



Gordon A. Cain Center

2021 LSU HIGH SCHOOL STEM PATHWAYS PROGRAM

- Biomedical Sciences ▪ Computing
- Digital Design & Emergent Media ▪ Pre-Engineering

Do you want to offer high quality, project-based, BESE-approved high school STEM courses to students at your school? **The LSU STEM Pathways Program is here to help!**

Benefits to Offering a BESE-Approved LSU Pathways Course at Your School		
Students	Teachers	Districts
<ul style="list-style-type: none"> ● Earn LSU Pathway Certificates and Industry Based Credentials ● High Quality, Project Based Courses ● Dual Enrollment opportunities ● Opportunity to apply for Scholarships at LSU 	<ul style="list-style-type: none"> ● No High Stakes Testing ● Opportunity to participate in various grant funded STEM education research projects ● Access to a minimum of six free Community of Practice sessions¹ ● Access to substantial LSU graduate tuition scholarships and support programs 	<ul style="list-style-type: none"> ● \$482 in CTE/CDF funding per student per seat ● SPS points for Industry Based Credentials

If taught by an LSU-certified STEM Pathway teacher, LSU’s STEM Pathway courses earn districts \$482 in CTE/CDF funding per student/seat as well as SPS points for IBC’s or dual enrollment credit. Teachers can become certified to teach a specific Pathway course by attending the **2021 LSU Pathways Virtual Summer Training Institute** which will be offered in two sessions: **Session 1: JUNE 7- JUNE 22** and **Session 2: JUNE 23 - JULY 9**. The registration fee is \$1,920 per teacher per course section.²

Will you be offering an LSU STEM Pathway course in 2021-22?

STEP 1: All new and returning schools should complete the Letter of Intent by April 1st:

<https://forms.gle/CCuujkRBSUSSrFbr7>

STEP 2: After receiving the Letter of Intent, teachers who need to be trained will be provided a registration link for the training institute and the schools/districts will receive a Memorandum of Understanding (MoU) which has to be returned to LSU by May 1, 2021.

More information on the Summer Training Institute & MoU on the next pages; if you have questions, please send an email to stempathways@lsu.edu.

¹ LSU provides support for first-year pathway teachers by hosting at least six course-specific Community of Practice (CoP) sessions assisting with course implementation issues. CoP teacher stipends will be determined and paid for by the districts.

² Some courses require two sections for complete training and CTE/CDF course eligibility. See schedule below for details.

SUMMER TRAINING INSTITUTE INFORMATION ³	
Session 1: JUNE 7- JUNE 22 Session 2: JUNE 23 - JULY 9	\$1,920 per course section ⁴

Schools/Districts are encouraged to pay a teacher a stipend for attending the training using CDF or CTE funding. Registration fee waivers, tuition waivers, and stipends may be available for selected schools and/or teachers participating in the Summer Training Institute courses. Please request information regarding your eligibility.

<u>Requirements to Participate in the Summer Training Institute</u>	
Schools/ District	<ul style="list-style-type: none"> ● Complete the Letter of Intent by April 1st: https://forms.gle/CCuujkRBSUSrFbr7 ● Sign and return the Memorandum of Understanding by May 1 (which will be sent upon receipt of the Letter of Intent). <ul style="list-style-type: none"> ○ Agree to offer the course in 2021-22 ○ Provide necessary technology and other required course materials ○ Pay \$96 administrative fee to LSU for each student receiving an LSU STEM Pathway Certificate of Course Completion and for which the school system receives \$482 in CTE/CDF funding
Teachers	<ul style="list-style-type: none"> ● If not already trained previously, you are required to register for training by April 15th; link will be provided upon receipt of your school's Letter of Intent. ● No content-specific prior knowledge required (see schedule for details)⁵ ● Strong work ethic and a desire to engage in project-based learning ● Suitable device and reliable internet access to be logged into a computer and actively participate during synchronous portions of training⁶

Spots are filling quickly so please complete the Letter of Intent by **April 1st, 2021** to register your school and reserve a spot in training. If you have questions about the LSU STEM Certification Pathways program, please send them to stempathways@lsu.edu.

