

PROPOSAL
FOR
BACHELOR OF SCIENCE
IN
SOFTWARE ENGINEERING TECHNOLOGY
(Titled as **Software Technology** before ABET Accredited)

SPONSORED BY:

DEPARTMENT of COMPUTER ENGINEERING TECHNOLOGY

SCHOOL OF TECHNOLOGY AND DESIGN
NEW YORK CITY COLLEGE OF TECHNOLOGY
THE CITY UNIVERSITY OF NEW YORK

Anticipated Initiation: **Fall 2023**

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PROGRAM IDENTIFICATION

COLLEGE	New York City College of Technology The City University of New York
PROGRAM TITLE	Software Engineering Technology (Titled as Software Technology before accredited by ABET)
DEGREE	Bachelor of Science
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TABLE OF CONTENTS

Curriculum Modification Proposal Form	1
1. Program Introduction	3
1.1 Introduction and Motivations	3
1.2 Goals	5
2. Needs and Justification	7
2.1 Employment Opportunities	7
2.2 Career Outlook	9
2.3 Salary Statistics	9
2.4 Related Degree Programs	10
2.4.1 Related Programs in CUNY	10
2.4.2 Related Undergraduate Programs out of CUNY	13
2.4.2 Related Graduate Programs out of CUNY	14
3. Student Interests & Enrollment Projection	15
3.1 Student Interests.....	15
3.2. Enrollment Projection.....	19
4. Curriculum	20
4.1 Anticipated Program Education Objectives	20
4.2 Anticipated Student Outcomes	20
4.3 Overview of the Curriculum	21
4.4 Courses Required to Complete the Program	22
4.5 Sample Degree Map (4-Year Course of Study)	25
4.6 Program Flowchart	27
4.7 Admission Requirements	28
4.8 Catalog Description of the New Courses	28
5. Faculty	33
6. Cost Assessment	37
7. Acknowledgments	38

References	39
New Course Proposal #1: CET1100 Introduction to Computer & Software Engineering Technology	41
New Course Proposal #2: SET2330 Cloud Database Fundamentals	55
New Course Proposal #3: SET2340 Computer Architecture	69
New Course Proposal #4: SET2430 Algorithmic Design & Data Structures	85
New Course Proposal #5: SET2440 System Programming	103
New Course Proposal #6: SET3530 Cloud Computing & Networking	121
New Course Proposal #7: SET3630 Cybersecurity Foundations	137
New Course Proposal #8: SET3510 Software Requirements Engineering	153
New Course Proposal #9: SET3610 Software Architecture & Design	169
New Course Proposal #10: SET4710 Software Testing & Quality Assurance	187
New Course Proposal #11: SET4810 Software Capstone Design	204
New Course Proposal #12: SET4940 Embedded Operating Systems	223
New Course Proposal #13: SET4955 Software Engineering Technology in Robotics	243
New Course Proposal #14: SET4900 Internship in Software Engineering Technology.....	256
Changes in Existing Course #1 for CET1111 Logic & Problem Solving	267
Changes in Existing Course #2 for CET1211 Introduction to Object-oriented Programming in Software Design	281
Changes in Existing Course #3 for CET1120 Technical Graphics	292
Changes in Existing Course #4 for CET1150 Fundamentals of Electrical Circuits	294
Changes in Existing Course #5 for CET1250 Fundamentals of Digital Systems	304
Changes in Existing Tech Electives	306
Appendix A: Letters of Support.....	324
Appendix B: Articulation Agreement Drafts	328
Appendix C: Sample Job Postings.....	334
Appendix D: Industry Advisory Board Meetings.....	345
Appendix E: Evidence of Consultation with Other Departments.....	349

New York City College of Technology, CUNY

Curriculum Modification Proposal Form

This form is used for all curriculum modification proposals. See the Proposal Classification Chart for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

Title of Proposal	Bachelor of Science in Software Engineering Technology (titled as "Software Technology" before accredited by ABET)
Date	August 2021
Major or Minor	Major
Proposer's Name	CET Department SET BS Program Proposal Committee (Committee coordinator: Prof. Xiaohai Li)
Department	Computer Engineering Technology
Date of Departmental Meeting in which proposal was approved	09/09/2021
Department Chair Name	Dr. Sunghoon Jang
Department Chair Signature and Date	09/13/2021 
Academic Dean Name	Dr. Gerarda M. Shields
Academic Dean Signature and Date	
Brief Description of Proposal (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body.)	<p>The Department of Computer Engineering Technology proposes a new degree program, <i>Bachelor of Science (BS) in Software Engineering Technology</i> (titled as "Software Technology" before receiving accreditation). This proposal presents the rationale of proposing this new BS degree program, detailed design of the program and its curriculum, new courses developed for the curriculum, and all required documents for proposing this degree program.</p> <p>The proposed program will be finally titled as "<i>BS in Software Engineering Technology</i>", but currently as</p>

	<p><i>“Software Technology”</i> before it is accredited by ABET. We seek approval for both titles by this proposal.</p>
<p>Brief Rationale for Proposal (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body).</p>	<p>Software engineers are needed in a very broad range of industries such as IT, semiconductor, consumer electronics, financial services, insurance, mobile communications, telecommunications, healthcare/medical, biotech, robotics and automation, aerospace, business/management, education, etc. Various data sources have reported a high demand for software engineers in New York metropolitan area and in the nation in recent years. Employment of software engineers is projected to keep growing in coming years in the region. However, none of the CUNY colleges offers a bachelor degree in Software Engineering or Software Engineering Technology yet. This proposed program will be the first one of this kind in CUNY.</p> <p>This proposed Software Engineering Technology (SET) BS program will equip students with fundamental knowledge and skills necessary to enter and thrive in a career in the design, development, testing, evaluation, management and maintenance of software.</p>
<p>Proposal History (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list).</p>	<ol style="list-style-type: none"> 1. 09/13/2021 Submitted to CCCC as a new proposal for a new degree program 2. 02/18/2022 Modification was made according to CCCC Subcommittee’s reviews 3. 03/11/2022 Meeting with Provost’s Office and Subcommittee 4. 04/07/2022 Updated with new content (new survey, new support letters, etc.) 5. 04/08/22 Updated version was submitted to CCCC and Provost’s Office. 04/10/2022 Comments from Subcommittee on the updated version were received. 6. 04/11/2022 Proposal was updated and submitted to CCCC and Provost’s Office 7. 05/05/2022 Open hearing on this proposal was hold 8. 09/08/2022 Proposal was updated and submitted 9. 11/03/2022 Proposal (V7) was updated and submitted

1. Program Introduction

1.1 Introduction & Motivation

With the development of modern technologies, software plays a pervasive and essential role in many aspects of our daily lives: communications, transportation, medicine, banking and finance, education, entertainment, government, and law (IEEE/ACM 2015). The efficiency and productivity of our daily lives, as well as in industries, have been greatly improved by software systems. In addition, many people's lives and livelihoods depend on software's effectiveness and quality such as medical instruments and healthcare equipment. Moreover, the scale, complexity and applications of computer programs rapidly evolve and upgrade every a few years. As a result, huge sums of resources have been spent on software design, development, maintenance and upgrading (OECD 2010) and a great number of skilled and experienced software engineers are needed in various industries.

