



## **MEC 101: Freshman Design Innovation (3 credits)**

Department of Mechanical Engineering

Fall 2021

Tue, Thu 1:15 PM-2:35 PM Engineering 143

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### **1. Teaching Team**

**Faculty:** Anurag Purwar, Ph.D

Office: 169 Light Engineering

Office Hours: Wed 2:00-5:00 pm on Zoom (link to my office zoom room will be posted on Blackboard)

Phone: (631) 632-8542

Email: [anurag.purwar@stonybrook.edu](mailto:anurag.purwar@stonybrook.edu) (all technical questions should be posted on Piazza either publicly or privately; email should be used only for strictly personal problems or issues)

**Teaching Assistant 1:** Zhijie Lyu

Office Hours: TBA

Email: [zhijie.lyu@stonybrook.edu](mailto:zhijie.lyu@stonybrook.edu)

**Teaching Assistant 2:** Anar Nurizada

Office Hours: TBA

Email: [anar.nurizada@stonybrook.edu](mailto:anar.nurizada@stonybrook.edu)

**Teaching Assistant 3:** Xueting Deng

Office Hours: TBA

Email: [xueting.deng@stonybrook.edu](mailto:xueting.deng@stonybrook.edu)

### **2. Course Description**

This course introduces students to the process of engineering design and provides a project-based design experience wherein the students design, build, and program a microcontroller driven autonomous mechatronic device. In doing so, they are provided an early exposure to the systematic approach to engineering problem solving that brings together fundamentals concepts of forces, motions, energy, materials, manufacturing processes, and machines and mechanisms from Mechanical Engineering and basic electronics, sensing, actuation, and Computer Programming.

### **3. Course Purpose**

MEC 101 is a required class for all Mechanical Engineering students. The class introduces design concepts and projects early in a student's education, promotes teamwork, and introduces modern engineering tools. A design innovation class at any level mandates that students undergo significant hands-on, experiential learning to achieve design education goals. In MEC101, this goal is currently fulfilled by incorporating an autonomous robot/machine design project, wherein the students must design and build an autonomous robot/machine that either carries out either a functional or interesting motion. The goal is to motivate students to think about designing and prototyping programmable,



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Electro-mechanical devices at an early stage of their engineering career. In doing so, they apply fundamentals to a fun and exciting design problem of their choice, learn to think critically, communicate ideas, and work in a team.

**4. Course Learning Outcomes (CLO)**

Upon completion of this course, students will be able to:

- CLO 1. Articulate an overview of the Mechanical engineering profession, the design process, and the ethics in Engineering
- CLO 2. Demonstrate familiarity with dimensions, units, conversion, and engineering estimation
- CLO 3. Calculate vectors as physical elements, basic engineering Statics (2D), balance of forces and moments
- CLO 4. Calculate Stress, Strain, and failure for mechanical components loaded in tension, compression or shear, and fundamental material properties for material selection
- CLO 5. Calculate mechanical energy, work, and power.
- CLO 6. Articulate how the motions of common mechanisms are realized.
- CLO 7. Demonstrate an understanding of basic electronics, sensing, actuation, and circuit drawing
- CLO 8. Demonstrate Microcontroller programming
- CLO 9. Work in a team to design and fabricate an autonomous, microcontroller driven machine

**5. Course Learning Outcomes Assessment and relationship to ABET Student Outcomes**

**The relevant ABET Student Outcomes are**

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CLOs	ASSESSMENT TOOLS	STUDENT OUTCOMES
CLO 1	HW, Exam	f,h
CLO 2	HW, Exam	a



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CLO 3	HW, Exam	a
CLO 4	HW, Exam	a
CLO 5	HW, Exam	a
CLO 6	HW, Exam	a
CLO 7	HW, Exam	a,k
CLO8	HW, Exam	k
CLO9	HW, Exam	d

**6. Course Topics**

1. Introduction to Mechanical Engineering Profession
2. Engineering Ethics
3. Fundamentals of computation: dimensions, units, significant digits
4. Vectors and Scalars
5. Forces, Moments and static equilibrium analysis
6. Stress, Strain, and fundamental material properties
7. Mechanical Energy, work, and power
8. Mechanisms, Machines and their motions
9. Basic electronics, sensing, and actuation
10. Microcontroller programming using Arduino

**7. Pre- or co-requisites**

AMS 151 or MAT 125 or MAT 131 or MAT 141 or MPE level 4 or greater and PHY 125 or PHY 131 or PHY 141