³ Some summer training courses can be taken for graduate credit with a full tuition scholarship (course fees have to be paid by participants or their schools). Participating teachers who want to receive graduate credit must enroll in the LSU Graduate School by May 1, 2021. If you are interested in receiving grad credit, please send a brief e-mail to stempathways@lsu.edu.

⁴ Some courses require two sections for complete training and CTE/CDF course eligibility. See schedule below for details.

⁵ Although prior STEM experience is a plus, many successful STEM Pathway teachers had no prior STEM background.

⁶ If a teacher does not have access to either a device/internet, the school is responsible for providing it.



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LSU STEM CERTIFICATION PATHWAYS: VIRTUAL 2021 SUMMER TRAINING INSTITUTE HIGH SCHOOL OPTIONS

Session 1: June 7th- June 22nd Session 2: June 23rd - July 9th

Due to the continued uncertainties of the coronavirus pandemic, we will be offering this year's summer training for the LSU STEM Pathways in a virtual setting, with some required face-to-face Saturday workshops this fall and next spring. Synchronous online meetings will occur at different points each day between **8 AM - 1 PM** and/or **12:00 PM - 5:00 PM**.

Group synchronous time will be **12:00 PM - 1:00 PM** each day. Assignments and asynchronous materials will be completed between each synchronous online meeting.

Courses available for graduate credit are denoted with a

Session I 12 days: M 6/7 - F 6/11, M 6/14 - F 6/18, M 6/21 - T 6/22	Session II 12 days: W 6/23 - F 6/25, M 6/28- F 7/2, T 7/6- F 7/9
BIOMEDICAL SCIENCES	
Comparative Anatomy & Physiology (AM Synchronous) No Prerequisites	Intro to Biomedical Sciences (AM Synchronous) No Prerequisites
By request we may be able to offer small virtual seminars for pilots in Forensics and Senior Biomedical Capstone (Sessions 1 & 2: times tbd). For select teachers only; inquire as to suitability.	
COMPUTING	
Cyber Security (AM Synchronous) No Prerequisites	Survey Computer Science (AM Synchronous) No Prerequisites
	Interactive Computing (INCO) (PM Synchronous) Pilot (Prerequisite: Intro to Computational Thinking)
Introduction to Computational Thinking I (ICT) (AM Synchronous + daily homework) No Prerequisites. Section II is Required.	Introduction to Computational Thinking II (ICT) (AM Synchronous + daily homework) Prerequisites: ICT Section I
Data Manipulation and Analysis (DMA) (AM Synchronous) Prerequisite: ICT	
Programming for STEM (PRG) is available on request to teachers who have taught at least two programming courses (ICT, DMA, INCO)	
DIGITAL DESIGN & EMERGENT MEDIA	
Sound Design (AM Synchronous) No Prerequisites	Digital Storytelling (AM Synchronous) No Prerequisites
Digital Image (AM Synchronous) No Prerequisites	Motion Graphics (AM Synchronous) No Prerequisites
Interactive Media Capstone (AM Synchronous) No Prerequisites	Advanced Film and TV Production (AM Synchronous) Pilot (Prerequisites : Basic Film & TV Production)
Basic Film and TV Production Section 1	Basic Film and TV Production Section 2



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(AM Synchronous) No Prerequisites 🎓, Section 2 is Required	(AM Synchronous) Prerequisites: Section 1, 🎓
Programming Digital Media Section 1 (AM Synchronous) No Prerequisites 🎓, Section 2 is Required	Programming Digital Media Section 2 (AM Synchronous) Prerequisites: Section 1, 🎓
Coding for the Web Section 1 (AM Synchronous) No Prerequisites 🎓, Section 2 is Required	Coding for the Web Section 2 (AM Synchronous) Prerequisites: Section 1, 🎓
By request we may be able to offer Digital Storytelling in Session 1.	
PRE-ENGINEERING	
Intro to Robotics (AM Synchronous) No Prerequisites 🎓	Engineering Design and Development (AM Synchronous) No Prerequisites (Includes IBC opportunity) Requires PC
Intro to Engineering (AM Synchronous) No Prerequisites 🎓	Principles of Engineering (AM Synchronous) Prerequisite: Intro to Engineering
Engineering Economy (PM Synchronous) (strong math background preferred)	Engineering Design and Development (PM Synchronous) Prerequisite: Already Inventor Certified Requires PC, *Special cost \$960 instead of \$1920 as session is abbreviated
Advanced Robotics VEX (PM Synchronous) Prerequisite: Intro to Robotics	
By request we may be able to offer small virtual seminars and study groups for returning teachers for Advanced Robotics (FIRST Robotics Pilot) and Survey of Drones (Pilot) . Sessions 1 & 2; times: tbd	