Software engineers are professionals working on aspects pertaining to software product, who practice engineering and technological principles, techniques and tools in order to create quality computer software and solve problems for a better world. Software engineering is a field to engineer software. Technically speaking, the field of software engineering is to apply scientific, mathematical, engineering and technological principles and practice in the full software development life cycle (SDLC), including software modeling, requirements analysis, design, validation and verification, development, testing, and maintenance (IEEE 2010). Software engineers analyze user requirements, design and develop new software programs, validate the design, analyze existing programs and identify area for modification, test and evaluate software and systems, monitor and diagnose software defects, upgrade existing software for new platforms or features, create technical specification and documentation, provide support services to customers, consult clients and colleagues concerning the performance and maintenance of systems, or work closely with other staff such as hardware engineers, UX/UI designers, and sales/marketing professionals. According to the job website Glassdoor.com, qualified software engineers are the most in-demand across all industries. The U.S. Bureau of Labor Statistics projects 22% growth from 2020 to 2030 for software engineer related positions (such as software developers, software quality assurance analysts, and software testers), a much faster-than-average growth rate.

The barriers to entry into software industry are constantly changing and evolving with the development of new technologies and applications. Although anyone can learn how to code through other curricula (such as computer science and computer engineering), having a systematic training in the field of software engineering and being able to apply and adapt are key attributes of a success software engineer who can handle unknown challenges ahead. A degree in Software Engineering or Software Engineering Technology can better help students lay down solid foundations and set on a path to start and continue their success in this dynamic and rapidly growing field.

Responding to the national and regional need, we are proposing a new academic degree program in Software Engineering Technology (SET) at the Bachelor of Science (B.S.) level at NYCCT. The proposed program will produce skilled individuals who are capable to meet software system related needs of public and private organizations in various industries, from requirement analysis, software development and performance analysis to software maintenance, every stage of software development life cycle.

In industry, Computer Science undergraduate degree is another common ladder for those ones who are interested in pursuing a career in the field of software engineering. This is largely due to the curricula in these two fields have some common courses related to computing and computer systems. For example, both include computer programming course(s) and teach students how to program. However, the principles behind these two fields of study have substantial differences. A fundamental difference is that computer science emphasizes more the science and theory behind computing, computers, and computational systems, whereas study in software technology typically deals with applying engineering and technological principles to undertake engineering activities of building, designing, testing and maintaining software products or software systems (IEEE/ACM 2015). As an example, when coming to software design, a computer scientist may work with theoretical analysis, mathematical modeling and algorithms to make decisions about how a program and an algorithm should be best designed, whereas a software engineer can be given specific program requirements and specifications and implement a design (Indeed 2020).

According to ABET, an Engineering Technology degree and an Engineering degree have closely related courses of study with noticeable differences in learning curriculum. Most notably, a baccalaureate

degree in Engineering emphasizes theories, mathematics and advanced theoretical concepts, while an Engineering Technology degree emphasizes application, implementation and hands-on experience. As an engineering technology program in the field of software engineering, the Software Engineering Technology BS program we are proposing perfectly meets the need and nature of this field.

The proposed BS in Software Engineering Technology degree program is consistent with the mission of New York City College of Technology in that it will provide students with solid technological education along with problem-solving and applied skills necessary to succeed in any area where software is applied. In addition, a dedicated Software Engineering Technology BS degree program will make the spectrum of the computer/computing curricula currently available at City Tech complete and provide more opportunities to our students.

Note: ABET does not allow us to include the word “Engineering” in a degree program title until the program is accredited by ABET. Thus, the name of the program is now *BS in Software Technology* in this proposal as submitted, and will change to *BS in Software Engineering Technology* immediately upon receiving ETAC/ABET accreditation. The rest of this proposal uses *Software Technology* and *Software Engineering Technology* (SET) interchangeably. In short, our program will be finally titled as “*BS in Software Engineering Technology*”, but currently “*BS in Software Technology*”. We seek approval for both titles by this proposal.

1.2 Goals

There are several types of software being used across all domains, namely, computer system software, computer application software, and specialized application or utility programs. A professional software engineer is usually seen to create, develop, test or maintain some of these types of software. They analyze user needs, define requirements and develop software solutions; design software or customize software for client use with the aim of optimizing operational efficiency or minimize cost; analyze and design databases within an application area; etc. Most software engineers collaborate with other specialists as a group to create desired product or system.

Many software developers specialize in a certain area of software development, such as mobile devices, networks, database, operating systems, web applications and embedded systems. Although each area requires its own set of techniques and skills, certain general knowledge and approaches apply across the areas, such as software architecture, software modeling, and software testing.

The field of software engineering is to engineer quality and meaningful software. It has been defined by IEEE (Institute of Electrical and Electronics Engineers)/ACM (Association for Computing Machinery) as “the application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software.” A college degree program in the field of software engineering generally combines mathematics, engineering, computing and social science in an effort to fully prepare the students for the technical and social challenges in their careers.

The goal of this proposed Software Engineering Technology BS program is to provide skilled and knowledgeable graduates who will responsibly meet the needs of businesses and organizations in software related positions. The proposed degree program will integrate applied and hands-on learning with conceptual curriculum. Graduates of this program will have the fundamental knowledge in mathematics, computing, engineering as well as technological skills needed to excel in the field. In addition, they will also gain hands-on and real-world experience necessary to meet the industry need as a professional software engineer. Graduates of this program will be able to start a software related career and make positive contributions in various areas such as IT, financial services, mobile communications, healthcare, biotech, robotics and automation, aerospace, business/management, education, etc, where software are used.

2. Needs and Justification

This BS in Software Engineering Technology (SET) degree program is proposed to respond to the needs of job market and students. In recent years, tremendous needs have been presented in national and regional wide job markets for software engineers and software engineer related positions. On the other hand, limited choices are available for prospective students in the region who are interested in obtaining an undergrad degree in software engineering field for starting a career in this field. This new program will significantly increase the opportunities to City Tech students for employment or graduate education.

2.1 Employment Opportunities

If searching a job website (such as indeed.com, monster.com, glassdoor.com), one can easily see companies looking for skilled software engineers/developers/analysts/technologists/etc literally come from every industry, not mentioning the big names in IT sector (Google, Amazon, Microsoft, IBM, Oracle, Apple). Examples are Intel (semiconductor), AT&T and Verizon (telecommunications and mobile communications), Samsung (mobile devices and consumer electronics), JP Morgan Chase and CitiBank (finance), Walmart (retailing), Ernst & Young and KPMG (accounting), UnitedHealthcare (healthcare), Pearson (publishing), and Coursera (education).

With increasing demand for new applications on mobile devices and tablets, the software engineering field is growing rapidly in recent years. According to the U.S. Bureau of Labor Statistics, software development positions are expected to increase 21% through 2028 – a whopping 284,100 new jobs – which is much faster than the national average for all other occupations. According to [DataUSA](#), the number of people employed as software developers or software engineers (regardless of applications and systems software) in the US reached 1.36 million in 2017. Among the top 10 US states with the highest number of software developers in terms of raw numbers, California leads the way with 628 thousand developers, Texas and New York come in second and third with 325 thousand and 218 thousand, respectively.

Since the last decade, New York City has promptly risen as a high-tech hub and has been surprisingly poised to be the “Silicon Valley of the East” (Oremus 2013). It has seen the fastest growth in technology industry (McGeehan 2012, NYS Office of the State Comptroller 2014), with nearly 7000 technology companies providing more than 100,000 jobs as of 2013 (NYS Office of the State Comptroller 2014). According to Startup Genome’s 2019 Global Startup Ecosystem Report, New York City’s tech ecosystem value is worth of more than \$64 billion (Startup Genome 2019). Many employments in the tech sector in New York City are related to designing, development or modification of software in certain application areas. According to U.S. Bureau of Labor Statistics, as of May 2018, New York State has 52,640 employments in the occupation of Software Developer and New York City Metropolitan area (New York-Newark-Jersey City) has 78,380 of such positions which was the highest employment level in any metropolitan areas in the nation (U.S. Department of Labor 2018).