**8. Technology and Tools**

A Flipped class like this cannot be conducted without appropriate use of technologies that enable learning outside a traditional classroom and on your own time. Some of the technologies and tools that would be required in this class are:

1. **Computer and Internet Connection:** This course requires that at home you have a solid **wired** internet connection to a reliable and working computer with webcam and microphone. Cheap



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Wi-Fi connections do not work and in the past students have had difficulties taking quizzes when they were connected to unreliable Wi-Fi access points, such as at Starbucks, etc. **We will not be responsible for you not being able to connect to the servers during the quizzes and no extensions on time will be given.**

Please install all the updates on your computer well before a quiz. The newer versions of Microsoft Windows OS are not very flexible with scheduling updates. You don't want an update to initiate just before a critical assignment, such as quiz or exams.

As a rule, always bring an internet connected device to the class so that you can take the quizzes or participate in the discussions.

2. **Blackboard:** The Stony Brook University uses Blackboard (Bb) course management system for all course-related management. The Bb site for this class will be the central online location for posting all class-related materials, announcements, calendar, etc. Most of the information pertaining to this class can be found at the MEC 101 course website at <http://blackboard.stonybrook.edu>
3. **Piazza:** This term we will be using Piazza, an online forum, for class discussion. The system is highly catered to getting you help fast and efficiently from your classmates, the TA, and myself. Rather than emailing questions to me or the TAs, please post your questions on Piazza.

You can post questions with public or private settings. **As a rule, all questions should be posted using public settings** unless 1) you have a non-technical private question that only concerns you, or 2) you need to post your own solutions to a problem and want to discuss with the teaching team privately.

Please sign up at <http://piazza.com/stonybrook/fall2021/mec101/home>

In the beginning of the class, I will add you to the Piazza manually. However, you will have to complete the sign up yourself to finish the registration process.

4. **Respondus LockDown Browser:** You will need to use this browser to take quizzes online; please download it from this link: <http://www.respondus.com/lockdown/download.php?id=772113517>
5. **Calculators:** Only an approved NCEES allowed calculator will be permissible to use during quizzes and exams. Please see the *Calculator Policy* section below on details.
6. **Microphone and Webcam:** needed for on-line quizzes and exam proctoring. The web cam should be either swiveling type or if built-in should allow you to rotate the monitor or laptop for



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showing your 360-degree environment in the beginning of a test.

7. **Adobe Acrobat Reader (free) and Microsoft Word:** Free to Stony Brook University students, go to <https://it.stonybrook.edu/software/title/microsoft-office>
8. **Scanner or camera app:** A scanner to scan HW, Quizzes, or Exams, as necessary or you can use a smartphone or tablet camera with an app for creating high quality, cropped pdf documents, such as free version of CamScanner (search for it in Google PlayStore or Apple iTunes store). It is your responsibility to ensure that your scans will be legible without being too large in size. This will be needed for submitting your HWs and cheat sheets, if any.

### **9. Communication**

You must have an active Stony Brook University e-mail account and access to the Internet. All instructor correspondence will be sent to your SBU e-mail account. Please plan on checking your SBU email account regularly for course related messages. To log in to Stony Brook Google Mail, go to <http://www.stonybrook.edu/mycloud> and sign in with your NetID and password.

This course uses Bb for the facilitation of communications between faculty and students, submission of assignments, and posting of grades. The Bb Course Site can be accessed at <https://blackboard.stonybrook.edu>

### **10. Required Course Material**

1. MEC 101 MECHATRONICS KIT, Publisher: ELEC XPRSS, Edition: F21  
Buy from <https://www.elexp.com/stony-brook-university> (estimated cost \$95 + shipping and handling)  
**Do not buy unless the kit mentions edition as F21. This link will not work until I have confirmed with the vendor. Please be patient and I will let you know when you can purchase the kit.**

You will need parts in this kit to carry out HW exercises, in-class exercises, final robot design project, as well as to outfit a Two-wheel drive Mobile Robot called SnapBot that I will provide to you. This is a required material for the class.

2. Course Fee: \$50 – this pays for the laser cutting of the SnappyXO parts, material, and any other tools and items that we provide to you. This is part of your tuition and fee that you directly pay to the school. We, i.e., instructors, do not collect this money from you.

### **Supplementary Material**



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Online resources, such as tutorials, on-line videos for Arduino programming, data sheets for electronics as assigned by instructor.