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HIGH SCHOOL STEM PATHWAY COURSE DESCRIPTIONS

BIOMEDICAL SCIENCES COURSE DESCRIPTIONS

Intro to Biomedical Sciences (9th Grade, 090811): This modular one-year course covers a large variety of fields in biomedicine. Each module is designed to take two to three weeks and provide students with opportunities to develop their public speaking and science literacy skills, as well as learn how to cooperate in a group efficiently and professionally. Topics include but are not limited to sports medicine, pharmacology, psychology, nutrition, veterinary medicine, bioinstrumentation, biomedical engineering, forensic anthropology, parasitology, and speech pathology. Modules can be selected based on student interest, availability of potential guest speakers, or timing of field trips.

Comparative Anatomy & Physiology (9th or 10th Grade, 312095): This one-year course engages students in rigorous study of the body's physiological systems and then compares these systems across many species in the animal kingdom (both vertebrates and invertebrates). Course assignments range from formal assessments to hands on dissections and labs. Additionally, this course places an emphasis on public speaking through scientific presentations and independent research to enhance scientific reading and writing skills. Students will also learn to read and interpret published scientific articles to examine evolutionary relationships between species, making connections that will be built on in later bioinformatics studies.

Forensic Science (10th or 11th Grade, 312096): This is a one-year lab-intensive course that allows students to pursue an in-depth study of forensic science as a tool for collecting evidence and crime scene analysis. Areas of study include physical evidence, properties of matter and the analysis of glass, drugs, forensic toxicology, the microscope, forensic serology, DNA, trace evidence, fire investigation, investigation of explosives, fingerprints, ballistics, forensic anthropology, casts and impressions, document examination and computer forensics.

PILOT: Bioinformatics (11th or 12th Grade, 090813): This course introduces bioinformatics to high school students, emphasizing searching and retrieving biological data, sorting the data, and finally analyzing the sorted data to draw meaningful conclusions. This course involves hands-on activities and projects on computers/laptops and teaches students how to relate the outcome of each activity to a real-life biological scenario. While moving through this course, students are introduced to cutting-edge bioinformatics resources and tools so that by the end of the course they are prepared to either pursue advanced college-level computational biological studies, or apply the knowledge gained in this course to tackle common bioinformatic tasks at a university-level biology research lab.

PILOT: Biomedical Capstone (11th or 12th Grade, 090812): (Prerequisites: Introduction to Biomedical Science and Comparative Anatomy and Physiology) This course is for seniors in the Biomedical Academy. Students spend time interning for a wide range of biomedically focused local companies, businesses, and organizations. Students in this course will gain work experience and become more familiar with several possible career paths and opportunities available to them so that they can make informed decisions on how to best achieve their biomedical professional goals. It is recommended that students have access to their own transportation.

COMPUTING COURSE DESCRIPTIONS

Cyber Security (9th-12th Grade, 040217): This is a full-year course designed to foster interest in Information Technology and networking careers. Through hands-on projects, students learn to install and administer operating systems, to have computers communicate with each other and to detect and repair vulnerabilities in systems and networks. This course also covers connections of computing and society, including ethics, security, and privacy in on-line communication. Students taking this course will be expected to take the CompTIA IT Fundamentals certification exam.

