. Explain the concepts of complete dominance, incomplete dominance, codominance, multiple alleles, pleiotropy, epistasis, and polygenic inheritance.

**1.7: *Evolution and natural selection***

- 1.7. a. Describe the sources of genetic variation within a population and explain why variation is essential for evolution.
- 1.7. b. Describe and apply the postulates of Darwin's theory of evolution through natural selection.
- 1.7. c. Define evolution and natural selection, mutation, sexual selection, gene flow, and genetic drift.
- 1.7. d. Explain the basic principles of population genetics.



- 1.7. e. Discuss the biological, ecological, morphological, and phylogenetic species concepts, as well as reproductive isolation mechanisms and the process of speciation.
- 1.7. f. Explain some of the mechanisms behind different scientific hypotheses concerning the origin of life forms.
- 1.7. g. Explain endosymbiosis and the origin of eukaryotic cells.
- 1.7. h. Discuss the advantages and disadvantages of multicellularity.
- 1.7. i. Describe the various lines of evidence for evolution, including DNA and other molecular data, morphology and anatomy, developmental biology, biogeography, fossils, and radiometric dating.

**1.8: *Hierarchical organization of life***

- 1.8. a. Describe the methods used in the classification of organisms.
- 1.8. b. Explain how phylogenetic trees are constructed.
- 1.8. c. Describe the principal characteristics of the major taxa such as Domains/Kingdoms.
- 1.8. d. Describe basic ecological concepts in regards to the hierarchical organization of life.

**1.9: *Unity and diversity of life***

- 1.9.a. Describe the use of evolutionary theory in explaining the unity and diversity of life.
- 1.9. b. Describe the use of genetic evidence to establish evolutionary relationships between organisms.
- 1.9. c. Describe the key characteristics and groups of viruses.
- 1.9. d. Describe the biological diversity of plants, animals, fungi, protists, and prokaryotes at the levels of genes, cells, organs, individuals, and populations.
- 1.9.e. Discuss the key distinguishing features of the prokaryotic domains, Archaea and Eubacteria, including similarities and differences in organisms from various taxonomic groups.
- 1.9.f. Discuss the key distinguishing features of the eukaryotic clades, including similarities and differences in organisms from various taxonomic groups.
- 1.9. g. Discuss the key distinguishing features, including similarities and differences, between major groups of Protist clades.
- 1.9. h. Discuss the key distinguishing features, including similarities and differences, between major groups of fungal phyla, including morphology and reproductive biology.
- 1.9.i. Discuss the key distinguishing features, including similarities and differences, between plant taxa from bryophytes to angiosperms, including morphology, plant anatomy, plant development, and reproductive biology.

**1.10: *Anatomy and physiology of plants***

- 1.10. a. Describe and recognize plant cellular and subcellular structures.
- 1.10. b. Describe basic comparative plant anatomy and morphology.
- 1.10. c. Describe the characteristics and roles of plant cells and tissues.



- 1.10. d. Describe and recognize modes of plant reproduction and dispersal.
- 1.10. e. Describe the mechanism and pathways involved in the transport of water, minerals, and nutrients in plants.
- 1.10. f. Describe basic soil characteristics and plant mineral nutrition.
- 1.10. g. Describe the basic developmental processes in plants and the roles of plant hormones in growth and development.

**1.11 : *Anatomy and physiology of animals***

- 1.11. a. Describe the characteristics and roles of epithelium, muscle, connective, and nervous tissue.
- 1.11. b. Describe examples of homeostatic mechanisms and their regulation.
- 1.11. c. Describe examples of invertebrate and vertebrate physiological systems.
- 1.11. d. Describe and recognize a range of structures of invertebrate and vertebrate physiological systems, including but not limited to: exo- and endo-skeletal systems; the structure of skeletal muscle, the structure and function of a sarcomere, and the structure and interaction of actin and myosin myofilaments during relaxation and contraction; the structures and mechanisms involved in nervous signal transmission; the structures and functions of the endocrine system; the structures of the reproductive system; and how hormones affect cells and how cells regulate hormone reception and the response.

**1.12 : *Ecology***

- 1.12. a. Describe the meaning and importance of ecology.
- 1.12. b. Describe the components of the biosphere.
- 1.12. c. Examine the role of physiological ecology in an organism's success.
- 1.12. d. Explain the basic principles of population ecology.
- 1.12. e. Describe several community-level interactions such as competition, predation/herbivory, and symbiosis.
- 1.12. f. Explain the characteristics and functions of ecosystems.
- 1.12. g. Apply knowledge of ecology to environmental and conservation problems.

**1.13 : *Laboratory skills***

- 1.13. a. Develop, implement, and evaluate an experimental problem through data collection and analysis.
- 1.13. b. Properly use a microscope, balance, pipette, micropipettes, and other basic laboratory equipment.
- 1.13. c. Demonstrate the use of basic computer applications such as Excel for creating graphs and running simple statistical analyses.



- 1.13. d. Demonstrate the proper technique for weighing and measuring materials using the metric system.
- 1.13. e. Calculate concentrations and convert units.
- 1.13. f. Demonstrate familiarity with basic biochemical analysis for organic molecule identification.
- 1.13. g. Demonstrate the use of spectrophotometric assays for various applications.
- 1.13. h. Write scientific reports, with graphical presentation of data (technical writing skills) using appropriate scientific language.
- 1.13. i. Present scientific information orally, with graphical presentation of data using appropriate presentation technology.

**1.14 : *Scientific literature***

- 1.14. a. Locate and critically evaluate scientific information.
- 1.14. b. Write literature reviews.



## Section 2. Molecular Biology Competencies

### 2.1: *Introduction to molecular biology*

- 2.1.a. Discuss the history and logic of molecular biology.
- 2.1. b. Discuss the similarities and differences between molecular biology, biochemistry, and genetics.
- 2.1. c. Identify applications of molecular biology in a variety of fields.
- 2.1. d. Discuss examples of standard model systems (phage, *Escherichia coli*, yeast, cultured cells) and why you would use them.

### 2.2: *Protein structure/function*

- 2.2.a. Define the structure of an amino acid as well as net charge at physiological pH.
- 2.2. b. Identify categories of amino acid side groups (hydrophobic, polar, charged) and which amino acids are in each category.
- 2.2. c. Apply pKa to terminal groups and side groups on amino acids.
- 2.2. d. Identify special amino acid properties (cysteine, proline).
- 2.2.e. Describe the 1°, 2°, 3°, and 4° structure of proteins.
- 2.2.f. Compare biochemical and functional definitions of protein domains.
- 2.2.g. Understand the role post-translational modifications have on protein function such a proteolytic cleavage, phosphorylation by kinases, dephosphorylation by phosphatases, ubiquitination and glycosylation.
- 2.2.h. Understand how allosteric regulation, competitive inhibition and cofactors are important for protein function and regulation.

### 2.3: *Nucleic acid structure/function*

- 2.3.a. Explain nucleotide base-pairing rules and why only certain base pairs are possible.
- 2.3. b. Describe why the double helix is thermodynamically favored.
- 2.3. c. Examine properties of DNA and RNA in solution.
- 2.3. d. Examine base composition and base distribution.
- 2.3.e. Discuss the ways to denature DNA and why they cause strands to dissociate; describe A, B, and Z helices.
- 2.3.f. Examine hybridization kinetics, including C0t curves, dependence of Tm on sequence, and how to read a C0t curve.



**2.4: Evidence for DNA as the genetic material**

- 2.4.a. Discuss the tetranucleotide model for the structure of DNA and the importance of data or evidence in scientific reasoning.
- 2.4. b. Understand the significance of the experiments of Griffith and Avery, Chargaff, and Hershey and Chase in how they relate to DNA's secondary structure and its role as the genetic material.
- 2.4. c. Describe and identify DNA structures including chromatin and chromosomes, linear vs circular DNA, positive and negative supercoiling, DNA gyrase and Topo II, and behavior of DNA of different topologies in gel electrophoresis.

**2.5: DNA replication**

- 2.5.a. Describe how the Meselson-Stahl experiment relates to semi-conservative replication.
- 2.5. b. Discuss the role of Okazaki experiments, leading and lagging strands, and requirements for DNA polymerase activity.
- 2.5. c. Discuss the roles of helicase, supercoiling, and the need for gyrase/topoisomerase II as well as single-strand binding proteins.
- 2.5. d. Examine the mechanism of proofreading, 5' → 3' exo/nick translation, strand displacement, and differences between DNA pol I and DNA pol III.
- 2.5.e. Discuss the roles of origins of replication and origin binding proteins, primase and primers, primer removal, and ligase.
- 2.5.f. Discuss the differences between prokaryotic and eukaryotic DNA replication.
- 2.5. g. Describe the function of telomerase.

**2.6: Transcription**

- 2.6.a. Compare and contrast the similarities and differences between DNA replication and transcription.
- 2.6. b. Understand promoters and terminators, sigma factor and prokaryotic RNA polymerase, TATA boxes and -35/Pribnow boxes, formation of an open complex, elongation, and termination.
- 2.6. c. Compare and contrast the 3 RNA polymerases in eukaryotes and which classes of RNA molecules each transcribes.
- 2.6. d. Describe TFIID transcription factors, what each one does, and the order in which they bind to a promoter/assembly of a basal transcription initiation complex for RNA pol II.
- 2.6.e. Describe the activation of RNA pol II and the switch from initiation to elongation; lack of specificity in termination in eukaryotes; and the role of transcription factors, silencers, and enhancers.
- 2.6.f. Describe the processing of tRNA, rRNA, and mRNA.



**2.7: Translation**

- 2.7.a. Understand the genetic code and how to read a codon table.
- 2.7. b. Describe the structure of tRNAs, including charging/aminoacyl-tRNA synthetase.
- 2.7. c. Describe the structure of a ribosome, including ribosome binding sites.
- 2.7. d. Discuss translation initiation, A and P sites and the peptidyltransferase reaction, release factor and termination, and polycistronic vs monocistronic mRNAs.
- 2.7. e. Describe translation: protein processing, EF-Tu and the "proof-reading" function in translation, energetics of translation, and polysomes.

**2.8: Mutagenesis**

- 2.8.a. Describe types of mutations, including: single base substitutions, frameshifts caused by insertions and deletions, silent mutations, point mutations, nonsense mutations, spontaneous deamination of cytosine, spontaneous depurination, thymine dimers, and base tautomerization.
- 2.8. b. Discuss types of mutagens and how they cause mutations.
- 2.8. c. Explain mechanisms of reversion and repair.

**2.9: Gene regulation in prokaryotes**

- 2.9.a. Compare and contrast positive and negative regulation and the role of an inducer.
- 2.9. b. Understand regulation of the *lac* operon, the *lac* repressor, and the concept of allosteric regulation.
- 2.9. c. Understand the *trp* operon regulation at the levels of transcription initiation and attenuation.

**2.10: Gene regulation in eukaryotes**

- 2.10.a. Describe histones and their interaction with DNA, understand basic structure of a nucleosome, compare and contrast heterochromatin and euchromatin, and discuss the general role of histone modification in regulation of gene expression.
- 2.10. b. Discuss higher-order packing of eukaryotic DNA, including the structure and function of centromeres and telomeres.
- 2.10. c. Describe transcriptional regulation in the context of heterochromatin, euchromatin, histone modifications, and chromatin structure.
- 2.10. d. Understand HDACs, cancer, hypermethylation of promoters, and transcribability.
- 2.10. e. Describe types of eukaryotic transcription factors (Zn fingers, homeobox genes, basic-helix-loop-helix proteins) and the importance of relative concentration and relative affinity of multiple factors.
- 2.10. f. Explain mechanisms of post-transcriptional regulation including alternative splicing and the effects of different splice variants.