In addition, in recent several years, New York City has become one of the most popular hotbeds for information technology startups. According to builtinnyc.com, New York City tech startups raised a total of \$25 billion in 2018. As of 2019, 9,000 startups are homed in New York City, and average early-stage funding per NYC startup totals \$641,000. The growth of the startup market in New York has made it unnecessary for talented young people to pursue opportunities on the West Coast. According to a recent survey by KPMG, nearly 60% of tech industry leaders believe that New York will overtake Silicon Valley very soon.

The job openings in major job websites have demonstrated the strong needs of software engineers in the region. As of 04/2019, the available openings in NYC, with a job title of “software engineer”, “software developer”, “full-stack developer”, “front-end developer”, posted on the four leading job websites (Indeed, Monster, Glassdoor and ZipRecruiter) are:

Indeed	Monster	<u>Glassdoor</u>	<u>ZipRecruiter</u>
7,934	19,251	6,973	16,157

For many decades, people have come to the Big Apple in search of opportunities and American Dream, whether in business, finance, fashion, arts, media, and entertainment. The growth of the tech

sector in NYC has made it more attractive to our students to choose to stay and pursue a career in NYC.

2.2 Career Outlook

With a BS degree in Software Engineering Technology, students will be qualified for many software engineer and related engineering, development or testing positions, including:

- **Software engineer or software developer.** Apply engineering principles and systematic methods to design or develop software programs or systems and operating data for computers, mobile devices, etc.
- **Software architect or system architecture designer.** Evaluate or design software architectures and determine how they will be used to fulfill business needs.
- **Front-end Developer, Back-end Developer, or Full stack Developer.** Develop client-side (front-end), server-side (back-end), or both end software. Develop database and server-side control software for a web or mobile application.
- **UX/UI Engineer.** Implement, test, and upgrade wireframes and visual prototypes, and develop user interfaces for desktop/laptop, mobile, embedded, cloud-based systems, etc.
- **Cloud software engineer or cloud technologist.** Develop, test or maintain cloud based software applications, or engineer software for cloud services or infrastructure.
- **Security software engineer or technologist.** Identify security vulnerabilities and write secure code to mitigate risks to software and data.
- **Firmware engineer or developer.** Design or develop firmware for embedded systems or specialized hardware systems.

Other positions can be embedded software engineer or technologist, software test engineer or technologist, mobile developer etc. See Appendix B for some sample job postings.

2.3 Salary Statistics

Software engineering is a financially rewarding career in NYC metropolitan area, as well as in the nation. The 2021 U.S. News & World Report ranked software developer or engineer as the best technology job in the United States, and the second-best job across all categories. As of March 2020,

according to Glassdoor, the average NYS based software engineer earns \$103,000 per year; the average base salary of a software engineer in New York City is \$107,197 per year which is 4% above the national average; and even just for an entry level Software Engineer in NYC, the average base salary is \$86,685/yr, which is 1% above national average. On the other hand, an entry level IT helpdesk specialist in NYC only has an average salary of \$50,583/yr and IT Support Specialist \$59,038/yr.

2.4 Related Degree Programs

Despite of the high demand of software engineers in the region, the talent pool produced by local universities and colleges are not enough. NYC has more than 120 college/universities and private IT education schools which attract many local students who love the city and help provide human resource to the domain. According to DataUSA, all these programs altogether produced more than 7,500 computer science graduates in 2018; but roughly 20,000 new workers are expected to be needed by all private and public organizations in New York City in 2022.

State wide, besides two private universities (*Rochester Institute of Technology* and *Clarkson University*), one public college (*SUNY Oswego*, located north to Syracuse) offers an undergraduate degree in Software Engineering. Among the colleges/universities in New York City metropolitan area, although handful ones have an undergraduate degree program in Computer Science, none (including all CUNY campuses) offers a baccalaureate degree in Software Engineering or Software Engineering Technology. The proposed program will be the first one of this kind in CUNY and the entire NYC.

2.4.1 Related Degree Programs in CUNY

As of August, 2021, there are no any CUNY colleges/schools having an undergraduate baccalaureate degree program in Software Engineering or Software Engineering Technology. The existing programs in CUNY that are related to software engineering field are either Computer Science, Information Systems, Computer System Technology, or Computer Engineering/Computer Engineering Technology. The only program close to this proposed one is at LaGuardia Community College, which offers an AAS degree in Programming and Software Development. But it is only an associate level degree program,

not bachelor. (Note: The only bachelor-level degree program in Computer Engineering Technology is in our CET department.)

CUNY Campus	Department or Majors	Degree Offered
Baruch College	Paul H. Chook Department of Information Systems and Statistics	BBA in Computer Information Systems (CIS)
Borough of Manhattan Community College	Computer Information Systems (CIS) Department	AS in CS AAS in Computer Information Systems
Bronx Community College	Business & Information Systems Department	AAS in Computer Information Systems; AS in Computer Programming
Brooklyn College	Computer and Information Science Department	BS in CS, BS in Information Systems, BS in Multimedia Computing, BS in Computational Mathematics
City College	School of Engineering	BE in Computer Engineering, BS in Computer Science
College Of Staten Island	Computer Science	BS in Computer Science AAS in Computer Technology
Guttman Community College	Information Technology Program	AAS in Information Technology
Hostos Community College	Department of Mathematics	AS in CS
Hunter College	Computer Science	BA and MA
John Jay College	Department of Mathematics and Computer Science (MCS)	BS in CS and Information Security
Kingsborough Community College	Department of Mathematics and Computer Science	AS in CS AAS in Computer Information Systems
LaGuardia Community College	Department of Math, Engineering and Computer Science (MEC)	AS in CS AAS in Computer Technology

CUNY Campus	Department or Majors	Degree Offered
		AAS in Programming and Software Development
Lehman College	Computer Science	BS, BA and MS in CS BS in Computer Information Systems
Medgar Evers College	Department of Physics & Computer Science	BS and AS in CS
New York City College Of Technology	CET Department CST Department Mathematics Department	BTech in CET BTech in CST, AAS in CIS AS in CS
Queens College	Computer Science	BS, BA, BA/MA in CS
Queensborough Community College	Engineering Technology Department; Department of Mathematics and Computer Science	AAS in CET AAS in Computer Information Systems; AS in Computer Science and Information Security (joint with John Jay)
York College	Department of Mathematics and Computer Science	BS in CS

2.4.2 Related Undergraduate Programs out of CUNY

According to ABET, as of March 2021, there are only 31 ABET accredited Software Engineering and Software Engineering Technology undergraduate degree programs in the nation. Only one of them is BS degree program in Software Engineering Technology, which is offered by *Oregon Institute of Technology* in Oregon. We will pursue ABET accreditation after having the first class of graduates. After our program is accredited by ABET, it will be the second accredited Software Engineering Technology BS program in the nation.