Data Manipulation and Analysis (10th-12th Grade, 080532): This course introduces students to the emerging field of Data Science. Instructional units cover the standard practices for effective data manipulation, analysis, and interpretation as well as necessary concepts in the three disciplines involved (mathematics, statistics, and computing.) Numerous examples of typical scenarios are provided. The emphasis on this course is in the application of the concepts rather than the theory. In the second semester, students will work in teams on large projects in which they will use programming to analyze large datasets and create models. The students will summarize their findings for each project in a written report and will also present them orally.

Interactive Computing (10th-12th Grade, 061180): This is a course for students in 10th grade and up. It focuses on the nuisances of programming for interacting with the real world in two representative areas: autonomous robots and the front end of web applications. Students learn how to iteratively approximate a software model to the realities of the physical hardware, how to write test suites and how to systematically debug their programs. Through fun and engaging projects, the students learn problem solving skills, such as programming robots to navigate mazes and play soccer, developing on-line pages to read sensors and control actuators in greenhouses, and automating devices at home with Internet of Things (IoT) technologies.

Introduction to Computational Thinking (9th-10th Grade, 061140): This course introduces students to the basic ideas of computational thinking and artistic design, as students create images and learn to utilize the Cartesian plane. Students will use an open source, Web-based programming environment to create code for simple drawings, animations and simulations, through which they learn how to use abstraction, decomposition and pattern recognition to model problems and arrive at an algorithmic solution. Program code is presented with a dual purpose: as the main way to interact with a computer and as a proxy to organize ideas explicitly and communicate them to other people. Many examples are drawn from Algebra I and Geometry, so that students can visualize and manipulate the mathematical concepts in a more concrete form. The creativity and programming of images requires critical analysis, aesthetic awareness, and an understanding of decomposition of complex objects into geometric components. Students are encouraged to develop their own ideas while learning the elements and principles of visual design. Students are also taught the foundations in programming graphics, slideshow animations, and drawing using code. The curriculum of this course focuses on integrating computational thinking into the content areas: Art, English, science, math, and social studies. The course build cross curricular connections into core disciplines through the techniques of science diagramming, ELA story illustration, recreating historical moments, and photo elicitation to help students explore culture.

Programming for STEM (11th-12th Grade, 144300): This course expands the practice of software development in a variety of settings, so that students acquire a broad set of programming skills and a deeper understanding of software engineering principles. Students learn to plan, design, and implement relatively large programming projects that require background research and teamwork. Topics include simulations, games, and interactive on-line applications. Robust program design and sound software engineering practices are emphasized throughout the course.

Survey Computer Science (8th or 9th grade, 061179): This one-year course can be taken in middle school for high school credit and counts as either a core course or as an elective course for the LSU Computing Pathway. It introduces the basics of computing using fun and engaging activities instead of formally describing the concepts. This course follows the framework of Big Ideas adopted in the AP Computer Science Principles (CSP) course, but it has more emphasis on exploration and experimentation, and less emphasis on problem-solving and formal analysis than a regular CSP course. To prepare students for the rigors of other courses in the Pathways, this course models ways to adopt a productive disposition that fosters creativity and perseverance, with a focus on developing students' interest in computing and identification with the computing professions.

Digital Storytelling (9th Grade, 040241): This is a project-based learning (PBL) inspired course that utilizes a PBL assessment guide in addition to thoughtful integrated learning. Throughout the course, experimentation, and the practice of storytelling through the lenses of multiple mediums allows students to develop narrative reasoning skills, while simultaneously giving them a realm to be creative and challenged. The course was created in response to the demand from “entertainment” industries for individuals skilled in content creation and transfer of thinking. The purpose of this course is to get our students to become creators rather than just consumers. The course focuses on content creation, specifically in the realms of: Visual, Auditory, Videographic, and Interactive Storytelling. The course also focuses on Digital Literacy, and how to become a responsible denizen. At any point throughout the course, students use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills.