**2.11 : *Biotechnology***

- 2.11. a. Demonstrate an understanding of current applications in biotechnology, such as recombinant and transgenic methods in plants, animals, and microorganisms.
- 2.11. b. Describe the role of selectable markers, DNA ligase, and transformation in recombinant DNA experiments.
- 2.11. c. Describe recombinant DNA techniques and their uses, including Southern blot, Northern blot, Western blot, in situ hybridization, Sanger sequencing, PCR, and site directed mutagenesis.

**2.12 : *Molecular techniques***

- 2.12.a. Describe basic molecular biological techniques, including chromatography and electrophoresis, and explain how size, shape, and charge play a role.
- 2.12. b. Explain acrylamide electrophoresis of proteins, including denaturing vs non-denaturing gels.
- 2.12. c. Describe isoelectric focusing and 2-D gels.
- 2.12. d. Explain PCR, DNA sequencing, dideoxy sequencing, and acrylamide gels.
- 2.12. e. Understand how to read a sequencing gel, including fluorescent tagged ddNTPs/automated sequencing and capillary gel electrophoresis, PCR, the importance of Taq polymerase and the thermal cycler, and sources of thermostable polymerases.

**2.13 : *Laboratory skills***

- 2.13. a. Apply investigative laboratory skills relevant to molecular biology, including the microscopic study of chromosomes, electrophoresis, DNA isolation, the handling and genetic analysis of microbes, and basic recombinant DNA techniques such as restriction digests and bacterial transformation in data analysis and in the simulation of biological systems.
- 2.13. b. Describe molecular exclusion chromatography, ion exchange chromatography, TLC, HPLC, and affinity chromatography.
- 2.13. c. Apply principles of electrophoresis, including agarose gel electrophoresis of DNA.
- 2.13. d. Prepare and analyze Southern and Northern blots.
- 2.13. e. Prepare and analyze PCR, DNA sequencing, dideoxy sequencing, and acrylamide gels.
- 2.13. f. Design, conduct, statistically evaluate, and interpret the results of a genetic experiment, expanding on one, or more, of the laboratory techniques listed in the previous competency.
- 2.13. g. Write scientific reports, with graphical presentation of data (technical writing skills) using appropriate scientific language.
- 2.13. h. Present scientific information orally, with graphical presentation of data using appropriate presentation technology.



### Section 3. Genetics Competencies

#### 3.1: *Inheritance*

- 3.1. a. Demonstrate understanding of Mendelian and non-Mendelian inheritance principles.
- 3.1. b. Use current terminology to explain the modern understanding of eukaryotic chromosome structure.
- 3.1. c. Apply an understanding of genetic principles to the analysis of genetic problems and systems.
- 3.1. d. Apply basic probability theory and statistical hypothesis testing techniques to the analysis of genetic problems, including linkage analysis.
- 3.1. e. Explain and discuss the importance of genetics to Biology as a whole and to certain human concerns such as medical and technological innovations, including recombinant DNA technology, genetic engineering, and genetic testing.
- 3.1. f. Discuss how genes and the environment interact to produce a specific phenotype.
- 3.1. g. Explain the cellular activities of mitosis and meiosis as they relate to genetics.
- 3.1. h. Analyze pedigrees to determine patterns of inheritance in families.
- 3.1. i. Describe common genetic disorders.

#### 3.2: *Population genetics and evolution*

- 3.2. a. Explain evolution in terms of molecular genetics and population genetics.
- 3.2. b. Demonstrate understanding of population statistics, including Hardy-Weinberg equilibrium.
- 3.2. c. Explain perturbations to and deviations from Hardy-Weinberg equilibria and what they mean for the evolution of species.

#### 3.3: *Linkage and mapping*

- 3.3. a. Describe genetic linkage, genetic linkage mapping, syntenic genes, complete genetic linkage, and incomplete genetic linkage.
- 3.3. b. Calculate recombination frequency and discuss how recombination frequency correlates with gene distance.
- 3.3. c. Describe biological factors that affect accuracy of genetic maps and recombination.

#### 3.4: *DNA replication and repair*

- 3.4. a. Review DNA structure and function.
- 3.4. b. Review the evidence of DNA as the genetic material.
- 3.4. c. Describe why replication is semiconservative, bidirectional, and discontinuous.



- 3.4. d. Describe the process of DNA replication in prokaryotes and eukaryotes.
- 3.4.e. Explain the role of telomeres in the completion of lagging strand replication.
- 3.4.f. Describe how mutations arise and how they generate different phenotypes.
- 3.4. g. Describe the features of base excision repair, nucleotide excision repair, mismatch repair, and double strand break repair (single strand annealing, homologous recombination, non-homologous end joining).

**3.5: *Gene regulation***

- 3.5. a. Describe negative versus positive control and the role of activator and repressor proteins.
- 3.5. b. Describe the regulation of prokaryotic genes such as the *lac*, *trp*, and *araC* operons.
- 3.5. c. Discuss eukaryotic gene regulation mechanisms.

**3.6: *Protein synthesis***

- 3.6. a. Describe differences between viral, prokaryotic, and eukaryotic chromosomes.
- 3.6. b. Describe RNA nucleotide structure, RNA assembly, and RNA structure.
- 3.6. c. Compare and contrast prokaryotic and eukaryotic gene structure and transcription processes.
- 3.6. d. Compare and contrast structure and composition of prokaryotic and eukaryotic ribosomes.
- 3.6. e. Compare and contrast prokaryotic and eukaryotic translation, including the molecular factors involved.

**3.7: *Genetic basis of disease***

- 3.7. a. Examine examples of monogenic disease and compare autosomal dominant versus autosomal recessive genes as well as sex-linked recessive genes.
- 3.7. b. Understand the mechanism of chromosomal nondisjunction and its contribution to disease such as Down syndrome and sex chromosome disorders.
- 3.7. c. Understand the role of variation in chromosome number, such as polyploidy and aneuploidy, in the development of human disease.
- 3.7. d. Understand the mechanism of chromosomal translocations and their contribution to disease.
- 3.7. e. Solve pedigree analysis to determine dominant and recessive traits and examine their use in predicting human disease.



- 3.7. f. Examine the role of mitochondrial genes and their role in human disease.
- 3.7. g. Understand the function of proto-oncogenes and tumor suppressors in the development of human cancer.
- 3.7. h. Examine the role viruses have in contributing to genetic disease such as cancer.
- 3.7. i. Recognize other mechanisms that contribute to or prevent human disease such as DNA repair, telomeres and telomerase, control of apoptosis, and transposable elements.
- 3.7. j. Understand the effect of various mutagens on DNA structure and role they play in mutagenesis.

**3.8: *Biotechnology***

- 3.8. a. Demonstrate an understanding of current applications in biotechnology, such as recombinant and transgenic methods in plants, animals, and microorganisms.
- 3.8. b. Describe the role of selectable markers, DNA ligase, and transformation in recombinant DNA experiments.
- 3.8. c. Describe recombinant DNA techniques and their uses, including Southern blot, Northern blot, Western blot, in situ hybridization, Sanger sequencing, PCR, and site directed mutagenesis.
- 3.8. d. Demonstrate an understanding of genomics, including genome mapping strategies such as cytogenic, linkage, and physical mapping. Describe possible applications for data gained through genomics.

**3.9: *Laboratory skills***

- 3.9. a. Apply investigative laboratory skills relevant to basic genetics, including the production and analysis of genetic crosses, the microscopic study of chromosomes, electrophoresis, DNA isolation, the handling and genetic analysis of microbes, basic recombinant DNA techniques such as restriction digests and bacterial transformation, and the use of computers to access information from online databases in data analysis and in the simulation of biological systems.
- 3.9. b. Design, conduct, statistically evaluate, and interpret the results of a genetic experiment, expanding on one, or more, of the laboratory techniques listed in the previous competency.
- 3.9. c. Apply the use of bioinformatics for DNA/protein sequence analysis, genomics, and proteomics.
- 3.9. d. Write scientific reports, with graphical presentation of data (technical writing skills) using appropriate scientific language.
- 3.9. e. Present scientific information orally, with graphical presentation of data using appropriate presentation technology.



## Section 4. Ecology Competencies

### 4.1: *Importance*

- 4.1. a. Explain the historical importance of ecology to human society.
- 4.1. b. Describe examples of early ecological studies.

### 4.2: *Biosphere*

- 4.2. a. Describe the effects of the Earth's axial tilt, solar radiation, moisture, and ocean circulation on climate.
- 4.2. b. Discuss examples of atmospheric circulations and geographic landforms on regional climate.
- 4.2. c. Examine the relationship between temperature and precipitation with vegetation distribution.
- 4.2. d. Describe the processes of soil formation, physical and chemical weathering, and biological decomposition.
- 4.2. e. Describe and compare the geographic locations, geological features, and dominant organisms that are common to the major terrestrial biomes on the Earth.
- 4.2. f. Describe and compare the physical, chemical, and biological characteristics of freshwater and marine biomes.
- 4.2. g. Diagram lentic temperature stratification in the summer and winter.
- 4.2. h. Discuss the influence of climate change on coral bleaching and eutrophication.

### 4.3: *Physiological ecology*

- 4.3. a. Describe the physical, biological, and behavioral factors that influence an organism's ability to grow and reproduce in its habitat and range distribution.
- 4.3. b. Discuss the importance of tradeoffs as organisms adapt to their environments.
- 4.3. c. Describe the challenges organisms have adapting to terrestrial, freshwater, and marine environments.

### 4.4: *Evolution and population genetics*

- 4.4. a. Review Darwin's theory of natural selection.
- 4.4. b. Describe several examples and mechanisms of natural selection.
- 4.4. c. Describe the mechanisms of speciation and extinction; identify the causes of speciation.
- 4.4. d. Explain coevolution, how it occurs, and what its effects are.
- 4.4. e. Describe examples of bottleneck effect, founder effect, Allee effect, and inbreeding depression.
- 4.4. f. Describe the mechanisms of adaptive radiation.



- 4.4. g. Identify and describe some examples of animal behavior or sexual dimorphism that increase reproductive success.
- 4.4. h. Explain and describe the importance of the environment to evolution, natural selection, and the maintenance of biodiversity.

**4.5: Populations**

- 4.5. a. Describe and compare logistic and exponential growth models.
- 4.5. b. Explain the role of carrying capacity.
- 4.5. c. Discuss the future impact of human population growth.
- 4.5. d. Discuss how survivorship and fecundity are used to predict the future growth and distribution of a population.
- 4.5. e. Discuss the influence of life history strategies on the growth and distribution of a population.
- 4.5. f. Explain the effects of density independent and density dependent factors on population growth.
- 4.5. g. Explain what intraspecific competition is; provide examples of intraspecific competition.

**4.6: Communities**

- 4.6. a. Discuss factors that influence the form, structure, or appearance of a plant community.
- 4.6. b. Discuss the concept of species diversity and the indices used to calculate species diversity.
- 4.6. c. Compare and contrast intraspecific and interspecific competition.
- 4.6. d. Explain the principles of competitive exclusion, resource partitioning, and character displacement and their relationship to competition.
- 4.6. e. Examine predation, herbivory, and symbiosis.
- 4.6. f. Describe models of succession for aquatic and terrestrial communities.
- 4.6. g. Recognize similarities among ecological communities inhabiting similar types of environments, and the diverse evolutionary adaptations that influence a species' range, dispersal, and ability to survive in its environment.

**4.7: Ecosystems**

- 4.7. a. Describe the major biotic and abiotic ecological characteristics that identify a given ecosystem.
- 4.7. b. Describe the biogeochemistry of an ecosystem and explain the cycles of nitrogen, carbon, phosphorous, and water.
- 4.7. c. Explain energy flow in ecosystems, photosynthesis, trophic levels, and biomass pyramids from an ecological perspective.



- 4.7. d. Discuss diverse adaptations for nutrient acquisition in ecosystems, the conversion of these nutrients into biologically useful forms, cycling of nutrients, and the indispensable roles of producers and decomposers.
- 4.7. e. Evaluate the impact of human behavior on earth's ecosystems, particularly as it relates to biological diversity, global climate change, and the ability of ecosystems to sustain life.
- 4.7. f. Recognize the continually changing nature of ecosystems, and discuss factors that impact ecosystems and the evolution of resident species through natural selection.