### **11. Course Delivery/Modality**

1. **Lectures:** The classes will be delivered in person; however, if warranted due to unexpected reasons, we can schedule a class on zoom. This is a flipped learning class, wherein some parts of the class will require you to watch lectures at home and take formative and summative quizzes to demonstrate understanding of the concepts, while parts related to problem solving and active learning would be conducted in class.
2. Course Attendance is mandatory; we will be taking attendance via a quiz in class randomly. Please always bring an internet connected device, preferably your laptop to the class.

### **12. Preferred Method of Contact with Instructor**

My preferred method of contact is via email at [anurag.purwar@stonybrook.edu](mailto:anurag.purwar@stonybrook.edu). I will respond to your emails as soon as possible, but please allow between 24-48 hours for a response. Please utilize your Stony Brook University email when getting in touch with me as that is the preferred method of contact from the institution. Include your full name and NetID in all emails to me. For technical questions about HW, quizzes, etc., please post on Piazza. Using Piazza, you can even ask a personal question by making it visible only to instructors.

### **13. Calculator Policy**

Only the following NCEES-allowed calculators will be permitted to be used on midterm and final exams in the Department of Mechanical Engineering. There will be no exceptions!

- Casio: All FX-115 and FX-991 models. Any Casio calculator must contain fx-115 or fx-991 in its model name.
- Hewlett Packard: The HP 33s and HP 35s models, but no others.
- Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.



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### **14. Grading**

Homework 10% (10 HWs assigned on Blackboard)

On-line Summative Quizzes 20% (10 Quizzes assigned on Blackboard)

One Midterm Exam 20%

Final Robot Design Project 25% (group project)

Final Exam 25% (Comprehensive)

There are two kinds of quizzes posted on the Bb:

1. **Summative Quizzes:** these kinds of quizzes test your understanding of a given module and are graded. They can be taken only once. Think of them as mini exams. Solutions and the correct answers to the questions will be available on Bb after the due date. The summative quizzes have to be taken using lockdown browser; see below for details on the lockdown browser.

You can also take an appointment at the Testing Center to take the summative quizzes if you do not trust your computing environment. Contact Testing Center at [testingcenter@stonybrook.edu](mailto:testingcenter@stonybrook.edu) to make an appointment. Keep in mind that you may have to ask at least a week in advance to set up a time to take a quiz.

2. **Formative (Test) Quizzes:** these kinds of quizzes are assigned to ensure that you are watching assigned videos, reading notes, and just paying attention. They can be taken as



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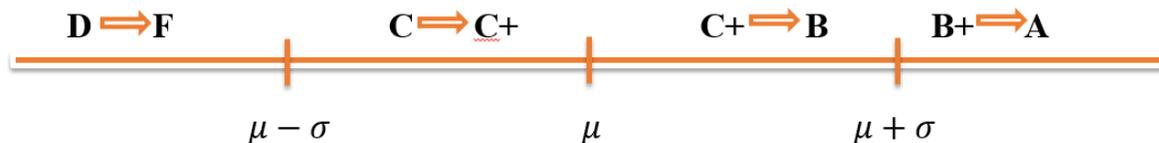
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many times as you want. You are required to take and complete these quizzes, but they do not count against your course grade. Think of them as test quizzes. Correct answers to these quizzes will be available on Bb only after the due date. The formative quizzes can be taken using a regular browser.

Your final letter grade will be decided based on the above weights and your relative placement in the class. The following scale shows roughly what your final letter grade range might look like, where  $\mu$  is the average, and  $\sigma$  is the standard deviation.

For example, if the class average is 70% and the standard deviation is 15%, then 85% and above is B+ to A grade range. You will have access to the class average and standard deviation for each HW, quiz, and exam, so you can always compute your relative placement in the class; however, we calculate grades only at the end of the semester.



### 15. Homework

There will be about 10 homework assignments. Homework will be posted and submitted on Blackboard.

Homework must be submitted by the specified due date and time. **No late homework will be accepted in any case.** However, since emergencies do happen, I will drop the lowest HW grade for each student. Please adhere to the following guidelines for submission (Not following these guidelines will result in deduction of points by the grader)

1. If you hand-write your solutions, then scan your HW using a scanner or a scanning app for mobile, such as CamScanner (<https://www.camscanner.com>) to properly scan each page of the HW and put them together in a single PDF. It is your responsibility to ensure that all pages are legible. Watch this video to learn how to use CamScanner to make a PDF of scanned pages. You may also use another scanning app. <https://www.youtube.com/watch?v=ep1GaO8PxwQ>
2. Submit the assignment on Bb by due date. You will be provided feedback directly on your scanned HW.
3. Keep in mind that you will be allowed two attempts only to submit the HW; thus, be very careful about what you submit. For any questions about that, please contact the TAs directly or post on Piazza.