Programming Digital Media (10th-12th Grade, 040243): Programming Digital Media introduces a broad array of topics related to digital media through project-oriented programming of graphics, audio, and hardware applications. The motivation for this course is to provide a basic introduction to computer programming using subjects that are relevant or appealing to students who are new to technological fields of study, with little to no prior programming experience. The course is presented in five segments, introducing coding, covering three distinct areas in digital media, plus a final integration project of these areas. There is a strong emphasis on computer programming tasks throughout, and the hands-on exercise of digital media tools in class is required. After an introduction to coding concepts, the first media topic introduces real-time graphics rendering and user interaction. The second introduces sound design. The third introduces basic electronics and physical computing. Finally, communication mechanisms are used allowing the disparate elements of graphics, sound, and hardware to be composed into interactive projects. *This may be offered as a dual enrollment course through LSU.*

Coding for the Web (10th-12th Grade, 040244): Coding for the web is an introductory course focusing on the foundational programming concepts in web development, such as: functions, loops, conditional statements, async functions, lambdas, as well as analyzing and solving problems like a programmer. Though this course uses HTML5, CSS3, JSS, and ES6, this is not a “web design” course. Students will have the skills, knowledge, and experience to create web applets by the end of the course. The main goal of this course is to develop students that have the ability to think critically about how to solve problems using computational thinking and good old-fashioned troubleshooting.

Digital Image (10th-12th Grade, 080021): This course is based on hands-on training in the use of computer hardware and software to create digital graphics with Photoshop and Illustrator. As the student develops familiarity with these industry standard programs and graphic tools, 2D animation and design projects will be overseen by mentors. The 2D animation portion of the class focuses on rigging, planar tracking, rotoscoping and motion tracking in order to develop seamless continuity of character animation and dynamic set development. *This may be offered as a dual enrollment course through LSU.*

Sound Design (10th-12th Grade, 080020): Sound Design /Introduction to Computer Music (dual enrollment option) introduces students to a broad range of topics and concepts in electronic and computer music. This course covers principles of digital audio, sound design, synthesis, Digital Audio Workstations, and sound art composition. Assignments and activities include listening, analysis, discussion, and hands-on recording and composition exercises.

Motion Graphics (10th-12th Grade, 080816): This course is based on hands-on training in the use of computer hardware and software to create digital graphics with Maya and Blender. As the student develops the familiarity with these industry standard programs and graphic tools, 3D animation and design projects will be overseen by mentors. The 3D animation portion of the class will focus on rigging, planar tracking, rotoscoping, motion tracking in order to develop seamless continuity of character animation and dynamic set development. *This may be offered as a dual enrollment course through LSU.*



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Basic Film & TV Production (10th-12th Grade, 080023): This course serves as an introduction to the filming and production skills required to create audiovisual media in the realm of film and television. Students will learn the differences between various film and television styles (narrative film, video journalism, documentary, broadcast, etc.) and will learn proper videography, editing, and production skills through hands-on projects. **Enrollment space is limited, and prior videography/video production experience is beneficial.**

PILOT: Advanced Film & TV Production (10th-12th Grade, 080024): This course expands upon the filming and production skills developed in the Basic course. Students will do in-depth projects in various film and television styles (narrative film, video journalism, documentary, broadcast, etc.) and will develop their skills in videography, editing, and production skills to develop a portfolio of video work. This course is in active development and will be piloted during the 2021-2022 academic year. **Completion of the Basic Film & TV Production, and prior videography/video production experience is required. Please contact the DDEM pathway coordinators before enrolling in this course.**

Interactive Media Capstone (11th-12th Grade, 040245): Interaction design & experience design incorporating digital media assets with programming to create interactive experiences. This is an advanced projects course to synthesize media and digital storytelling from other production courses into emergent media projects. Capstone Projects are faculty facilitated, student led teams creating a digital media artifact from conception to presentation. Example works might include a 2D or 3D video game; a student-developed social network web application; a movie or animation; interactive informational kiosk for a museum or library; a concert of student-created digital media performances. **Prior experience in media production is required, experience with coding is beneficial.**