**4.8: *Environmental biology***

- 4.8. a. Describe and explain the causes and consequences of pollution on the biosphere and the survival of all organisms.
- 4.8. b. Analyze a variety of timely environmental issues in light of their ecological, social, economic, ethical, or cultural implications.
- 4.8. c. Discuss the impacts of conductivity and fragmentation on ecosystem function and biogeography.

**4.9: *Lab/field experiences***

- 4.9. a. Collect data and formulate valid scientific conclusions of an ecological nature.
- 4.9. b. Work as part of a team in field and laboratory investigations of ecological phenomena.
- 4.9. c. Collect ecological data and apply basic statistical skills for analyzing and presenting quantitative and qualitative data to formulate conclusions.
- 4.9. d. Write scientific reports, with graphical presentation of data (technical writing skills) using appropriate scientific language.
- 4.9. e. Present scientific information orally, with graphical presentation of data using appropriate presentation technology.



## Section 5. General Chemistry Competencies

### 5.1: *Chemical toolbox*

- 5.1. a. Use theory to predict, graph, and interpret experiment observations.
- 5.1. b. Use math and critical reasoning to organize and manipulate data for meaningful interpretations of data and results, use statistics to judge limitations of error, and discern causes of error. Distinguish between precision and accuracy.
- 5.1. c. Apply relevant fundamental mathematical relationships in order to carry out accurate calculations related to the specific topics covered.
- 5.1. d. Apply rules of significant figures and rounding, converting among units, and using dimensional analysis to solve numerical problems.
- 5.1. e. Use problem-solving skills to reduce complex problems into simpler components, identifying principle objectives.
- 5.1. f. Integrate knowledge of two or more traditional subfields of chemistry to solve complex chemical problems.
- 5.1. g. Demonstrate computer literacy to use multiple programming, computational, online, and database tools. Utilize computational tools to organize, process, store, and retrieve data.
- 5.1. h. Understand the major systems of nomenclature used in chemistry for inorganic compounds.

### 5.2: *Matter*

- 5.2. a. Recognize the atomic symbols of the elements and use the periodic table to extract valuable information about atoms and ions, especially concerning bonding.
- 5.2. b. Classify matter: pure substances (elements and compounds) or mixtures (homogeneous or heterogeneous).
- 5.2. c. Understand the differences between physical and chemical changes, physical properties, and chemical properties.
- 5.2. d. Describe matter in terms of its physical properties (both intensive and extensive) and chemical properties.
- 5.2. e. Compare and contrast the three forms of matter: solid, liquids and gas. Compare a gas, a liquid, and a solid using a kinetic-molecular theory description.
- 5.2. f. Use mathematical relationships (including Boyle's Law, Charles's Law, Avogadro's Law, ideal gas law, and van der Waals equation) to describe gases.



- 5.2. g. Describe gases with respect to density, vapor pressure, partial pressures, diffusion, effusion, and molecular speed distributions.
- 5.2. h. Define changes of state physically and pictorially (heating curves and phase diagrams). Apply the Clausius-Clapeyron equation.
- 5.2. i. Describe liquids with respect to surface tension, viscosity, capillary action, and vapor pressure.
- 5.2. j. Identify types of solids: molecular solids, metallic solids, ionic solids, and covalent network solids. Identify coordination number, common unit cells (simple cubic, body-centered cubic, and face-centered cubic unit cell), and properties that relate to its structure.

**5.3: Atomic structure**

- 5.3. a. Demonstrate a comprehensive knowledge of the structure of the nucleus (including nucleons), atoms, isotopes, ions, and molecules.
- 5.3. b. Apply a fundamental knowledge of atomic orbitals (s, p, d, and f) to electronic configurations and the explanation of electronic spectroscopy.
- 5.3. c. Apply the Pauli Exclusion Principle, Hund's rule, and Aufbau principle to write the electron configurations for the elements, identifying diamagnetic and paramagnetic species. Explain how electron configurations relate to electronegativities and bonding properties of these elements. Distinguish between core and valence electrons.
- 5.3. d. Employ periodic trends (including successive ionization energies, electron affinities, atomic radii, ionic radii, shielding, and effective nuclear charge) to atoms and ions.
- 5.3. e. Understand the basic mathematical relationships underpinning quantum mechanics, such as the wave function, de Broglie wavelength, the Heisenberg uncertainty principle, and other physical properties of a particle.
- 5.3. f. Understand the interaction of light with matter. Relate energy of a photon to wavelength, frequency, and to emission and absorption spectroscopy. Understand the relative regions of the electromagnetic radiation.
- 5.3. g. Describe the shapes of s, p, and d orbitals and apply the rules of quantum numbers to electrons residing in these orbitals.

**5.4: Chemical bonding**

- 5.4. a. Predict, compare, and contrast the different types of intramolecular (covalent, ionic, and metallic) and intermolecular bonding (London forces (induced dipole), dipole-dipole, hydrogen-bonding, and ion-dipole) demonstrated in substances. Predict the consequences of these types of bonds on physical properties.



- 5.4. b. Apply valence bond theory (hybridization,  $\sigma + \pi$  bonds) and molecular orbital bonding models to describe bonding at the molecular level.
- 5.4. c. Develop a fundamental understanding of the behavior and properties of phases of matter (gases, liquids, and solids).
- 5.4. d. Define and identify ionic and covalent bonding, energetics of bonding, and lattice energy through the Born-Haber cycle.
- 5.4. e. Describe bonds using single, double, and triple bond notation, coordinate covalent bond, valence bond descriptions (hybrid orbitals), and sigma and pi bond descriptions.
- 5.4. f. Relate bonding properties (such as delocalized electrons, formal charge, bond length, bond order, and bond enthalpy) and its consequences to molecular structure and reactivity.
- 5.4. g. Define bonding in metals and metal compounds, metallic bonding, band theory, magnetic properties, conductivity, semiconductors, insulators, and defects.
- 5.4. h. Describe diatomic molecules using molecular orbital theory, identifying bonding, antibonding orbitals, and bond order.

**5.5: *Molecular structure and function***

- 5.5. a. Distinguish between structure/reactivity and structure/property relationships.
- 5.5. b. Relate bond polarity and molecular dipole moment to identify polar and non-polar molecules.
- 5.5. c. Predict general trends in the boiling points and solubilities of compounds, based on their size, polarity, and ability to form hydrogen bonds.
- 5.5. d. Distinguish between angle strain, torsional strain, steric strain, and understand their significance to reactivity.
- 5.5. e. Identify resonance-stabilized structures and compare the relative importance of their resonance forms. Calculate formal charges for different bonding modes.
- 5.5. f. Relate the dependence of structure and reactivity on context, particularly solvent effects and other non-covalent interactions.
- 5.5. g. Relate the interplay between electronic, steric, and orbital interactions in the behavior and properties of molecules.

**5.6: *Reactions***

- 5.6. a. Write accurate, balanced equations for chemical (including redox) and nuclear reactions, including deducing stable products in a nuclear reaction based on the stability of radionuclides. Predict the type of radioactive emission for a nuclear reaction. Distinguish the different classes of nuclear reactions (fission, fusion, artificial vs. natural radioactivity).



- 5.6. b. Employ the detailed quantitative relationships (moles, molar mass, and molarity) governing chemical reactions, including the ability to perform a variety of stoichiometry calculations (such as limiting reagent, dilutions, theoretical yield, percent yield).
- 5.6. c. Demonstrate a basic understanding of reaction chemistry, including oxidation-reduction (both inorganic and organic, half reactions, and net ionic equations), acid-base, neutralization, precipitation, substitution (both inorganic and organic), elimination, rearrangements, and addition.
- 5.6. d. Identify nucleophiles (Lewis bases) and electrophiles (Lewis acids), and write equations for Lewis acid-base reactions using curved arrows to show the flow of electrons.

**5.7: *Energy and thermodynamics***

- 5.7. a. Define a system (versus surroundings) in terms of kinetic and potential energy, internal energy, work, and heat.
- 5.7. b. Define chemical and physical processes as exothermic or endothermic processes, calculating  $\Delta H^\circ$  and  $\Delta S^\circ$  for a reaction based on stoichiometry. Calculate  $\Delta G^\circ$  from both  $\Delta H^\circ$  and  $\Delta S^\circ$ , and from  $\Delta G$  values of formation.
- 5.7. c. Manipulate common thermochemical calculations and relationships (including calorimetry, heats of reaction, Hess's Law and standard enthalpies or entropies of formation, calculating for reactions, and phase changes).
- 5.7. d. Manipulate common calculations and relationships to solutions (such as Henry's Law, calculating solution concentration and converting between the various forms of concentration expression, applying Raoult's Law, and calculating colligative properties).
- 5.7. e. Calculate and relate  $E_{\text{cell}}$ , equilibrium constant, and  $\Delta G$  at various conditions.
- 5.7. f. Calculate the binding energy in a nuclear reaction.

**5.8: *Kinetics***

- 5.8. a. Calculate reaction rates, determining reaction orders and rate constants.
- 5.8. b. Calculate concentrations given the rate law, time, and initial reactant concentrations, relating a reaction half-life to a rate constant.
- 5.8. c. Use the Arrhenius equation to determine a reaction's activation energy or rate constant at a different temperature.
- 5.8. d. Determine the molecularity and rate law for an elementary reaction.
- 5.8. e. Write the overall chemical reaction and rate law for a given mechanism.
- 5.8. f. Understand the effect of a catalyst. Employing methods of activation, including Brønsted or Lewis acid/base, free radical chemistry, and organometallic catalysis.



**5.9: Equilibrium**

- 5.9. a. Calculate and interpret values of equilibrium constants, writing equilibrium constant expressions and using them to calculate equilibrium constant values.
- 5.9. b. Calculate free-energy changes from equilibrium constants and calculate the position of reaction equilibrium from the free-energy changes.
- 5.9. c. Predict reaction direction based on comparing  $Q$  and  $K$ .
- 5.9. d. Describe and employ the reversibility of reactions. Apply Le Châtelier's principle for changes in equilibrium concentrations, temperature, and pressure.

**5.10: Experimentation**

- 5.10. a. Demonstrate a basic ability to define problems clearly, develop testable hypotheses, design and execute experiments, analyze data using appropriate statistical methods, understand the fundamental uncertainties in experimental measurements, and draw appropriate conclusions.
- 5.10. b. Apply major concepts, theoretical principles, and experimental findings in general chemistry lectures to the solution of laboratory problems.
- 5.10. c. Demonstrate creative and independent thinking in a laboratory setting.
- 5.10. d. Demonstrate knowledge of chemical, instrumental, and workplace safety. Know and follow the proper safety procedures and regulations for safe handling and use of chemicals.
- 5.10. e. Employ appropriate, safe, and ethical research methodologies to collect, analyze, and interpret data critically (error analysis) toward the solution of a problem.
- 5.10. f. Critically evaluate methodologies, data, and conclusions of one's own and others' technical work.
- 5.10. g. Use technology for computations, data acquisition, and database searching.
- 5.10. h. Demonstrate ability to maintain an organized and well-documented laboratory notebook.
- 5.10. i. Interact effectively in a group to solve scientific problems and work productively with a diverse group of peers.
- 5.10. j. Present information in a clear and organized manner, write well-organized and concise reports in a scientifically appropriate style, and use relevant technology in communications.
- 5.10. k. Write scientific reports, with graphical presentation of data (technical writing skills) using appropriate scientific formalisms.



- 5.10. l. Demonstrate the responsible treatment of data, proper citation of others' work, and the standards related to plagiarism and the publication of scientific results.
- 5.10.m. Find and evaluate the validity and usefulness of chemistry information in the scientific literature.
- 5.10. n. Demonstrate proper conceptual and mathematical knowledge upon which chemical instrumentation is based.
- 5.10. o. Collect empirical data through the safe and effective physical manipulation of materials, equipment, and instrumentation in a face-to-face instructional setting.