	School Name	Location	Program and Degree Name	Accreditation Dates
1	Arizona State University	Tempe, AZ	Software Engineering, B.S.	10/01/14
2	Auburn University	Auburn, AL	Software Engineering, BSW	10/01/02
3	California Polytechnic State University, San Luis	San Luis Obispo, CA	Software Engineering, BS	10/01/07
4	Clarkson University	Potsdam, NY	Software Engineering, BS	10/01/01
5	Drexel University	Philadelphia, PA	Software Engineering, BS	10/01/06
6	Embry-Riddle Aeronautical University - Daytona	Daytona Beach, FL	Software Engineering, BS	10/01/03
7	Embry-Riddle Aeronautical University - Prescott	Prescott, AZ	Software Engineering, BS	10/01/15
8	Fairfield University	Fairfield, CT	Software Engineering, BSE	10/01/04
9	Florida Gulf Coast University	Fort Myers, FL	Software Engineering, B.S.	10/01/14
10	Florida Institute of Technology	Melbourne, FL	Software Engineering, BS	10/01/03
11	Gannon University	Erie, PA	Software Engineering, BS	05/01/09
12	Iowa State University of Science and Technology	Ames, IA	Software Engineering, B.S.	10/01/11
13	Kennesaw State University	Kennesaw, GA	Software Engineering, B.S.	10/01/12
14	Milwaukee School of Engineering	Milwaukee, WI	Software Engineering, BS	10/01/01
15	Mississippi State University	Mississippi State, MS	Software Engineering, BS	10/01/01
16	Monmouth University	East Long Branch, NJ	Software Engineering, BSE	10/01/03
17	Montana Tech of the University of Montana	Butte, MT	Software Engineering, B.S.	10/01/06
18	Oregon Institute of Technology	Klamath Falls, OR	SWE Tech, BS	10/01/89
19	Pennsylvania State University, Behrend College	Erie, PA	Software Engineering, BS	10/01/04
20	Quinnipiac University	Hamden, CT	Software Engineering, BS	10/01/15
21	Rochester Institute of Technology	Rochester, NY	Software Engineering, BS	01/01/01
22	Rose-Hulman Institute of Technology	Terre Haute, IN	Software Engineering, BS	10/01/05
23	San Jose State University	San Jose, CA	Software Engineering, BS	10/01/16
24	Shippensburg University	Shippensburg, PA	Software Engineering, BS	10/01/14
25	The University of Virginia's College at Wise	Wise, VA	Software Engineering, B.S.	10/01/08
26	University of Michigan - Dearborn	Dearborn, MI	Software Engineering, BS	10/01/03
27	University of Texas at Arlington	Arlington, TX	Software Engineering, BS	10/01/02
28	University of Texas at Dallas	Richardson, TX	Software Engineering, BS	10/01/04
29	University of Wisconsin - Platteville	Platteville, WI	Software Engineering, BS	10/01/05
30	Michigan Technological University	Houghton, MI	Software Engineering, BS	10/01/18
31	SUNY Oswego	Oswego, NY	Software Engineering, BS	10/01/18

2.4.3 Related Graduate Programs out of CUNY

A search of graduate programs found 35 universities/colleges in the nation offering a non-online Master of Science, Master of Engineering or similar advanced degree in Software Engineering. 2 are in NYC metropolitan region (*NYIT* and *NYIT*), 2 are in Upstate NY (*RIT* and *Syracuse University*) and 2 are in the Philadelphia metropolitan region (*Drexel University* and *Penn State Great Valley*). All these schools provide opportunities to our future graduates who plan to pursue a master degree after obtaining his/her SET BS degree from City Tech.

	School Name	Location	Degree
1	Arizona State University	AZ, Online	Software Engineering, M.S.
2	Auburn University	AL	Software Engineering, M.S.
3	California Polytechnic State University	CA	Software Engineering, BS-MS blended
4	Carnegie Mellon University	PA	Master of Software Engineering
5	Drexel University	PA	Software Engineering, M.S.
6	Embry-Riddle Aeronautical University - Daytona Beach	FL	Software Engineering, M.S.
7	Fairfield University	Fairfield, CT	Software Engineering, 5 yr BS+MS
8	Florida Institute of Technology	FL	Software Engineering, M.S.
9	Lewis University	IL	M.S. in CS, SWE Concentration
10	New Jersey Institute of Technology	Newark, NJ	Software Engineering, M.S.
11	Pennsylvania State University, Great Valley	PA	Master of Software Engineering
12	Rochester Institute of Technology	Rochester, NY	Software Engineering, M.S.
13	San Francisco State University	CA	M.S. in CS, SWE Concentration
14	Southern Methodist University	TX	Software Engineering, M.S.
15	Stevens Institute of Technology	Hoboken, NJ	Software Engineering, M.S.
16	Stanford University	CA	Software Engineering, M.S.
17	Syracuse University	Syracuse, NY	Software Engineering, M.S.
18	Tufts University	MA	MSc in Software Systems Development
19	University of Maryland – College Park	MD	Software Engineering, M.E.
20	University of Michigan - Dearborn	MI	Software Engineering, M.S.
21	University of Northern Colorado	CO	Software Engineering, M.S.
22	University of Southern California	CA	M.S. in CS, SWE Concentration
23	University of Texas at Arlington	TX	Software Engineering, M.S.
24	University of Texas at Dallas	TX	Software Engineering, M.S.
25	University of Wisconsin–La Crosse	WI	Master of Software Engineering
26	Brandeis university	MA	Master of Software Engineering
27	East Carolina University	CA	Software Engineering, M.S.
28	Illinois Institute of Technology	IL	Software Engineering, M.S.
29	Loyola University Chicago	IL	Software Engineering, M.S.
30	Rose-Hulman Institute of Technology	IN	Software Engineering, M.S.
31	San José State University	CA	Software Engineering, M.S.
32	St. Mary's University	TX	Software Engineering, M.S.
33	Saint Cloud State University	MN	Professional Science Master of SWE
34	University of California Irvine	CA	Software Engineering, M.S.
35	University of Houston–Clear Lake	TX	Software Engineering, M.S.

3. Student Interests & Enrollment Projection

3.1 Student Interests

To investigate the students' interests in this proposed SET BS program, surveys have been conducted in Fall 2019, Spring 2020, Fall 2020 and Spring 2022. To have a better understanding of their interests, we specifically distributed the survey in three different groups of students: current students (mostly CET students, some CST, ETET and MECH students), CET alumni, and prospective students (P-Tech high-school students). Strong interest and anticipation on the proposed program across all these student bodies are clearly demonstrated by the survey results.

During Fall 2019 ~ Fall 2020, we collected 163 responses in total: 94 current students; 17 CET alumni; 52 high school students. Detailed survey results we obtained are in the following.

Responses from current students (CEB, MTECH & CST):

100%: *I think software play a very important role in modern technologies and society.*

96.2%: *I believe that the field of software engineering has great opportunities.*

80.8%: *I would be interested in learning more about software engineering.*

Responses from high school students (P-Tech):

71.5%: *I think software play a very important role in modern technologies and society.*

71.5%: *I believe that the field of software engineering has great opportunities.*

78.6%: *I would be interested in learning more about software engineering.*

Responses from CET alumni:

Answers to the question of “*what are the top 3 technical skills/knowledge you learned from CET Dept that you think are very helpful to your career by now?*”:

– C/C++ programming: **84.6%**

– Circuit analysis: **61.5%**

– Computer networking: **53.8%**

In Spring 2022, we updated the survey questionnaire slightly and did another round of survey via online only, and collected total 113 responses, including 102 current students and 11 P-Tech students. Detailed survey results we obtained are:

Responses from current students (CET/EMT, MTECH & CST):

99.0%: *I think software play a very important role in modern technologies and society.*

99.0%: *I believe that the field of software engineering has great opportunities.*

92.1%: *I would be interested in learning more about software engineering.*

87.2%: *Although I am not enrolled in this Software Engineering Technology BS program, I am interested in taking some of its major courses before graduating from NYCCT.*

89.2%: *I would suggest others to enroll in this Software Engineering Technology degree program if it is possible.*

Responses from P-Tech students:

100%: *I think software play a very important role in modern technologies and society.*

100%: *I believe that the field of software engineering has great opportunities.*

81.9%: *I would be interested in learning more about software engineering.*

88.9%: *I would be interested in enrolling into a software engineering technology degree program at college.*

86.9%: *If I do not enroll in a software engineering degree program at college, I would suggest my friends to enroll.*