PRE-ENGINEERING COURSE DESCRIPTIONS

Intro to Engineering (9th Grade, 110801): This course introduces the profession, ethics, and diversity of the field of engineering to students in their freshman year of high school. The course will allow students to explore the 10 primary concentrations within engineering by listening to guest speaker lectures, working on an interactive project with a team, and presenting the results of their project to the class. The majors are: Biological Engineering, Civil Engineering, Environmental Engineering, Chemical Engineering, Computer Engineering/ Electrical Engineering, Computer Science, Construction Management, Industrial Engineering, Mechanical Engineering, and Petroleum Engineering. Specifically, this course will emphasize that the engineer is a team worker who needs strong skills in technical problem solving, engineering design, ethical decision making, and communicating to diverse audiences. *This may be offered as a dual enrollment course through LSU.*

Intro to Robotics (10th Grade, 150780): This beginning robotics course uses VEX EDR Robotics parts and VEXCode software to introduce the student to basic programming as well as problem solving strategies. This course will involve students in the development, building and programming of robots to accomplish various tasks. Students will work hands-on in teams to design, build, program and document their progress. Topics may include motor speed, gear ratios, torque, sensors, program loops, project documentation and decision-making.

Principles of Engineering (10th Grade, 110864): This course is a sophomore-level survey of engineering course meant to be taken after Introduction to Engineering. The course continues to expose students to some of the major concepts that they will encounter in a postsecondary engineering course of study or in a technical career field. POE gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Students will spend approximately 3 weeks exploring each discipline through concept lectures and hands on projects. Through these lectures and projects students will learn concepts such as, but not limited to, electrical circuitry, computer programming on Arduino's, Rube Goldberg machines, biomechanics, and pneumatics/hydraulic systems. Students will work in teams to develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students will also hone their 21st century skills by documenting their work and communicating their solutions to their peers and members of the professional community. *Counts as a TOPS University*



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Physical Science Course

Engineering Economy (11th or 12th Grade, 144200): The Engineering Economy course is designed to teach students about the time value of money, cash flows occurring at different times with different amounts, and equivalence at different interest rates. These concepts will be used to evaluate engineering project proposals using well-accepted economic analysis techniques, such as present worth, future worth, capitalized cost, life-cycle costing, annual worth, rate of return, or benefit/cost analysis. Additionally, techniques such as replacement/retention studies, breakeven analysis, and payback analysis help make informed decisions about future uses of existing assets and systems. *This may be offered as a dual enrollment course through LSU.*

Engineering Design and Development (10th-12th Grade, 110861): The primary intent of the course is to provide the student with the skills necessary to understand, interpret, and create engineering drawings and working sketches. The student will learn to create 3D models and engineering drawings using Inventor. In addition to developing spatial reasoning and technical drawing skills, students will work on technical writing skills and certain soft skills through journal article reflections, work ethic lessons, and oral presentations on various topics throughout the semester. The course will culminate with a 6-8 week long final project where students will work on teams to identify a problem, design a unique solution using Inventor, create a prototype on a 3D Printer, and then test the solution. *Students taking this course will be expected to take the Autodesk Inventor Certified User (Advanced-Statewide IBC) certification exam. Counts as a TOPS University Art Course*

Advanced Robotics (11th or 12th Grade, 150731): This course will bring students into the world of competitive robotics. After completing Introduction to Robotics, students who are interested in joining a competition robotics team can join the advanced robotics course. This course will have a VEX and a FIRST Robotics (small pilot) option to allow schools the flexibility to meet the needs of their school. Curriculum for both robotics platforms will expose students to advanced building and programming techniques. Students are required to attend at least one weekend competition as part of the course.

PILOT: Survey of Drones (11th or 12th Grade, Course Code TBA): This course is designed as a senior capstone course and uses the fundamental skills learned in LSU's pathways pre engineering courses to design, assemble, and program drones for use in indoor racing. Students will learn the fundamentals of frame design, electronics, and programming necessary to design their own drone. Students will work hands-on to design drone parts in Inventor, prototype the parts using a 3D printer, solder the electrical components of the drone, and program the microcontroller all will formally document their progress. Topics may include computer aided design, 3D printing, signal transmission, flight controller programming, motor design, aerodynamics, torque, sensors, project documentation, and racing using first person viewing goggles. We will obtain the FAA Drone pilots license during the first semester. For the second semester, students are broken into teams consisting of a driver, a builder, and a programmer to design their own drones.