**5.11 : Visualization**

- 5.11. a. Understand the relationship between symbolic and particulate representations.
- 5.11. b. Predict molecular geometry, shape, and ideal bond angles at the molecular level using VSEPR theory.
- 5.11. c. Employ the concept of the mole to relate the macroscopic and microscopic views of chemical reactions.
- 5.11. d. Use mathematical equations to provide a tool to visualize chemical and physical processes.
- 5.11. e. Draw and interpret Lewis, condensed, and line-angle structural formulas. Convert these drawings to accurate Newman projections, Fisher projections, Haworth projections, or chair conformations as appropriate, envisioning these representations as space filling diagrams.
- 5.11. f. Visualize the movements of the microscopic world using a qualitative description of the gas laws based on the kinetic molecular theory.
- 5.11. g. Develop a basic understanding of the microscopic point of view, especially for thermodynamic quantities such as entropy.



## Section 6. Organic Chemistry Competencies

### 6.1: *Chemical toolbox*

- 6.1. a. Use theory to predict, graph, and interpret experiment observations.
- 6.1. b. Use math and critical reasoning to organize and manipulate data for meaningful interpretations of data and results, use statistics to judge limitations of error, and discern causes of error. Distinguish between precision and accuracy.
- 6.1. c. Apply relevant fundamental mathematical relationships in order to carry out accurate calculations related to the specific topics covered.
- 6.1. d. Apply rules of significant figures and rounding, converting among units, and using dimensional analysis to solve numerical problems.
- 6.1. e. Use problem-solving skills to reduce complex problems into simpler components, identifying principle objectives.
- 6.1. f. Integrate knowledge of two or more traditional subfields of chemistry to solve complex chemical problems.
- 6.1. g. Demonstrate computer literacy to use multiple programming, computational, online, and database tools. Utilize computational tools to organize, process, store, and retrieve data.
- 6.1. h. Understand the major systems of nomenclature used in chemistry for organic compounds, including stereochemistry (R/S and E/Z).

### 6.2: *Matter*

- 6.2. a. Recognize the atomic symbols of the elements and use the periodic table to extract valuable information about atoms and ions especially concerning bonding.
- 6.2. b. Classify matter: pure substances (elements and compounds) or mixtures (homogeneous or heterogeneous).
- 6.2. c. Understand the differences between physical and chemical changes, physical properties, and chemical properties.

### 6.3: *Chemical bonding*

- 6.3. a. Predict, compare, and contrast the different types of intramolecular (covalent, ionic, and metallic) and intermolecular bonding (London forces (induced dipole), dipole-dipole, hydrogen bonding, and ion-dipole) demonstrated in substances. Predict the consequences of these types of bonds on physical properties.



- 6.3. b. Apply valence bond theory (hybridization,  $\sigma + \pi$  bonds) and molecular orbital bonding models to describe bonding at the molecular level.
- 6.3. c. Describe bonds using single, double, and triple bond notation, coordinate covalent bond, valence bond descriptions (hybrid orbitals), and sigma and pi bond descriptions.
- 6.3. d. Relate bonding properties (such as delocalized electrons, formal charge, bond length, bond order, and bond enthalpy) and its consequences to molecular structure and reactivity.
- 6.3. e. Describe diatomic molecules using molecular orbital theory, identifying bonding, antibonding orbitals, and bond order.

**6.4: *Molecular structure and functions***

- 6.4. a. Distinguish between structure/reactivity and structure/property relationships.
- 6.4. b. Identify constitutional isomers, stereoisomers, and diastereomers, including cis-trans (geometric) isomers.
- 6.4. c. Distinguish between angle strain, torsional strain, steric strain, and understand their significance to reactivity.
- 6.4. d. Identify resonance-stabilized structures and compare the relative importance of their resonance forms. Calculate formal charges for different bonding modes.
- 6.4. e. Draw and describe reactive intermediate structures of carbocations, carbanions, free radicals, and carbenes and the structural features that stabilize them. Explain which are electrophilic and which are nucleophilic.

**6.5: *Reactions***

- 6.5. a. Demonstrate a basic understanding of reaction chemistry, including oxidation-reduction (both inorganic and organic, half reactions and net ionic equations), acid-base, neutralization, precipitation, substitution (both inorganic and organic), elimination, rearrangements, and addition.
- 6.5. b. Identify nucleophiles (Lewis bases) and electrophiles (Lewis acids), and write equations for Lewis acid-base reactions using curved arrows to show the flow of electrons.

**6.6: *Experimentation***

- 6.6. a. Demonstrate a basic ability to define problems clearly, develop testable hypotheses, design and execute experiments, analyze data using appropriate statistical methods, understand the fundamental uncertainties in experimental measurements, and draw appropriate conclusions.



- 6.6. b. Apply major concepts, theoretical principles and experimental findings in organic chemistry lectures to the solution of laboratory problems.
- 6.6. c. Demonstrate creative and independent thinking in a laboratory setting.
- 6.6. d. Demonstrate knowledge of chemical, instrumental, and workplace safety. Know and follow the proper safety procedures and regulations for safe handling and use of chemicals.
- 6.6. e. Employ appropriate, safe, and ethical research methodologies to collect, analyze, and interpret data critically (error analysis) toward the solution of a problem.
- 6.6. f. Critically evaluate methodologies, data, and conclusions of one's own and others' technical work.
- 6.6. g. Use technology for computations, data acquisition, and database searching.
- 6.6. h. Demonstrate ability to maintain an organized and well-documented laboratory notebook.
- 6.6. i. Interact effectively in a group to solve scientific problems and work productively with a diverse group of peers.
- 6.6. j. Present information in a clear and organized manner, write well-organized and concise reports in a scientifically appropriate style, and use relevant technology in communications.
- 6.6. k. Write scientific reports, with graphical presentation of data (technical writing skills) using appropriate scientific formalisms.
- 6.6. l. Demonstrate the responsible treatment of data, proper citation of others' work, and the standards related to plagiarism and the publication of scientific results.
- 6.6. m. Find and evaluate the validity and usefulness of chemistry information in the scientific literature.
- 6.6. n. Demonstrate proper conceptual and mathematical knowledge upon which chemical instrumentation is based.
- 6.6. o. Collect empirical data through the safe and effective physical manipulation of materials, equipment, and instrumentation in a face-to-face instructional setting.

**6.7: Visualization**

- 6.7. a. Draw and interpret Lewis, condensed, and line-angle structural formulas. Convert these drawings to accurate Newman projections, Fisher projections, Haworth projections, or chair conformations as appropriate, envisioning these representations as space filling diagrams.
- 6.7. b. Draw and identify the types of stereoisomers for a molecule, identifying the relationship between stereoisomers, and identifying each carbon with the R/S nomenclature.



- 6.7. c. Draw a reaction-energy diagram for a mechanism, and point out the corresponding transition states, activation energies, intermediates, and rate-limiting steps.
- 6.7. d. Cultivate the understanding that the way to molecular knowledge is through experimentation: correlating structure with reactivity and function through wet chemical methods, spectroscopy (notably NMR, FTIR, and MS), and use of computational simulations.

## Section 7. General Physics Competencies

### 7.1: *Mechanical sciences*

- 7.1. a. Understand and convert physical quantities and measurements in the SI and UCSC systems.
- 7.1. b. Define and compute vector and scalar quantities, such as speed and velocity, and analyze physical systems using the concepts of translational and rotational equilibrium, and kinetic and static friction.
- 7.1. c. Solve problems using the concepts of moment arm, torque, and center of gravity.
- 7.1. d. Solve problems that require an ability to apply Newton's Three Laws of Motion and describe the interaction of force, mass, weight, and acceleration due to gravity.
- 7.1. e. Demonstrate the ability to apply conservation principles (work, energy, linear-momentum, and angular momentum).
- 7.1. f. Compute the rotational motion, centripetal force and acceleration, moment of inertia, and rotational energy for rotating physical systems.
- 7.1. g. Measure and/or compute temperature and thermal expansion.
- 7.1. h. Compute the quantity of heat transferred using the concepts of specific heat capacity and latent heats of fusion and vaporization.
- 7.1. i. Compute the quantity of heat transferred using the concepts and mathematics of thermal conductivity, convection, and radiation.
- 7.1. j. Use the gas laws to compute values for volume, temperature, pressure, and amount of a gas.
- 7.1. k. Use laboratory equipment to demonstrate scientific principles.
- 7.1. l. Recognize uncertainties in data.
- 7.1. m. Tabulate and graph data and compute results.
- 7.1. n. Draw reasonable conclusions from quantitative data and communicate results to others.



## Section 8. General Calculus I Competencies

### 8.1: *General calculus I*

- 8.1. a. Examine limits and their properties. Specifically, define the limit and use this definition to evaluate a limit. Identify limits of functions graphically, numerically, and analytically. Use theorems on limits and find limits at infinity. Determine the continuity of a function and a combination of functions, including at a particular point or a removable discontinuity.
- 8.1. b. Use differentiation to evaluate a derivative. Study includes the definition of a derivative, average and instantaneous rates of change, and average and instantaneous velocity. Find derivatives to various functions by product, quotient, power, chain, and implicit rules. Find tangent and normal lines to curves.
- 8.1. c. Study applications of differentiation. Related rates and optimization problems will be worked as well as differentials and linear approximations. Intervals of increasing and decreasing, concavity, extrema, inflection points, and horizontal tangents will all be used.



## Section 9. Secondary Education Competencies

*Example of education courses at Ivy Tech Community College to include with corresponding sequence:*

EDUC 101 – Introduction to Teaching  
EDUC 121 – Child and Adolescent Development  
EDUC 255 – Multicultural Education  
EDUC 201 – Technology in Education  
EDUC 250 – Educational Psychology (CAPSTONE)

### Title, Description and Competencies of Courses

#### **EDUC 101- Introduction to Teaching**

Introduction to Teaching (Introduction to Teaching is a prerequisite for the other education courses on this list, except EDUC 121).

#### **1. Identify and appreciate the essential qualifications and personal demands of teaching as a profession.**

**InTASC Standard # 9: 9(o).** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.

#### **2. Define and evaluate his/her own teaching dispositions and learning style.**

**InTASC Standard # 9: 9(g).** The teacher understands and knows how to use a variety of self-assessment and problem-solving strategies to analyze and reflect on his/her practice and to plan for adaptations/adjustments.

**InTASC Standard # 9: 9(m).** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard # 9: 9(n).** The teacher sees him/herself as a learner, continuously seeking opportunities to draw upon current education policy and research as sources of analysis and reflection to improve practice.



**InTASC Standard #4: 4(p).** The teacher appreciates multiple perspectives within the discipline and facilitates learners' critical analysis of these perspectives

**InTASC Standard # 4: 4(q).** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.

**3. Recognize the essential function of professional ethics, personal morals, and a strong value system in the role of the teacher, including the importance of confidentiality and liability issues pertaining to family/school relationships.**

**InTASC Standard # 9: 9(o).** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.

**InTASC Standard #9: 9(j).** The teacher understands laws related to learners' rights and teacher responsibilities (e.g., for educational equity, appropriate education for learners with disabilities, confidentiality, privacy, appropriate treatment of learners, reporting in situations related to possible child abuse).

**4. Reflect on personal reasons for entering the teaching profession and write an initial statement of educational philosophy.**

**INTASC Standard #7 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**5. Review current teacher licensure laws in the State of Indiana. Compare this licensure process with requirements for teaching in a variety of global locations.**

**InTASC Standard # 9: 9(o).** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.

**6. Recognize and identify strategies to support the family's role as the child's first teacher and to support the family/teacher partnership in the child's development in a culturally competent manner.**

**InTASC Standard # 10: 10(m).** The teacher understands that alignment of family, school, and community spheres of influence enhances student learning and that discontinuity in these spheres of influence interferes with learning.