90.9%: *I am interested in knowing more about the program when NYCCT begins accepting applications to its Software Engineering Technology BS program.*

See the survey for current students at link:

https://docs.google.com/forms/d/1fCHP95D8cED5_qVydCQKtu2dM1Ga1f4xKPuMkzzZ8so/

See the survey for prospective students at link:

https://docs.google.com/forms/d/1buuiPWdamcZao_pSpUoLoH_06B939QRUJyydhAkWMmc/

3.2 Enrollment Projection

To have a reasonable estimate of the annual enrollment of this new program, we use most recent college-wide application/enrollment data together with our survey result. According to National Center for Education Statistics, in Fall 2020 the total number of applications for admission to City Tech was 21,525, with an acceptance rate of 79.1%, but only 17% of the admitted were enrolled and 39.6% were enrolled in School of Technology and Design. According to the data from City Tech Office of Assessment, Institutional Research & Effectiveness (AIRE) (<http://air.citytech.cuny.edu/data-dashboard/enrollment-trends-fall>), during the past three academic years before COVID (2017, 2018 and 2019), School of Technology and Design enrolled an average 1,429 full-time freshmen per year, in which 428 joined the two Computer baccalaureate programs (186 in CET and 242 in CST); in Fall 2020, School of Technology and Design enrolled 1,131 full-time freshmen, in which 299 went to the two Computer bachelor degree programs (188 in CET and 111 in CST). In Fall 2020, School of Technology and Design also enrolled 109 transfer students, in which 17 joined CET BTech and 92 joined CST BTech program. After this SET BS program is in place, students will have three Computer baccalaureate programs (CET, CST and SET) to choose. Assuming the applicants have normal-distributed interests in these three programs, we make the following estimate of the annual new enrollments in the first five years after the program starts:

Academic Year	Estimated Freshmen enrollment in SET	Estimated Transfer Students in SET	Annual New Enrollment
2023-24 (1 st yr of the program)	93	25	118
2024-25	98	28	126
2025-26	104	31	135
2026-27	111	36	147
2027-28	121	42	163

According to City Tech AIRE's data, during the last 5 academic years (2016~21), the CET Btech program has an average one-year retention rate of 66.44% and four-year graduation rate of 5.6%, and the CST Btech program has a rate of 69.10% and 9.9%, respectively. Assuming the new SET program will have similar rates, we estimate its one-year retention rate as 67.77% and four-year graduation rate as 7.75%. Therefore, the total number of students in the program in the first five years is estimated as:

Academic Year	Annual New Enrollment	Retention	Graduation	Total Students in the Program
2023-24 (1 st yr of the program)	118	--	--	118
2024-25	126	80	--	206
2025-26	135	140	--	275
2026-27	147	186	--	333
2027-28	163	226	20	369

4. Curriculum

4.1 Anticipated Program Education Objectives

According to ABET's definition, **Program Education Objectives** are broad statements that describe what graduates are expected to attain within a few years after graduation. Program educational objectives are based on the needs of the program's constituencies.

Education Objectives of the proposed Software Engineering Technology BS Program:

Within a few years after graduation,

Statements	Theme
1. Graduates of the program are expected to achieve sustained employment with potential growth in a broad range of fields and demonstrate a comprehensive set of skills that meet the needs of the dynamics of technology advancements in the field.	Employment and technical skills (i.e, hard skills)
2. Graduates of the program who desire to expand their education will pursue additional educational opportunities including related graduate programs.	Further education
3. Graduates of the program are expected to demonstrate professionalism, ethical principles, continue lifelong learning, and commit to contribute to their fields, community and the society.	Soft skills

4.2 Anticipated Student Outcomes

To support the program educational objectives, the curriculum of this proposed SET BS degree program has been designed to achieve the following student outcomes:

- Ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline;

- Ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;
- Ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;
- Ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes;
- Ability to function effectively as a member as well as a leader on technical teams.

We will design rubrics to assess these outcomes. We will also collect assessment documents, students' sample work, and evidences for obtaining ABET accreditation after the program has a class of graduates.

4.3 Overview of the Curriculum

According to the latest IEEE/ACM curriculum guideline and the latest ABET accreditation criteria (specifically, program criteria), an accredited Software Engineering Technology baccalaureate degree program's curriculum should provide both breadth and depth across the range of engineering, technology and computer science topics. The curriculum "must include computing fundamentals, software design and construction, requirements analysis, security, verification, and validation; software engineering processes and tools appropriate for the development of complex software systems; and discrete mathematics, probability, and statistics, with applications appropriate to software engineering" (ABET 2020).

To meet these criteria, we design the curriculum to include:

1. **45 credits** of the CUNY Pathways general education requirements (required core, flexible core, college option) which will help students develop a solid liberal arts education.
2. **15 credits** of Gen Ed Program-Specific Degree Required course in mathematics which will help students develop a strong foundation in mathematics, probability, and statistics, required by ABET.
3. **30 credits** of Computer essential courses taken mostly during the first two years of the

program. They will introduce students to the fundamentals of computer systems, computing, electrical circuits and digital systems, including logic and problem Solving, programming languages, algorithm and data structure, database, cyber security, system programming, and computer architecture, etc.

4. **15 credits** of Software engineering technology core courses, most of which will be taken during the last two years of the program. These courses teach students the core principles, approaches and techniques of software engineering, including introduction to software engineering process and SDLC, requirements analysis, software architecture and design, testing and validation, cloud computing, and capstone project.
5. **15 credits** of Technical elective courses that will be taken during the last three semesters of the program. Tech elective courses in a variety of subjects are included and proposed for this curriculum, including IoT, Artificial Intelligence and Machine Learning, Image Processing, Computer Vision, Embedded Operating Systems, and Robotics. By taking these courses, students will have the unique opportunities to learn the latest major and emerging technology and become more competitive in job market upon their graduation.
6. **3 credits of Internship (optional)**. An internship is considered as another 3cr tech elective course in the curriculum. This offers an option to students who are interested and obtain an offer to practice the profession in industry.

4.4 Course Required to Complete the Program

The curriculum of the proposed Bachelor of Science in Software Engineering Technology program is detailed below. Note the curriculum meets City Tech’s General Education requirements.

General Education Common Core	45 credits
Program-Specific Required Gen Ed	15 credits
Computer Essentials	30 credits
Software Engineering Technology Core	15 credits
Technical Electives (including Internship)	15 credits
TOTAL	120 credits

I. Gen Ed**60 cr**

<u>Required Core:</u>		
English Composition I	ENG1101	3 credits
English Composition II	ENG1121	3
Mathematical and Quantitative Reasoning	Any. MAT1275 or higher recommended	4
Life and Physical Sciences	Any	4
<u>Flexible Core:</u>		
World Culture and Global Issues	Any	3
US Experience in Its Diversity	Any	3
Creative Expression	Any	3
Individual and Society	Any	3
Scientific World	Any. MAT1375 or higher recommended	4
An additional course	Any	3
<u>College Option:</u>		
Speech/Oral Communication	Any	3
Interdisciplinary Course	Any	3
Additional LA I	Any	3
Additional LA II	Any	3
Subtotal		45
<u>Program-Specific Degree Requirements *:</u>		
Calculus I	MAT1475	4
Calculus II	MAT1575	4
Probability and Statistics I	MAT2572	4
Introduction to Linear Algebra	MAT2580	3
Subtotal		15

II. Computer Essentials:**30cr**

1. Intro to Computer & Software Engineering Technology	CET1100	2
2. Logic & Problem Solving	CET1111	3
3. Technical Graphics (current EMT1120)	CET1120	1
4. Fundamentals of Electrical Circuits	CET1150	3
5. Object-oriented Software Design	CET1211	2
6. Fundamentals of Digital Systems (current EMT1250)	CET1250†	4
7. Cloud Database Fundamentals	SET2330	3
8. Computer Architecture	SET2340	3
9. Algorithmic Design & Data Structures	SET2430	3
10. System Programming	SET2440	3