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### **16. Getting Started**

During the **first** week of the course you will go through Bb and practice using Bb functions that are necessary to be successful in the class. You will:

1. Read the syllabus
2. Introduce yourself on the Piazza Discussion Board,
3. Take the Syllabus Quiz on the syllabus using Respondus monitor and Lockdown browser.
4. Submit HW0, which you simply submit with a one-line comment stating that you have completed above activities. You can find more information under the “Getting Started” menu item in Bb. Unless you complete all of the above steps, you will not be able to progress further in the class.

### **17. Expectations**

#### **Communication**

Your email addresses in Blackboard is your official University EPO email address (firstname.lastname@stonybrook.edu or firstname.lastname@stonybrookmedicine.edu) and you cannot change your email address in Blackboard. This means that you are responsible for all email that go to your University EPO email address as your professors will be communicating with you this way.

Treat your Stony Brook email address as your primary means of communicating with others in the Stony Brook community. Make it a practice to log in at least daily to check for new important items and address them. I use email and blackboard exclusively to communicate with you.

To access Google Apps for Education, go to <http://www.stonybrook.edu/mycloud> and authenticate with your NetID and NetID password.

#### **Fundamentals**

From your high school level classes, you should have acquired a working knowledge of basic Trigonometry (sines, cosines, basic trigonometry formula, etc.), Geometry, and basic Physics.

### **18. Exams and Quizzes**



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There will be one midterm and a final exam and 10 summative quizzes in this course. The exam dates are as follows, while quizzes will be given on a more frequent basis. **Please note that while you will have several days over which you can submit a HW or a quiz, the exams are an exception, which will be administered only on specific days and times.**

**Midterm:** Thursday, Oct 7, 2021, in class

**Robot Design Project Demo:** Thursday, December 2, 2021, in class

**Final Exam:** Tuesday, December 14, 2021, from 2:15 am to 5:00 pm, in class

All exams will be given in class. The exams are closed book/notes. If you miss an exam due to unforeseen events, you will have to provide me a proof of the reason, such as doctor's certificate for a medical emergency or death certificate for death in family before I will give you a makeup exam. There will be no make-up exams for reasons that I deem are or were within your control. Thus, this rules out reasons such as pre-arranged vacation, travel, conflict with other exams or other engagements.

An exception to the above policy is that if you will be participating in a university-sponsored activity or fall under a NY state provision of Equivalent Opportunity/Religious Absences posted at [https://www.stonybrook.edu/sb/bulletin/current/policiesandregulations/policies\\_expectations/equivopportunity\\_religiousabsences.php](https://www.stonybrook.edu/sb/bulletin/current/policiesandregulations/policies_expectations/equivopportunity_religiousabsences.php) that would require you to miss an exam, you need to inform me in the first week of the semester with a written notice.

For summative quizzes, you should create contingency plans for technical failures, such as power shut down, power recycle, cable/DSL/internet unavailability, laptop battery dying, etc. All of these events have happened before during the quizzes and we will not admit these as valid reasons for an extension or make-up. **Take quizzes at least a day before they are due so that in case of a technical failure, you have at least 24 hours to correct the problem.**

### **Mode of Conduct for Quizzes: using LockDown Browser and a Webcam for Online Summative Quizzes**

This course requires the use of LockDown Browser and a webcam for online summative quizzes. The webcam can be built into your computer or can be the type that plugs in with a USB cable. Watch this [short video](#) to get a basic understanding of LockDown Browser and the webcam feature. A student [Quick Start Guide \(PDF\)](#) is also available.

Then, download and install LockDown Browser from this link:

<http://www.respondus.com/lockdown/download.php?id=772113517>

Don't Google for a download link — it may be for the wrong school! Our version of the LockDown Browser is tied to Stony Brook University.

If you get a warning message from your anti-virus software, please white-list this download.

To ensure LockDown Browser and the webcam are set up properly, do the following:

- Start LockDown Browser, log into **Bb**, and select this course.



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- Locate and select the **Help Center** button on the LockDown Browser toolbar.
- Run the **Webcam Check** and, if necessary, resolve any issues.
- Run the **System & Network Check**. If a problem is indicated, see if a solution is provided in the Knowledge Base. Troubleshooting information can also be emailed to our institution's help desk.
- Exit the Help Center and locate the Syllabus quiz named **Syllabus Quiz**, which is part of the *Getting Started* menu.
- Upon completing and submitting the syllabus quiz, exit LockDown Browser.