**InTASC Standard # 10: 10(q).** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.



**7. Identify career choices within the field of education, including opportunities to teach abroad, and review programs for professional preparation.**

**InTASC Standard # 10: 10(h).** The teacher uses and generates meaningful research on education issues and policies.

**InTASC Standard # 10: 10(f).** The teacher engages in professional learning, contributes to the knowledge and skill of others, and works collaboratively to advance professional practice.

**InTASC Standard # 10: 10(h).** The teacher uses and generates meaningful research on education issues and policies.

**8. Define and describe the nature, purpose and responsibilities of the public education system in a democratic society. Compare and contrast with the role of public education in other countries.**

**InTASC Standard #4: 4(p).** The teacher appreciates multiple perspectives within the discipline and facilitates learners' critical analysis of these perspectives

**InTASC Standard #5: 5(d).** The teacher engages learners in questioning and challenging assumptions and approaches in order to foster innovation and problem solving in local and global contexts.

**InTASC Standard #5: 5(p).** The teacher knows where and how to access resources to build global awareness and understanding, and how to integrate them into the curriculum

**InTASC Standard # 10: 10(h).** The teacher uses and generates meaningful research on education issues and policies.

**9. Review the history of American education and identify the philosophical foundations of education and their global roots.**

**InTASC Standard #4: 4(p).** The teacher appreciates multiple perspectives within the discipline and facilitates learners' critical analysis of these perspectives.

**InTASC Standard #5: 5(d).** The teacher engages learners in questioning and challenging assumptions and approaches in order to foster innovation and problem solving in local and global contexts.

**InTASC Standard #5: 5(q).** The teacher is constantly exploring how to use disciplinary knowledge as a lens to address local and global issues.



**InTASC Standard #5: 5(p).** The teacher knows where and how to access resources to build global awareness and understanding, and how to integrate them into the curriculum.

**InTASC Standard # 10: 10(h).** The teacher uses and generates meaningful research on education issues and policies.

**10. Identify and observe in the classroom various elements of diversity that affect K-12 student learning and accomplishment.**

**InTASC Standard # 10: 10(q).** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**InTASC Standard # 9: 9(m).** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard #9: 9(i).** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a).** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b).** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.

**InTASC Standard #9: 9(e).** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p).** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n).** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.



**InTASC Standard #7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #4: 4(q).** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.

**InTASC Standard # 2: 2(l).** The teacher believes that all learners can achieve at high levels and persists in helping each learner reach his/her full potential.

**InTASC Standard #2: 2(m).** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #1: 1(g).** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging

**InTASC Standard #2: 2(n).** The teacher makes learners feel valued and helps them learn to value each other.

**InTASC Standard #2: 2(o).** The teacher values diverse languages and dialects and seeks to integrate them into his/her instructional practice to engage students in learning.

**InTASC Standard #2: 2(j).** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k).** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(g).** The teacher understands and identifies differences in approaches to learning and performance and knows how to design instruction that uses each learner's strengths to promote growth.

**InTASC Standard #2: 2(d).** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.



**InTASC Standard #2: 2(f).** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs.

**11. Recognize and examine the diversity in schools in the United States and globally.**

**InTASC Standard #9: 9(i).** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a).** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b).** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.

**InTASC Standard #9: 9(e).** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p).** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n).** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.

**InTASC Standard #2: 2(k).** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**12. Identify and observe in the classroom the cultural, family, and environmental factors that affect students in schools.**

**InTASC Standard # 10: 10(q).** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.



**InTASC Standard # 9: 9(m).** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard #9: 9(i).** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a).** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b).** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.

**InTASC Standard #9: 9(e).** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p).** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n).** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.

**InTASC Standard #7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #4: 4(q).** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.

**InTASC Standard # 2: 2(l).** The teacher believes that all learners can achieve at high levels and persists in helping each learner reach his/her full potential.

**InTASC Standard #2: 2(m).** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.



**InTASC Standard #1: 1(g).** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging.

**InTASC Standard #2: 2(n).** The teacher makes learners feel valued and helps them learn to value each other.

**InTASC Standard #2: 2(o).** The teacher values diverse languages and dialects and seeks to integrate them into his/her instructional practice to engage students in learning.

**InTASC Standard #2: 2(j).** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k).** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(g).** The teacher understands and identifies differences in approaches to learning and performance and knows how to design instruction that uses each learner's strengths to promote growth.

**InTASC Standard #2: 2(d).** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(f).** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs.

### **13. Identify classroom management strategies for the secondary classroom.**

**InTASC Standard #3: 3(i).** The teacher understands the relationship between motivation and engagement and knows how to design learning experiences using strategies that build learner self-direction and ownership of learning.

**InTASC Standard # 3(d).** The teacher manages the learning environment to actively and equitably engage learners by organizing, allocating, and coordinating the resources of time, space, and learners' attention.



**14. Define school and classroom culture.**

**InTASC Standard #2: 2(j).** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k).** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(n).** The teacher makes learners feel valued and helps them learn to value each other.

**15. Identify positive characteristics of school and classroom culture.**

**InTASC Standard #2: 2(j).** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k).** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(n).** The teacher makes learners feel valued and helps them learn to value each other.

**16. Develop a classroom management plan.**

**InTASC Standard #3: 3(i).** The teacher understands the relationship between motivation and engagement and knows how to design learning experiences using strategies that build learner self-direction and ownership of learning.

**InTASC Standard # 3(d).** The teacher manages the learning environment to actively and equitably engage learners by organizing, allocating, and coordinating the resources of time, space, and learners' attention.

**17. Complete a minimum of twenty (20) hours of supervised service learning in a classroom and reflect on the experience in relation to personal skills, dispositions, and future professional decisions.**



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**InTASC Standard # 10: 10(q).** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**InTASC Standard # 9: 9(m).** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard #9: 9(i).** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a).** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b).** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.

**InTASC Standard #9: 9(e).** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p).** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n).** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.

**InTASC Standard #7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #4: 4(q).** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.

**InTASC Standard # 2: 2(l).** The teacher believes that all learners can achieve at high levels and persists in helping each learner reach his/her full potential.



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**InTASC Standard #2: 2(m).** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #1: 1(g).** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging.

**InTASC Standard #2: 2(n).** The teacher makes learners feel valued and helps them learn to value each other.

**InTASC Standard #2: 2(o).** The teacher values diverse languages and dialects and seeks to integrate them into his/her instructional practice to engage students in learning.

**InTASC Standard #2: 2(j).** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k).** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(g).** The teacher understands and identifies differences in approaches to learning and performance and knows how to design instruction that uses each learner's strengths to promote growth.

**InTASC Standard #2: 2(d).** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(f).** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs.



## EDUC 121 - Child and Adolescent Development

**MAJOR COURSE LEARNING OBJECTIVES: Upon successful completion of this course, the student will be expected to:**

### **1. Explore the physical, social, emotional, cognitive, and moral development of the child from birth through adolescence.**

**InTASC Standard # 1: 1(d).** The teacher understands how learning occurs--how learners construct knowledge, acquire skills, and develop disciplined thinking processes--and knows how to use instructional strategies that promote student learning.

**InTASC Standard #1: 1(e).** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard # 7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

### **2. Recognize theories of growth and development that focus on early and middle childhood through the adolescent years.**

**InTASC Standard #1: 1(d).** The teacher understands how learning occurs--how learners construct knowledge, acquire skills, and develop disciplined thinking processes--and knows how to use instructional strategies that promote student learning.

**InTASC Standard #1: 1(e).** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.



**3. Examine and implement observation and interviewing skills as a means of understanding the child.**

**InTASC Standard #1: 1(d).** The teacher understands how learning occurs--how learners construct knowledge, acquire skills, and develop disciplined thinking processes--and knows how to use instructional strategies that promote student learning.

**InTASC Standard # 1: 1(a).** The teacher regularly assesses individual and group performance in order to design and modify instruction to meet learners' needs in each area of development (cognitive, linguistic, social, emotional, and physical) and scaffolds the next level of development.

**InTASC Standard #1: 1(c).** The teacher collaborates with families, communities, colleagues, and other professionals to promote learner growth and development.

**InTASC Standard #1: 1(e).** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #1: 1(h).** The teacher respects learners' differing strengths and needs and is committed to using this information to further each learner's development.

**InTASC Standard #1: 1(k).** The teacher values the input and contributions of families, colleagues, and other professionals in understanding and supporting each learner's development.

**InTASC Standard #2: 2(d).** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(m).** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard # 3: 3(a.)** The teacher collaborates with learners, families, and colleagues to build a safe, positive learning climate of openness, mutual respect, support, and inquiry.

**InTASC Standard # 3: 3(n).** The teacher is committed to working with learners, colleagues, families, and communities to establish positive and supportive learning environments.

**InTASC Standard #3: 3(q).** The teacher seeks to foster respectful communication among all members of the learning community.



**InTASC Standard #3: 3(r).** The teacher is a thoughtful and responsive listener and observer.

**InTASC Standard #4: 4(i).** The teacher accesses school and/or district-based resources to evaluate the learner's content knowledge in their primary language.

**InTASC Standard #6: 6(b).** The teacher designs assessments that match learning objectives with assessment methods and minimizes sources of bias that can distort assessment results.

**InTASC Standard #6: 6(g).** The teacher effectively uses multiple and appropriate types of assessment data to identify each student's learning needs and to develop differentiated learning experiences.

**InTASC Standard #6: 6(t).** The teacher is committed to using multiple types of assessment processes to support, verify, and document learning.

**InTASC Standard #6: 6(v).** The teacher is committed to the ethical use of various assessments and assessment data to identify learner strengths and needs to promote learner growth.

**InTASC Standard #7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #9: 9(h).** The teacher knows how to use learner data to analyze practice and differentiate instruction accordingly.

**InTASC Standard #9: 9(j).** The teacher understands laws related to learners' rights and teacher responsibilities (e.g., for educational equity, appropriate education for learners with disabilities, confidentiality, privacy, appropriate treatment of learners, reporting in situations related to possible child abuse).

**InTASC Standard #10: 10(q).** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

#### 4. Discuss confidentiality when working with children/adolescents and families.

**InTASC Standard #9: 9(j).** The teacher understands laws related to learners' rights and teacher responsibilities (e.g., for educational equity, appropriate education for learners with disabilities, confidentiality, privacy, appropriate treatment of learners, reporting in situations related to possible child abuse).

**InTASC Standard #6: 6(v).** The teacher is committed to the ethical use of various assessments and assessment data to identify learner strengths and needs to promote learner growth.



**5. Identify pro-social and anti-social behavior.**

**InTASC Standard #7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**6. Identify appropriate environments that promote healthy emotional/social development for all children/adolescents.**

**InTASC Standard #1: 1(e).** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**7. Recognize appropriate personal strengths and behaviors desired when working with children age eight through adolescence.**

**InTASC Standard # 9: 9(g)** The teacher understands and knows how to use a variety of self assessment and problem-solving strategies to analyze and reflect on his/her practice and to plan for adaptations/adjustments.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**8. Identify and analyze societal issues facing today's children/adolescents.**

**InTASC Standard #9: 9(d)** The teacher actively seeks professional, community, and technological resources, within and outside the school, as supports for analysis, reflection, and problem-solving.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.



**9. Identify and explore ways to support diverse children/adolescents in their personal growth and development related to trust, autonomy, initiative, industry and identity.**

**InTASC Standard # 2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**10. Identify community and school resources needed to support children through adolescent-age children and families.**

**InTASC Standard # 2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard # 3: 3(n)** The teacher is committed to working with learners, colleagues, families, and communities to establish positive and supportive learning environments.

**InTASC Standard #9: 9(d)** The teacher actively seeks professional, community, and technological resources, within and outside the school, as supports for analysis, reflection, and problem-solving.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.



## EDUC 201 - Technology in Education

### 1. Create instructional materials in a variety of applications, formats and styles.

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

### 2. Demonstrate an understanding of technological operations and concepts for instruction.

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

### 3. Plan and design effective learning environments and experiences supported by technology.

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.