11. Cybersecurity Fundamentals	SET3630†	3
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 *Common core shared by future CET AAS program*

III. Software Engineering Technology Core:

15 cr

1. Software Requirements Engineering	SET3510	3
2. Software Architecture and Design	SET3610	3
3. Software Testing & Quality Assurance	SET4710	3
4. Cloud Computing & Networking	SET3530	3
5. Software Capstone Design	SET4810	3

IV. Tech Electives (Take any 5)

15 cr

Internet of Things	CET4925	3
Introduction to Artificial Intelligence	CET4973	3
Digital Image Processing	CET4910	3
Software Engineering Technology in Robotics	SET4955	3
Embedded Operating Systems	SET4940	3
Internship in Software Engineering Technology	SET4900	3
Other 4-credits CET4900 series tech electives		

Total Credits:

120

Notes:

† **Writing Intensive (WI) courses.** Students must complete two major courses designated as WI for the baccalaureate degree: CET1250 is for the freshman and sophomore years and SET3630 is for the junior and senior years.

* Students must complete a total of 60 credits in general education courses. If students take any of the Program-Specific required general education courses as part of the General Education Common Core (i.e., double duty course), they are recommended to complete the general education requirements by taking one or more of the following General Education Electives:

General Education Electives (to complete the required 60 Gen Ed credits)		
Calculus III	MAT 2675	4
Probability & Statistics II	MAT 3672 (Pre: MAT2572)	4
Stochastic Models	MAT 3772 (Pre: MAT2572)	3
Computational Statistics with Applications	MAT 4672 (Pre: MAT3672)	3
Introduction to Computational Science	MAT 1630 (Pre/Co: MAT1475)	3
Discrete Structures and Algorithms I	MAT 2440 (Pre: MAT1375 or higher and MAT1630)	3
Discrete Structures and Algorithms II	MAT 2540 (Pre: MAT 2440)	3
Differential Equations	MAT 2680	3
Physics I	PHYS 1433 or PHYS 1441 (Calculus based)	4 or 5
Physics II	PHYS 1434 or PHYS 1442 (Calculus based)	4 or 5

4.5 Sample Degree Map (4-Year Course of Study)

A sample degree map (i.e, 4-year course of study) for full-time students is listed here:

1st Semester

1. CET1111 Logic & Problem Solving	3cr
2. CET1100 Intro to Comp. & SW ET	2
3. CET1150 Electrical Circuits	3
4. CET1120 Tech. Graphics	1
5. MAT1275 (Math & Quant. Reasoning)	4
6. ENG1101 English Composition I	3
total 16	

2nd Semester

1. CET1211 Object Oriented Prog.	2 cr
2. CET1250 Digital Sys.	4
3. MAT1375 (Sci. World)	4
4. PHYS 1433 General Physics I	4
4. ENG1121 English Composition II	3
total 17	

3rd Semester

1. SET2330 Cloud Database	3
2. SET2340 Computer Architecture	3
3. MAT1475 Calculus I	4
5. Gen Ed Flexible Core	3
total 13	

4th Semester

1. SET2430 Algorithms & Data Structures	3
2. SET2440 Sys. Programming	3
3. MAT1575 Calculus II	4
4. Gen Ed Flexible Core WI	3
5. Gen Ed Flexible Core	3
total 16	

5th Semester

1. SET3530 Cloud Comp & Networking	3
2. SET3510 Software Requirements	3
3. MAT2572 Prob. & Statistics I	4
4. COM1330 Public Speaking or higher	3
total 13	

6th Semester

1. SET3630 Cybersecurity	3
2. SET3610 Software Architecture	3
3. MAT2580 Linear Algebra	3
4. Tech Elective	3
5. Gen Ed College Option – ID course	3
total 15	

7th Semester

1. SET4710 Software Testing	3
2. Tech Elective	3
3. Tech Elective	3
4. Gen Ed Flexible Core WI	3
5. Gen Ed College Option – Liberal Arts I	3
total 15	

8th Semester

1. SET4810 Software Capstone	3
2. Tech Elective	3
3. Tech Elective	3
4. Gen Ed Flexible Core	3
5. Gen Ed College Option – Liberal Art II	3
total 15	

Legend:

	Computer Essentials	(30cr, 11 courses)
	SET Core	(15cr, 5 courses)
	Tech Electives	(15cr, 5 courses)
	Gen Ed – Program Specific	(15cr, 4 courses)
	Gen Ed – 4credit courses	(12cr, 3 courses)
	Gen Ed – 3credit courses	(33cr, 11 courses)

Total: 120cr, **39** courses / 8 semesters

A sample degree map for part-time students is listed here:

1st Semester

1. CET1111 Logic & Problem Solving	3cr
2. CET1100 Intro to Comp. & SW ET	2
3. CET1150 Electrical Circuits	3
4. MAT1275 (Math & Quant. Reasoning)	4
Subtotal	12*

2nd Semester

1. CET1211 Object Oriented Prog.	2 cr
2. CET1120 Tech. Graphics	1
3. MAT1375 (Sci. World)	4
4. ENG1101 English Composition I	3
Subtotal	10