When taking an online quiz or exam that requires LockDown Browser and a webcam, remember the following guidelines:

- Ensure you're in a location where you won't be interrupted
- Turn off all other devices (e.g. tablets, phones, second computers)
- Clear your desk of all external materials not permitted — books, notes, other devices
- Remain at your computer for the duration of the test
- If the computer or networking environment is different than what was tested above, repeat the Webcam and System checks prior to starting the test
- To produce a good webcam video, do the following:
  - Avoid wearing baseball caps or hats with brims
  - Ensure your computer or tablet is on a firm surface (a desk or table) — not on your lap, a bed, or other surface that might move
  - If using a built-in webcam, avoid tilting the screen after the webcam setup is complete
  - Take the exam in a well-lit room and avoid backlighting, such as sitting with your back to a window
- Remember that LockDown Browser will prevent you from accessing other websites or applications; you will be unable to exit the test until all questions are completed and submitted.

## 19. Academic Policies

**Academic Integrity Statement:** Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at

<http://www.stonybrook.edu/uaa/academicjudiciary/>

**Critical Incident Management:** Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the



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learning environment, or inhibits students' ability to learn. Until/unless the latest COVID guidance is explicitly amended by SBU, during Fall 2021 "disruptive behavior" will include refusal to wear a mask during classes.

For the latest COVID guidance, please refer to:

<https://www.stonybrook.edu/commcms/strongertogether/latest.php>

**University Student Conduct Code** can be found at (check for most current version)

<http://studentaffairs.stonybrook.edu/ucs/docs/universitystudentconductcode.pdf>

**ADA & Disability Support Services (DSS) Statement:** The Rehabilitation Act of 1973 – Section 504 applies to all postsecondary educational programs that receive federal assistance. Reasonable accommodations and academic assistance are provided to students with disabilities registered with the Disability Support Services, ECC (Educational Communications Center) Building, room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. For procedures and information go to the following website: <http://www.stonybrook.edu/ehs/fire/disabilities>

**Course Materials and Copyright Statement:** Course material accessed from Bb, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity and Student Conduct Codes.

## **20. Academic Integrity - Exam Policy**

### **Statement on Academic Dishonesty**

Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Any suspected instance of academic dishonesty will be reported to the Committee on Academic Standing and Appeals (CASA) within the College of Engineering and Applied Sciences (CEAS). A finding of academic dishonesty against a student has significant consequences

### **Electronic Devices**

Electronic devices, including cellular phones, smartwatches, speakers, electronic translators, and headphones must be turned off (and not, for example, simply set on vibration mode) during any examination.

Note: even if a student does not answer a ringing cell phone during an exam, it can be considered academic dishonesty for not having it turned off.



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### **21. Netiquette Guidelines**

The following are guidelines for participation on the discussion forums:

- Remember that with the absence of face-to-face communication it's easy to misunderstand.
- Carefully review and read materials that you receive electronically to ensure that you fully understand the message.
- Be sure to carefully re-read and understand what you will be sending in order to ensure that you are not misunderstood by anyone.
- Disagreement in higher education is encouraged, but it is important to be polite, and to clearly communicate why you disagree, support your own ideas with academic sources.
- Avoid cluttering your messages with excessive emphasis (stars, arrows, exclamations).
- If you are responding to a message, either include the relevant part of the original message in your message, or make sure refer to the original's contents so as to avoid confusion.
- Be specific and clear, especially when asking questions.
- If your messages can be typed in UPPER and lower case, please use the two appropriately instead of all UPPERCASE characters. This gives the appearance of shouting and makes the message less readable.
- Remember that not all readers have English as their native language, so make allowance for possible misunderstandings.

### **22. Getting Technical Help**

Students that need help with Bb can contact the TLT Student Help Desk by calling (631) 632-9602, emailing [helpme@stonybrook.edu](mailto:helpme@stonybrook.edu); more information is available via Stony Brook

IT: <http://it.stonybrook.edu/services/blackboard#section-6706>

Frequently ask questions about the Bb LMS along with tutorials are available here:

<http://it.stonybrook.edu/services/blackboard/navigate-manage>

### **23. Subject to Change Notice**

All material, assignments, and deadlines are subject to change with prior notice. It is your responsibility to stay in touch with your instructor, review the course site regularly, or communicate with other students, to adjust as needed if assignments or due dates change.

### **24. Syllabus Disclaimer**

The instructor views the course syllabus as an educational understanding between the instructor and



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students. Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. The instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus changes via email or in the course site Announcements. Please remember to check your SBU email and the course site Announcements often.