**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

**InTASC Standard # 10: 10(t)** The teacher embraces the challenge of continuous improvement and change.

**4. Apply current research on teaching and learning with technology to the planning of instructional materials and learning environments.**

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

**InTASC Standard # 9: 9(n)** The teacher sees him/herself as a learner, continuously seeking opportunities to draw upon current education policy and research as sources of analysis and reflection to improve practice.

**InTASC Standard # 10: 10(t)** The teacher embraces the challenge of continuous improvement and change.



**5. Apply technology to the creation of effective assessment and evaluation strategies.**

**InTASC Standard #6: 6(i)** The teacher continually seeks appropriate ways to employ technology to support assessment practice both to engage learners more fully and to assess and address learner needs.

**6. Use technology to enhance your productivity, efficiency and professional practice.**

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

**InTASC Standard # 9: 9(n)** The teacher sees him/herself as a learner, continuously seeking opportunities to draw upon current education policy and research as sources of analysis and reflection to improve practice.

**InTASC Standard # 10: 10(t)** The teacher embraces the challenge of continuous improvement and change.

**7. Analyze the social, ethical, legal, and human issues surrounding the use of technology in the classroom.**

**InTASC Standard # 9: 9(f)** The teacher advocates, models, and teaches safe, legal, and ethical use of information and technology including appropriate documentation of sources and respect for others in the use of social media.

**InTASC Standard #9: 9(o)** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.

**8. Analyze and utilize the standards presented in the NETS and INTASC consortia.**



## EDUC 255 - Introduction to Multicultural Teaching

### 1. Demonstrate an understanding and awareness of how cultural factors including personal preferences, ethnic characteristics, values, and bias influence classroom teaching.

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

### 2. Identify and apply essential multicultural and global concepts in the classroom and community.

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard #5: 5(d)** The teacher engages learners in questioning and challenging assumptions and approaches in order to foster innovation and problem solving in local and global contexts.

### 3. Identify standards for education with a multicultural focus.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.



**4. Examine goals and positions for and against multicultural education.**

**InTASC Standard #2: 2(k).** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**5. Discuss the effects of exceptionality, gender, ethnic, socioeconomic and religious factors of learning.**

**InTASC Standard #1: 1(g).** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging.

**InTASC Standard #1: 1(h).** The teacher respects learners' differing strengths and needs and is committed to using this information to further each learner's development.

**InTASC Standard #2: 2(d).** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(f).** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs.

**InTASC Standard #2: 2(h).** The teacher understands students with exceptional needs, including those associated with disabilities and giftedness, and knows how to use strategies and resources to address these needs.

**InTASC Standard #2: 2(j).** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**6. Identify the roles of the school, parents, and the community in multicultural education.**

**InTASC Standard #10: 10(l).** The teacher understands schools as organizations within a historical, cultural, political, and social context and knows how to work with others across the system to support learners.

**InTASC Standard # 10: 10(m).** The teacher understands that alignment of family, school, and community spheres of influence enhances student learning and that discontinuity in these spheres of influence interferes with learning.



**InTASC Standard #10: 10(q).** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**7. Formulate strategies for teaching in a multicultural environment.**

**InTASC Standard #8: 8(k).** The teacher knows how to apply a range of developmentally, culturally, and linguistically appropriate instructional strategies to achieve learning goals.

**InTASC Standard # 8: 8(l).** The teacher knows when and how to use appropriate strategies to differentiate instruction and engage all learners in complex thinking and meaningful tasks.

**InTASC Standard #8: 8(p).** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**8. Create classroom materials designed to enhance sensitivity to diversity.**

**InTASC Standard #7: 7(a).** The teacher individually and collaboratively selects and creates learning experiences that are appropriate for curriculum goals and content standards, and are relevant to learners

**9. Describe culturally responsive teaching methods and dispositions.**

**InTASC Standard #8: 8(k).** The teacher knows how to apply a range of developmentally, culturally, and linguistically appropriate instructional strategies to achieve learning goals.

**InTASC Standard # 8: 8(l).** The teacher knows when and how to use appropriate strategies to differentiate instruction and engage all learners in complex thinking and meaningful tasks.

**10. Participate or serve in various cultural interactions and/or collaborations.**

**InTASC Standard #7: 7(a).** The teacher individually and collaboratively selects and creates learning experiences that are appropriate for curriculum goals and content standards, and are relevant to learners



**Course Five: EDUC 250 - Educational Psychology (CAPSTONE)**

**1. Discuss the importance of educational psychology as a foundation for effective teaching.**

**InTASC Standard # 7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**2. Identify and describe individual differences and social influences on growth, development, and learning.**

**InTASC Standard #1: 1(e).** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f).** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**3. Analyze major theories of intelligence and learning, including Erikson and Piaget.**

**InTASC Standard # 7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**4. Apply theory and research to real-life situations through examples, case studies, and actual observations.**

**InTASC Standard # 7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**5. Identify and describe theories of motivation, relating those theories to effective teaching.**

**InTASC Standard # 7: 7(i).** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**6. Analyze the contemporary issues of education.**

**7. Apply theory and real-life experiences to construct a personal philosophy of teaching.**



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# Secondary Education Math

## TSAP

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TSAP Secondary Education: Math Faculty Panel

09.28.2017

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INDIANA COMMISSION *for*  
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TSAP Secondary Education: Math Faculty Panel

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INDIANA COMMISSION *for*  
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**TSAP Secondary Education: Math Faculty Panel**

**09.28.2017**

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**Pathway: Secondary Education Math**

**Approved: 04.20.2018**

**Preamble:**

The courses mapped for this Transfer Single Articulation Pathway (TSAP) associate's degree are based upon a set of competencies agreed upon across all of the public institutions and are the minimum competencies for transfer in this major.

After a statewide review process, some four-year universities may have specific competencies required that are not included in this mapping and **may limit the admission options for TSAP students**. To increase the likelihood of student success, TSAP advisors in the two-year programs are encouraged to contact the academic advising offices in the major area of the TSAPs at the four-year institutions to discuss the minimum criteria for admission.

It is important that individual students review the published TSAP admission criteria at the specific university/campus to which they wish to transfer. This should be done at the beginning of their enrollment as a TSAP student at either Ivy Tech or Vincennes University. Understanding admission and degree requirements will facilitate student success. The universities in the state of Indiana are committed to the success of TSAP students, and student success is a three-way partnership among students and the academic advisors at both institutions.

A lack of communication after students enroll in a TSAP could result in a misunderstanding of the admission requirements to a specific four-year institution and/or TSAP program, such as minimum grades, specific course sequences, etc., and such misunderstanding could affect the time to graduation.

To be eligible, a student must:

- Have met the TSAP and STGEC eligibility guidelines as defined by Indiana Code
- Have graduated with the TSAP associate degree,
- Have met all the admission requirements (e.g., minimum GPA, minimum course grades, etc.) of the TSAP program at the 4-year institution, and
- Have been admitted to the campus AND into the degree program as a TSAP student.



The competencies and outcomes established below should be met at the associate level so that students who graduate with the TSAP associate degree will be prepared to begin work at the upper level of the baccalaureate program (this does not restrict lower-level coursework from being completed at the four-years when necessary).

### **Section: 1. Calculus-Based Probability and Statistics**

*Prerequisite: Calculus II*

#### **Students will:**

1. Collect, display, analyze, and interpret sample data in a variety of situations using the techniques of exploratory data analysis;
2. Identify correct data collection methods such as sampling surveys, experimental designs and observational studies;
3. Represent relationships between variables in graphical displays, use correlation and regression to explain such relationships;
4. Use experimental and theoretical probabilities as appropriate to formulate and solve problems involving uncertainty;
5. Understand discrete and continuous probability distributions;
6. Understand the underlying population distributions and its relationship to the sampling distributions of the sample mean and the sample proportion
7. Construct and understand confidence intervals and conduct hypothesis testing;
8. Demonstrate appropriate use of technological tools for collecting, analyzing, and drawing conclusions from data;
9. Recognize the misuse of statistics and common misconceptions of probability.
10. Use Statistical software.

#### **Course Content:**

- a. Introduction to data collection methods including sampling designs, experimental designs and observational studies
- b. Descriptive statistics including numerical and graphical summaries of data
- c. Basic elements of probability to support statistics
- d. Concept of random variables and probability distributions
- e. Important distributions of both discrete and continuous types, including the binomial, hypergeometric, chi-square, normal, t, and uniform distributions
- f. Sampling distributions and Central Limit Theorem
- g. Inferential statistics, including confidence intervals and hypotheses tests
- h. Regression topics, including simple linear regression and correlation



**Suggested Texts:**

*Probability and Statistics for Engineers and Scientists* by Walpole, Raymond, and Ye  
*Introduction to Statistics and Data Analysis* by Peck, Olsen, and Devore

**Section 2: Calculus III, 4 credit class**

*Prerequisite: Calculus II*

**Required Topics:**

1. Compute vector operations, including dot product and cross product of vectors in the plane and in 3-dimensions
2. Apply the dot product and cross product
3. Find equations for lines in space
4. Analyze and visualize equations for planes and curves in space
5. Analyze and visualize equations for quadric surfaces
6. Analyze and visualize curves, surfaces, and regions in 3 dimensions in cylindrical and spherical coordinate systems.
7. Perform calculus operations on vector valued functions, including limits, partial derivatives and multiple integrals.
8. Apply calculus to motion in space, length of curves, curvature, and normal vectors.
9. Perform calculus operations on functions of several variables including limits, partial derivatives, chain rule, directional derivatives, gradients.
10. Find and classify extrema and tangent planes of functions of several variables, using Lagrange Multipliers and other techniques.
11. Find areas, volumes, and surface areas using double integrals in rectangular and polar coordinates and using triple integrals in rectangular, cylindrical, and spherical coordinates.
12. Understand vector fields and compute line integrals.
13. Apply the computational and conceptual principles of calculus to find solutions to problems in various scientific and business applications.

**Suggested Texts:**

Those used for Calculus I and Calculus II in the CTL

**Section 3: Differential Equations**

*Prerequisite: Calculus II*

1. Construct an appropriate mathematical model for problems in the physical, biological, and social sciences.



2. Solve first order ordinary linear differential equations and initial value problems using the method of integrating factors.
3. Solve first order separable ordinary differential equations and initial value problems.
4. Solve exact first order differential equations.
5. Apply Euler's method to initial value problems.
6. Find a fundamental set of solutions and the general solution to second order linear homogenous ordinary differential equations with constant coefficients.
7. Solve second order non-homogeneous ordinary differential equations.
8. Find series solutions near an ordinary point to second order ordinary differential equations.
9. Solve systems of linear differential equations
10. Apply Laplace transform

**Suggested Texts:**

*Elementary Differential Equations* by Boyce and diPrima

*A First Course in Differential Equations with Modeling Applications* by Zill

*Elementary Differential Equations* by Edwards and Penney

**Section 4: Linear Algebra**

*Prerequisite: Calculus II*

**Students will be able to:**

**a. Matrix Manipulation and Factorization**

1. Calculate the linear combinations, dot product, length and angle between vectors.
2. Determine the product of a matrix and a vector and the product of two matrices.
3. Use elementary row operations (Gauss-elimination) to write a matrix in row-reduced echelon form.
4. Use elementary row operations to solve a system of linear equations.
5. Use elementary row operations to determine whether a square matrix is invertible, and to find the inverse of an invertible matrix.
6. Determine a particular solution and the general solution of a system of linear equations.
7. Prove simple statements involving properties of matrix products.

**b. Vector Spaces, Subspaces and Orthogonality**

1. State the axioms that define a vector space; use the axioms to determine whether a structure is a vector space; recognize various examples of vector spaces, including nonstandard examples.
2. Show whether a particular subset of a vector space is a subspace.
- 3.