3rd Semester

1. CE1250 Digital Sys.	4
2. PHYS 1433 General Physics I	4
Subtotal	8

4th Semester

1. SET2330 Cloud Database	3
2. SET2340 Computer Architecture	3
3. MAT1475 Calculus I	4
Subtotal	10

5th Semester

1. SET2430 Algorithms & Data Structures	3
2. ENG1121 English Composition II	3
3. Gen Ed Flexible Core	3
Subtotal	9

6th Semester

1. SET2440 Sys. Programming	3
2. MAT1575 Calculus II	4
3. Gen Ed Flexible Core WI	3
Subtotal	10

7th Semester

1. SET3530 Cloud Comp & Networking	3
2. SET3510 Software Requirements	3
3. Gen Ed Flexible Core	3
Subtotal	9

8th Semester

1. SET3630 Cybersecurity	3
2. MAT2572 Prob. & Statistics I	4
3. COM1330 Public Speaking or higher	3
Subtotal	10

9th Semester

1. SET3610 Software Architecture	3
2. MAT2580 Linear Algebra	3
3. Gen Ed College Option – ID course	3
Subtotal	9

10th Semester

1. SET4710 Software Testing	3
2. Tech Elective	3
3. Gen Ed Flexible Core WI	3
Subtotal	9

11th Semester

1. Tech Elective	3
2. Tech Elective	3
3. Gen Ed College Option – Liberal Art I	3
Subtotal	9

12th Semester

1. SET4810 Software Capstone	3
2. Tech Elective	3
3. Gen Ed Flexible Core	3
Subtotal	9

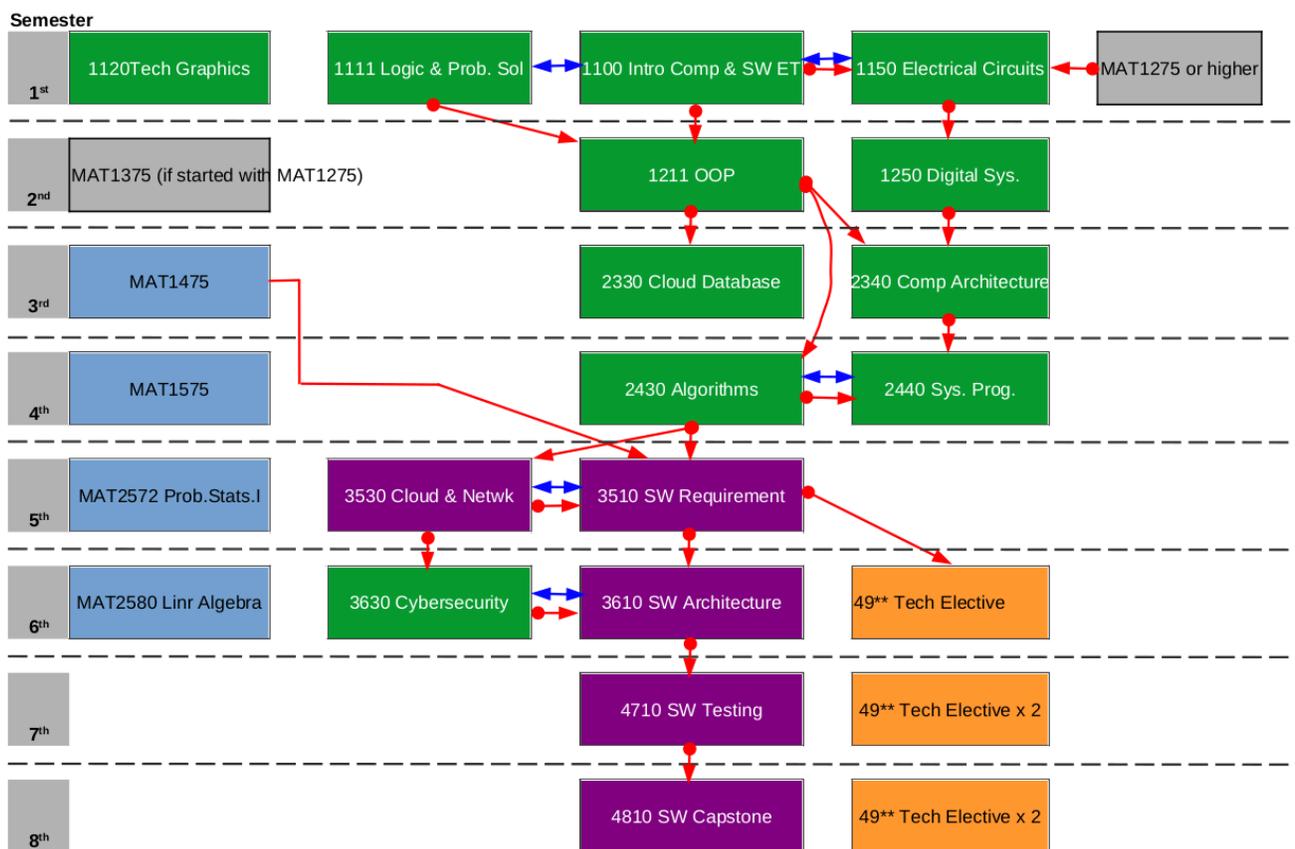
13th Semester

1. Tech Elective	3
2. Gen Ed College Option – Liberal Art II	3
Subtotal	6

* Due to the pre/co-requisite requirements, the first semester will have 12credits.

4.6 Program Flowchart

The following flowchart shows the relationship among all the major courses in the proposed program curriculum:



Legend:

- Pre-requisite
 - Co-requisite
 - Pre- or Co-requisite
 - Computer Essentials (30cr, 11 courses)
 - SET Core (15cr, 5 courses)
 - Tech Elective (15cr, 5 courses)
 - Gen Ed-Prog Specific (15cr, 4 courses)
 - MAT1275; MAT1375
- Total: 27 courses / 8 semester

- Note:**
1. 12 other gen-ed courses are not listed
 2. Tech Elective has its own other pre/co-requisites besides SET3510 or SET3610

4.7 Admission Requirements

The requirements of the entry to the proposed Software Engineering Technology Bachelor of Science program are:

Freshman Criteria

- Students must meet the College standards for admission into a baccalaureate program and must be eligible to enroll in MAT 1275, MAT 1275CO, or higher.

Transfer Criteria

- Must be CUNY proficient (reading, writing, and math)
- Must have a minimum cumulative GPA of **2.0**
- Must have completed prerequisites for taking MAT 1275, MAT 1275CO, or higher
- Applicants must submit a personal statement

4.8 Catalog Description of the New Courses

- **CET1100 Intro to Computer & Software Engineering Technology**

1 Class Hours, 2 Lab hours, 2 Credits

Introduction to computer and software engineering technology, and the degree programs in the Computer Engineering Technology (CET) Department. This course introduces the basics of computer hardware and software systems, and prepares students to achieve academic success in CET majors. Topics include history of computing and computer, basic computer organization and components, survey of various computing machines and platforms, discrete mathematics, introduction to programming languages and development tools, basic system administration, software categories, overview of software development life cycle, copyrights, security, and ethical issues. Education resources in CET Department and City Tech are also introduced for student's academic success.

Prerequisite: None

- **CET1111 Logic & Problem Solving**

2 Class Hours, 2 Lab hours, 3 Credits

A practical introduction to the foundations of problem-solving and design thinking applied in computer and software engineering technology. Students are brought into the process of build physical computing systems that interact with the user or the environment through sensors and actuators. Students learn fundamental computational techniques, logic, creative

problem solving, and iterative development through project-based learning.

Prerequisite: CUNY proficiency in mathematics

Co-requisite: CET1100

- **CET1211 Introduction to Object-oriented Programming in Software Design**

1 Class hours, 2 Lab hours, 2 Credits

Introduction to Object-Oriented programming (OOP) in software design and applications. Topics include modern software design principles, object-oriented paradigm, classes, objects, methods, attributes, encapsulation, abstraction, inheritance, polymorphism, and OOP designing applications in real-world situations.

Prerequisite: CET1100 and CET1111

Pre/Co-requisite: MAT 1275CO or MAT1275 or higher

- **SET2330 Cloud Database Fundamentals**

2 Class hours, 2 Lab hours, 3 Credits

Practical technical knowledge of cloud computing, relational databases, NoSQL databases, and Database-as-a-Service (DaaS). The architecture and features of different implementations of cloud databases, including their ability to effectively handle scalability and flexibility issues raised by modern applications. Students perform standard cloud databases management tasks, such as creating and replicating databases, loading and querying data, modifying database permissions, and indexing, aggregating and partitioning data.

Prerequisite: CET1211, MAT1375 or higher

- **SET2340 Computer Architecture**

2 Class hours, 2 Lab hours, 3 Credits

An introduction to modern computer architecture and organization, principles and practices. covers essential knowledge related to the interdependencies of computer software and hardware that underlie the design, implementation and maintenance of high performance, efficient and state-of-the-art computer systems.

Prerequisite: CET1250, MAT1375 or higher

- **SET2430 Algorithmic Design and Data Structures**

2 Class hours, 2 Lab hours, 3 Credits

Fundamental algorithmic techniques and ideas for computational problems which arise in practical

applications such as sorting and searching data. Common data structures used in various computational problems and typical use cases. Students learn how these data structures are implemented, which helps understand what happens inside a particular built-in implementation and what to expect from it.

Prerequisite: CET1211

Pre/Co-requisite: SET2440

- **SET2440 System Programming**

2 Class hours, 2 Lab hours, 3 Credits

Introduction to the fundamentals of operating systems and system programming in a Linux or Unix system. Topics include system calls, files and directories, file I/O, memory management, process and threads, inter-process communication, signals, exceptions, sockets and networking, shell scripting, etc. All topics are viewed from a UNIX/Linux system programming perspective.