4. Understand the concept of linear independence of vectors, and the concept of a spanning set of vectors.
5. Understand the concept of a basis of a vector space, and the dimension of a vector space. Recognize the geometric meaning of a basis of a vector space.
6. Determine a basis for the four fundamental subspaces of a matrix: column space, row space, null space and left null space of a matrix. Understand how the dimensions of these spaces are related to each other and use this in applications.
7. Understand the concept of orthogonal complement of subspaces of inner product spaces. Compute the orthogonal complement of a subspace.
8. Recognize the orthogonality relationships among the four fundamental subspaces associated with a matrix.

**c. Determinants, Eigenvalues, and Eigenvectors, Linear Transformations**

1. Calculate the determinant of a matrix through cofactor expansion.
2. Recognize many properties of the determinant, and their roles in making computation of the determinant easier.
3. Know the formula for the inverse of an invertible matrix via the classical adjoint matrix.
4. Solve a system of linear equations using inverses.
5. Understand the concept of eigenvalues and eigenvectors of a matrix, including the geometric interpretation. Compute eigenvalues and eigenvectors for a given square matrix. Understand the relationship between eigenvalues of a matrix and its trace and its determinant.
6. Recognize the conditions for the diagonalizability of a matrix. Understand the role of the algebraic and geometric multiplicities of eigenvalues in the diagonalizability of a matrix.
7. Diagonalize a diagonalizable matrix.
8. Explain the idea of a linear transformation and determine the matrix of a linear transformation. Determine whether a given transformation is a linear transformation.
9. Understand the notion of Kernel and Nullity of a linear transformation; understand the rank-nullity theorem, and use it in applications.
10. Prove simple statements involving eigenvalues, eigenvectors and/or linear transformations.

**Suggested Texts:**

*Elementary Linear Algebra* by Anton  
*Linear Algebra and its Applications* by Lay  
*Introduction to Linear Algebra* by Strang



## Section 5: Secondary Education Competencies

### Courses to include with corresponding sequence

#### **Freshman Year:**

EDUC 101 – Introduction to Teaching  
EDUC 121 Child and Adolescent Development

#### **Sophomore Year:**

EDUC 255 – Multicultural Education  
EDUC 201 – Technology in Education  
EDUC 250 – Educational Psychology (CAPSTONE)

### Title, description, and competencies of course

#### **Freshman Year:**

Course One: EDUC 101  
Introduction to Teaching

Introduction to Teaching (Introduction to Teaching is a prerequisite for the other education courses on this list, except EDUC 121).

#### **1. Identify and appreciate the essential qualifications and personal demands of teaching as a profession.**

**InTASC Standard # 9: 9(o)** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.

#### **2. Define and evaluate his/her own teaching dispositions and learning style.**

**InTASC Standard # 9: 9(g)** The teacher understands and knows how to use a variety of self-assessment and problem-solving strategies to analyze and reflect on his/her practice and to plan for adaptations/adjustments.



**InTASC Standard # 9: 9(m)** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard # 9: 9(n)** The teacher sees him/herself as a learner, continuously seeking opportunities to draw upon current education policy and research as sources of analysis and reflection to improve practice.

**InTASC Standard #4: 4(p)** The teacher appreciates multiple perspectives within the discipline and facilitates learners' critical analysis of these perspectives.

**InTASC Standard # 4: 4(q)** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.

**3. Recognize the essential function of professional ethics, personal morals, and a strong value system in the role of the teacher, including the importance of confidentiality and liability issues pertaining to family/school relationships.**

**InTASC Standard # 9: 9(o)** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.

**InTASC Standard #9: 9(j)** The teacher understands laws related to learners' rights and teacher responsibilities (e.g., for educational equity, appropriate education for learners with disabilities, confidentiality, privacy, appropriate treatment of learners, reporting in situations related to possible child abuse).

**4. Reflect on personal reasons for entering the teaching profession and write an initial statement, of educational philosophy.**

**InTASC Standard # 7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**5. Review current teacher licensure laws in the State of Indiana. Compare this licensure process with requirements for teaching in a variety of global locations.**

**InTASC Standard # 9: 9(o)** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.



**6. Recognize and identify strategies to support the family’s role as the child’s first teacher and to support the family/teacher partnership in the child’s development in a culturally competent manner.**

**InTASC Standard # 10: 10(m)** The teacher understands that alignment of family, school, and community spheres of influence enhances student learning and that discontinuity in these spheres of influence interferes with learning.

**InTASC Standard # 10: 10(q)** The teacher respects families’ beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**7. Identify career choices within the field of education, including opportunities to teach abroad, and review programs for professional preparation.**

**InTASC Standard # 10: 10(h)** The teacher uses and generates meaningful research on education issues and policies.

**InTASC Standard # 10: 10(f)** The teacher engages in professional learning, contributes to the knowledge and skill of others, and works collaboratively to advance professional practice.

**InTASC Standard # 10: 10(h)** The teacher uses and generates meaningful research on education issues and policies.

**8. Define and describe the nature, purpose and responsibilities of the public education system in a democratic society. Compare and contrast with the role of public education in other countries.**

**InTASC Standard #4: 4(p)** The teacher appreciates multiple perspectives within the discipline and facilitates learners’ critical analysis of these perspectives.

**InTASC Standard #5: 5(d)** The teacher engages learners in questioning and challenging assumptions and approaches in order to foster innovation and problem solving in local and global contexts.

**InTASC Standard #5: 5(p)** The teacher knows where and how to access resources to build global awareness and understanding, and how to integrate them into the curriculum.

**InTASC Standard # 10: 10(h)** The teacher uses and generates meaningful research on education issues and policies.



**9. Review the history of American education and identify the philosophical foundations of education and their global roots.**

**InTASC Standard #4: 4(p)** The teacher appreciates multiple perspectives within the discipline and facilitates learners' critical analysis of these perspectives.

**InTASC Standard #5: 5(d)** The teacher engages learners in questioning and challenging assumptions and approaches in order to foster innovation and problem solving in local and global contexts.

**InTASC Standard #5: 5(q)** The teacher is constantly exploring how to use disciplinary knowledge as a lens to address local and global issues.

**InTASC Standard #5: 5(p)** The teacher knows where and how to access resources to build global awareness and understanding, and how to integrate them into the curriculum.

**InTASC Standard # 10: 10(h)** The teacher uses and generates meaningful research on education issues and policies.

**10. Identify and observe in the classroom various elements of diversity that affect K-12 student learning and accomplishment.**

**InTASC Standard # 10: 10(q)** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**InTASC Standard # 9: 9(m)** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a)** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b)** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.



**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p)** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n)** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #4: 4(q)** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.

**InTASC Standard # 2: 2(l)** The teacher believes that all learners can achieve at high levels and persists in helping each learner reach his/her full potential.

**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #1: 1(g)** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging.

**InTASC Standard #2: 2(n)** The teacher makes learners feel valued and helps them learn to value each other.

**InTASC Standard #2: 2(o)** The teacher values diverse languages and dialects and seeks to integrate them into his/her instructional practice to engage students in learning.

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.



**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(g)** The teacher understands and identifies differences in approaches to learning and performance and knows how to design instruction that uses each learner's strengths to promote growth.

**InTASC Standard #2: 2(d)** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(f)** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs.

#### **11. Recognize and examine the diversity in schools in the United States and globally.**

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a)** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b)** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.

**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p)** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n)** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.



**12. Identify and observe in the classroom the cultural, family, and environmental factors that affect students in schools.**

**InTASC Standard # 10: 10(q)** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**InTASC Standard # 9: 9(m)** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a)** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b)** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.

**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p)** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n)** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #4: 4(q)** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.

**InTASC Standard # 2: 2(l)** The teacher believes that all learners can achieve at high levels and persists in helping each learner reach his/her full potential.



**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #1: 1(g)** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging.

**InTASC Standard #2: 2(n)** The teacher makes learners feel valued and helps them learn to value each other.

**InTASC Standard #2: 2(o)** The teacher values diverse languages and dialects and seeks to integrate them into his/her instructional practice to engage students in learning.

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(g)** The teacher understands and identifies differences in approaches to learning and performance and knows how to design instruction that uses each learner's strengths to promote growth.

**InTASC Standard #2: 2(d)** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(f)** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs.

### 13. Identify classroom management strategies for the secondary classroom.

**InTASC Standard #3: 3(i)** The teacher understands the relationship between motivation and engagement and knows how to design learning experiences using strategies that build learner self-direction and ownership of learning.



**InTASC Standard # 3(d)** The teacher manages the learning environment to actively and equitably engage learners by organizing, allocating, and coordinating the resources of time, space, and learners' attention.

**14. Define school and classroom culture.**

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(n)** The teacher makes learners feel valued and helps them learn to value each other.

**15. Identify positive characteristics of school and classroom culture.**

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(n)** The teacher makes learners feel valued and helps them learn to value each other.

**16. Develop a classroom management plan.**

**InTASC Standard #3: 3(i)** The teacher understands the relationship between motivation and engagement and knows how to design learning experiences using strategies that build learner self-direction and ownership of learning.

**InTASC Standard # 3(d)** The teacher manages the learning environment to actively and equitably engage learners by organizing, allocating, and coordinating the resources of time, space, and learners' attention.



**18. Complete a minimum of twenty (20) hours of supervised service learning in a classroom and reflect on the experience in relation to personal skills, dispositions, and future professional decisions.**

**InTASC Standard # 10: 10(q)** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**InTASC Standard # 9: 9(m)** The teacher is committed to deepening understanding of his/her own frames of reference (e.g., culture, gender, language, abilities, ways of knowing), the potential biases in these frames, and their impact on expectations for and relationships with learners and their families.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard # 9: 9(a)** The teacher engages in ongoing learning opportunities to develop knowledge and skills in order to provide all learners with engaging curriculum and learning experiences based on local and state standards.

**InTASC Standard # 9: 9(b)** The teacher engages in meaningful and appropriate professional learning experiences aligned with his/her own needs and the needs of the learners, school, and system.

**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**InTASC Standard #8: 8(p)** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**InTASC Standard #7: 7(n)** The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #4: 4(q)** The teacher recognizes the potential of bias in his/her representation of the discipline and seeks to appropriately address problems of bias.



**InTASC Standard # 2: 2(l)** The teacher believes that all learners can achieve at high levels and persists in helping each learner reach his/her full potential.

**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #1: 1(g)** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging.

**InTASC Standard #2: 2(n)** The teacher makes learners feel valued and helps them learn to value each other.

**InTASC Standard #2: 2(o)** The teacher values diverse languages and dialects and seeks to integrate them into his/her instructional practice to engage students in learning.

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(g)** The teacher understands and identifies differences in approaches to learning and performance and knows how to design instruction that uses each learner's strengths to promote growth.

**InTASC Standard #2: 2(d)** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(f)** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs



**Freshman Year**

Course Two: EDUC 121

Child and Adolescent Development

**MAJOR COURSE LEARNING OBJECTIVES:** Upon successful completion of this course the student will be expected to:

**1. Explore the physical, social, emotional, cognitive, and moral development of the child from birth through adolescence.**

**InTASC Standard # 1: 1(d)** The teacher understands how learning occurs--how learners construct knowledge, acquire skills, and develop disciplined thinking processes--and knows how to use instructional strategies that promote student learning.

**InTASC Standard #1: 1(e)** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard # 7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**2. Recognize theories of growth and development that focus on early and middle childhood through the adolescent years.**

**InTASC Standard #1: 1(d)** The teacher understands how learning occurs--how learners construct knowledge, acquire skills, and develop disciplined thinking processes--and knows how to use instructional strategies that promote student learning.

**InTASC Standard #1: 1(e)** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.



### 3. Examine and implement observation and interviewing skills as a means of understanding the child.

**InTASC Standard #1: 1(d)** The teacher understands how learning occurs--how learners construct knowledge, acquire skills, and develop disciplined thinking processes--and knows how to use instructional strategies that promote student learning.

**InTASC Standard # 1: 1(a)** The teacher regularly assesses individual and group performance in order to design and modify instruction to meet learners' needs in each area of development (cognitive, linguistic, social, emotional, and physical) and scaffolds the next level of development.

**InTASC Standard #1: 1(c)** The teacher collaborates with families, communities, colleagues, and other professionals to promote learner growth and development.

**InTASC Standard #1: 1(e)** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #1: 1(h)** The teacher respects learners' differing strengths and needs and is committed to using this information to further each learner's development.

**InTASC Standard #1: 1(k)** The teacher values the input and contributions of families, colleagues, and other professionals in understanding and supporting each learner's development.

**InTASC Standard #2: 2(d)** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**InTASC Standard # 3: 3(a)** The teacher collaborates with learners, families, and colleagues to build a safe, positive learning climate of openness, mutual respect, support, and inquiry.

**InTASC Standard # 3: 3(n)** The teacher is committed to working with learners, colleagues, families, and communities to establish positive and supportive learning environments.



**InTASC Standard #3: 3(q)** The teacher seeks to foster respectful communication among all members of the learning community.

**InTASC Standard #3: 3(r)** The teacher is a thoughtful and responsive listener and observer.

**InTASC Standard #4: 4(i)** The teacher accesses school and/or district-based resources to evaluate the learner's content knowledge in their primary language.

**InTASC Standard #6: 6(b)** The teacher designs assessments that match learning objectives with assessment methods and minimizes sources of bias that can distort assessment results.

**InTASC Standard #6: 6(g)** The teacher effectively uses multiple and appropriate types of assessment data to identify each student's learning needs and to develop differentiated learning experiences.

**InTASC Standard #6: 6(t)** The teacher is committed to using multiple types of assessment processes to support, verify, and document learning.

**InTASC Standard #6: 6(v)** The teacher is committed to the ethical use of various assessments and assessment data to identify learner strengths and needs to promote learner growth.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #9: 9(h)** The teacher knows how to use learner data to analyze practice and differentiate instruction accordingly.

**InTASC Standard #9: 9(j)** The teacher understands laws related to learners' rights and teacher responsibilities (e.g., for educational equity, appropriate education for learners with disabilities, confidentiality, privacy, appropriate treatment of learners, reporting in situations related to possible child abuse).

**InTASC Standard #10: 10(q)** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

#### **4. Discuss confidentiality when working with children/adolescents and families.**

**InTASC Standard #9: 9(j)** The teacher understands laws related to learners' rights and teacher responsibilities (e.g., for educational equity, appropriate education for learners with disabilities, confidentiality, privacy, appropriate treatment of learners, reporting in situations related to possible child abuse).



**InTASC Standard #6: 6(v)** The teacher is committed to the ethical use of various assessments and assessment data to identify learner strengths and needs to promote learner growth.

**5. Identify pro-social and anti-social behavior.**

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**6. Identify appropriate environments that promote healthy emotional/social development for all children/adolescents.**

**InTASC Standard #1: 1(e)** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**7. Recognize appropriate personal strengths and behaviors desired when working with children age eight through adolescence.**

**InTASC Standard # 9: 9(g)** The teacher understands and knows how to use a variety of self-assessment and problem-solving strategies to analyze and reflect on his/her practice and to plan for adaptations/adjustments.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**8. Identify and analyze societal issues facing today's children/adolescents.**

**InTASC Standard #9: 9(d)** The teacher actively seeks professional, community, and technological resources, within and outside the school, as supports for analysis, reflection, and problem-solving.



**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**9. Identify and explore ways to support diverse children/adolescents in their personal growth and development related to trust, autonomy, initiative, industry and identity.**

**InTASC Standard # 2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**InTASC Standard #9: 9(i)** The teacher understands how personal identity, worldview, and prior experience affect perceptions and expectations, and recognizes how they may bias behaviors and interactions with others.

**InTASC Standard #9: 9(e)** The teacher reflects on his/her personal biases and accesses resources to deepen his/her own understanding of cultural, ethnic, gender, and learning differences to build stronger relationships and create more relevant learning experiences.

**10. Identify community and school resources needed to support children through adolescent-age children and families.**

**InTASC Standard # 2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard # 3: 3(n)** The teacher is committed to working with learners, colleagues, families, and communities to establish positive and supportive learning environments.

**InTASC Standard #9: 9(d)** The teacher actively seeks professional, community, and technological resources, within and outside the school, as supports for analysis, reflection, and problem-solving.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.



**Sophomore Year**

Course Three: EDUC 201

Technology in Education

**1. Create instructional materials in a variety of applications, formats and styles.**

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

**2. Demonstrate an understanding of technological operations and concepts for instruction.**

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.



**3. Plan and design effective learning environments and experiences supported by technology.**

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

**InTASC Standard # 10: 10(t)** The teacher embraces the challenge of continuous improvement and change.

**4. Apply current research on teaching and learning with technology to the planning of instructional materials and learning environments.**

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.



**InTASC Standard # 9: 9(n)** The teacher sees him/herself as a learner, continuously seeking opportunities to draw upon current education policy and research as sources of analysis and reflection to improve practice.

**InTASC Standard # 10: 10(t)** The teacher embraces the challenge of continuous improvement and change.

**5. Apply technology to the creation of effective assessment and evaluation strategies.**

**InTASC Standard #6: 6(i)** The teacher continually seeks appropriate ways to employ technology to support assessment practice both to engage learners more fully and to assess and address learner needs.

**6. Use technology to enhance your productivity, efficiency and professional practice.**

**InTASC Standard #4: 4(g)** The teacher uses supplementary resources and technologies effectively to ensure accessibility and relevance for all learners.

**InTASC Standard # 8: 8(g)** The teacher engages learners in using a range of learning skills and technology tools to access, interpret, evaluate, and apply information.

**InTASC Standard #8: 8(n)** The teacher knows how to use a wide variety of resources, including human and technological, to engage students in learning.

**InTASC Standard #8: 8(o)** The teacher understands how content and skill development can be supported by media and technology and knows how to evaluate these resources for quality, accuracy, and effectiveness.

**InTASC Standard #8: 8(r)** The teacher is committed to exploring how the use of new and emerging technologies can support and promote student learning.

**InTASC Standard # 9: 9(n)** The teacher sees him/herself as a learner, continuously seeking opportunities to draw upon current education policy and research as sources of analysis and reflection to improve practice.

**InTASC Standard # 10: 10(t)** The teacher embraces the challenge of continuous improvement and change.

**7. Analyze the social, ethical, legal, and human issues surrounding the use of technology in the classroom.**



**InTASC Standard # 9: 9(f)** The teacher advocates, models, and teaches safe, legal, and ethical use of information and technology including appropriate documentation of sources and respect for others in the use of social media.

**InTASC Standard #9: 9(o)** The teacher understands the expectations of the profession including codes of ethics, professional standards of practice, and relevant law and policy.

**8. Analyze and utilize the standards presented in the NETS and INTASC consortia.**

**Sophomore Year**

Course Four-EDUC 255

Introduction to Multicultural Teaching

**1. Demonstrate an understanding and awareness of how cultural factors including personal preferences, ethnic characteristics, values, and bias influence classroom teaching.**

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.

**2. Identify and apply essential multicultural and global concepts in the classroom and community.**

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**InTASC Standard #2: 2(m)** The teacher respects learners as individuals with differing personal and family backgrounds and various skills, abilities, perspectives, talents, and interests.



**InTASC Standard #5: 5(d)** The teacher engages learners in questioning and challenging assumptions and approaches in order to foster innovation and problem solving in local and global contexts.

**3. Identify standards for education with a multicultural focus.**

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**4. Examine goals and positions for and against multicultural education.**

**InTASC Standard #2: 2(k)** The teacher knows how to access information about the values of diverse cultures and communities and how to incorporate learners' experiences, cultures, and community resources into instruction.

**5. Discuss the effects of exceptionality, gender, ethnic, socioeconomic and religious factors on learning.**

**InTASC Standard #1: 1(g)** The teacher understands the role of language and culture in learning and knows how to modify instruction to make language comprehensible and instruction relevant, accessible, and challenging.

**InTASC Standard #1: 1(h)** The teacher respects learners' differing strengths and needs and is committed to using this information to further each learner's development.

**InTASC Standard #2: 2(d)** The teacher brings multiple perspectives to the discussion of content, including attention to learners' personal, family, and community experiences and cultural norms.

**InTASC Standard #2: 2(f)** The teacher accesses resources, supports, and specialized assistance and services to meet particular learning differences or needs.

**InTASC Standard #2: 2(h)** The teacher understands students with exceptional needs, including those associated with disabilities and giftedness, and knows how to use strategies and resources to address these needs.

**InTASC Standard #2: 2(j)** The teacher understands that learners bring assets for learning based on their individual experiences, abilities, talents, prior learning, and peer and social group interactions, as well as language, culture, family, and community values.



**6. Identify the roles of the school, parents, and the community in multicultural education.**

**InTASC Standard #10: 10(l)** The teacher understands schools as organizations within a historical, cultural, political, and social context and knows how to work with others across the system to support learners.

**InTASC Standard # 10: 10(m)** The teacher understands that alignment of family, school, and community spheres of influence enhances student learning and that discontinuity in these spheres of influence interferes with learning.

**InTASC Standard #10: 10(q)** The teacher respects families' beliefs, norms, and expectations and seeks to work collaboratively with learners and families in setting and meeting challenging goals.

**7. Formulate strategies for teaching in a multicultural environment.**

**InTASC Standard #8: 8(k)** The teacher knows how to apply a range of developmentally, culturally, and linguistically appropriate instructional strategies to achieve learning goals.

**InTASC Standard # 8: 8(l)** The teacher knows when and how to use appropriate strategies to differentiate instruction and engage all learners in complex thinking and meaningful tasks.

**InTASC Standard #8: 8(p)** The teacher is committed to deepening awareness and understanding the strengths and needs of diverse learners when planning and adjusting instruction.

**8. Create classroom materials designed to enhance sensitivity to diversity.**

**InTASC Standard #7: 7(a)** The teacher individually and collaboratively selects and creates learning experiences that are appropriate for curriculum goals and content standards, and are relevant to learners

**9. Describe culturally responsive teaching methods and dispositions.**

**InTASC Standard #8: 8(k)** The teacher knows how to apply a range of developmentally, culturally, and linguistically appropriate instructional strategies to achieve learning goals.

**InTASC Standard # 8: 8(l)** The teacher knows when and how to use appropriate strategies to differentiate instruction and engage all learners in complex thinking and meaningful tasks.



**10. Participate or serve in various cultural interactions and/or collaborations.**

**InTASC Standard #7: 7(a)** The teacher individually and collaboratively selects and creates learning experiences that are appropriate for curriculum goals and content standards, and are relevant to learners.

**Sophomore Year**

Course Five: EDUC 250

Educational Psychology (CAPSTONE)

**1. Discuss the importance of educational psychology as a foundation for effective teaching.**

**InTASC Standard # 7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**2. Identify and describe individual differences and social influences on growth, development, and learning.**

**InTASC Standard #1: 1(e)** The teacher understands that each learner's cognitive, linguistic, social, emotional, and physical development influences learning and knows how to make instructional decisions that build on learners' strengths and needs.

**InTASC Standard #1: 1(f)** The teacher identifies readiness for learning, and understands how development in any one area may affect performance in others.

**3. Analyze major theories of intelligence and learning, including Erikson and Piaget.**

**InTASC Standard # 7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**4. Apply theory and research to real-life situations through examples, case studies, and actual observations.**

**InTASC Standard # 7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.



**5. Identify and describe theories of motivation, relating those theories to effective teaching.**

**InTASC Standard # 7: 7(i)** The teacher understands learning theory, human development, cultural diversity, and individual differences and how these impact ongoing planning.

**6. Analyze the contemporary issues of education.**

**7. Apply theory and real-life experiences to construct a personal philosophy of teaching.**