Prerequisite: SET2340

Pre/Co-requisite: SET2430

- **SET3530 Cloud Computing & Networking**

2 Class hours, 2 Lab hours, 3 Credits

Introduction to cloud computing and network virtualization. Networking theory and concepts from the perspective of hands-on practices in a cloud-based computing environment. Topics include overview of cloud computing and networking, network protocols, concepts and design, cloud computing service models, cloud deployment models, directory services, dynamic host service and name service, internet data transaction protection, protocol security, routing and remote access service, virtual private network and hybrid cloud. Students use cloud services (AWS, Google Cloud, Microsoft Azure, or IBM Cloud) to conduct case studies.

Prerequisite: SET2430

Pre/Co-requisite: SET3510

- **SET3630 Cybersecurity Fundamentals**

Writing Intensive

2 Class hours, 2 Lab hours, 3 Credits

Concepts, skills, and tools needed to survive and thrive in today's threat-ridden and target-rich cyber environment. A focus on practical, useful real-world skills for the protection of networks, systems and data against innovative cyber threats. Cyber network security concepts will be presented first, followed by cyber network security hands-on and

culminating with cyber network application domains.

Prerequisite: SET3530

- **SET3510 Software Requirements Engineering**

3 Class hours, 3 Credits

An important step in the software development life cycle (SDLC). Topics include the requirements process, identifying stakeholders and goals, modeling of the current system, proposing solutions, eliciting functional and non-functional requirements.

Prerequisite: SET2430, MAT1475 or higher

Pre/Co-requisite: SET3530

- **SET3610 Software Architecture & Design**

3 Class hours, 3 Credits

Identification, analysis and evaluation of different architectural styles for software , including object-oriented and component-based. Students design software to meet criteria such as safety, security, performance, and reliability.

Prerequisite: SET3510, MAT1475 or higher

Pre/Co: SET3630

- **SET4710 Software Testing & Quality Assurance**

3 Class hours, 3 Credits

The theory and principles of software testing and quality assurance, from integration to execution and automation. The topics cover the basics of test design, test automation, and test-driven development, agile principles, values, techniques, practices, procedures, and tools. In addition, metrics and models for software quality as a product, in process, and in maintenance.

Prerequisite: SET3610, MAT1475 or higher

- **SET4810 Software Capstone Design**

2 Class hours, 2 Lab hours, 3 Credits

A comprehensive course where students apply knowledge and techniques learned throughout their course of study. Topics include requirements analysis and elicitation, architecture and design, development, validation and verification, testing, project management, and reporting in a project of their choosing addressing a real-world problem.

Prerequisite: SET4710, MAT1575 or higher

- **SET4940 Embedded Operating Systems**

2 class hours and 2 lab hours, 3 credits

A practical understanding of embedded operating systems used in embedded and real-time applications. Topics include embedded operating systems kernel architectures and examples, embedded Linux component stack, real-time scheduling, synchronization, communication, storage, process and memory management, hardware interfacing and device drivers, and real-time operating system performance analysis. Students use the latest tools to customize open-source systems and build a processor-independent embedded operating system.

Pre-requisite: SET2440 and SET3510

- **SET4955 Software Engineering Technology in Robotics**

2 Class hours, 2 Lab hours, 3 Credits

Application of software engineering and technology concepts and practice in robotics. Subjects cover the design, analysis, synthesis, and testing of software systems for real-world robotic applications such as navigation, localization, mapping, manipulation, and coordination.

Prerequisite: SET3610

Pre/Co-requisite: MAT 2580

- **SET4900 Internship in Software Engineering Technology**

2 Class hours, 120 field work hours, 3 Credits*

Assignment to field-work/study situations of a minimum of eight hours per week at one of the following: small, medium, or large companies or governmental institutions or non-profit organizations. Students may work in design, programming, software maintenance, debugging, or other appropriate activities related to the field of software engineering. Supervision provided by faculty and by the job supervisor.

**Students keep a weekly log or journal shared and presented via Blackboard.*

Pre-requisite: SET3610 and department approval

5. Faculty

The CET Department currently has 14 full-time faculty and 52 adjunct professors, most of who are qualified to teach part of the courses in this proposed program. We have full-time faculty members doing well published research in related areas and developed new course proposals for the proposed curriculum. Below is the list of full-time faculty members in CET Department:

Sunghoon Jang (Department Chair)

Education: PhD in Biomedical Engineering, University of Connecticut

Areas of Interest:

- Biomedical Sensors and Instruments
- Biomedical Signal Processing and Control Systems
- Opto-electronics and Laser Optics
- Non/Minimally invasive Optical and Electro-chemical Glucose sensors

Xiaohai Li (Coordinator of CET Department SET BS Program Proposal Committee)

Education: Ph.D. in Electrical Engineering, Graduate Center of CUNY

Areas of Interest:

- Robotics and Embedded Systems
- Applied Control Systems: Theory and Applications
- Network Science, IoT
- Wireless Sensor Networks
- Computer Vision and Perceptual Computing

José M. Reyes Álamo

Education: Ph.D. in Computer Science, Iowa State University

Areas of Interest:

- Smart Environments, Smart Homes
- Ubiquitous computing
- Cloud Computing
- Web Services
- Service-Oriented Computing
- Software Engineering

Robert Armstrong

Education: MA in Computer Information Science, Brooklyn College/CUNY

Seymour Blank

Education: PhD in physiology, Cornell University

Aparicio Carranza

Education: Ph.D. in Electrical Engineering, The Graduate School of CUNY

Areas of Interest:

- Virtualization & Cloud Computing
- Software Defined Networking (SDN)
- Cyber Security
- Linux & Clustering
- Optical Networking & DWDM

Ohbong J. Kwon

Education: Ph.D. in Electrical and Computer Engineering, University of Florida

Areas of Interest:

- Digital Signal Processing
- Digital Design (FPGA)
- Control systems

Lili Ma

Education: Ph.D. in electrical engineering, Utah State University

Areas of Interest:

- Controls and Robotics
- Autonomous mobile robots
- Vision-based control, visual servoing, visual tracking, coordinated control
- Image processing and computer vision

Benito Mendoza

Education: Ph.D. in Computer Science and Engineering, University of South Carolina

Areas of Interest:

- Multi-Agent Systems
- Bio-Inspired Systems

- Context and Situation Awareness
- Cyber-Physical Systems
- Artificial Intelligence in Education and Intelligent Tutoring Systems

Edward Morton

Education: M.B.A. Fairleigh Dickinson University

John Razukas

Education: MS in Mechanical Engineering, Polytechnic University of New York

Yu Wang

Education: Ph.D. in Electrical Engineering, the Graduate Center of the CUNY

Areas of Interest:

- Formal Methods for Modeling Real-time Systems
- Digital Design
- Testing for Hardware and Software
- Computer networks
- Optoelectronics

Chen Xu

Education: Ph.D. in Biomedical Engineering, University of Connecticut

Area of interest:

- Biomedical sensors and instrumentations
- Image processing and signal processing
- Near-infrared diffuse optical tomography
- Photoacoustic tomography
- Non-invasive medical test

Farrukh Zia

Education: Ph.D. in Computer Engineering, Syracuse University

Research interests:

- Neural networks and fuzzy logic applications
- Mechatronics and Robotics

- Wireless communication
- Embedded systems
- Sensor networks.

6. Cost Assessment

CET Department currently has a certain amount of equipment and resource for offering the major courses listed in this proposal. But an additional computer lab with at least 22 desktops and purchasing related software will be needed (such as software of VCS/SCM, database, testing/testing automation, continuous delivery (CD), performance analysis, documentation generators, etc.). Regular maintenance, routine upgrade and replacement of existing computer hardware and software will be also necessary.

CET department currently has 15 full-time faculty members providing full-time teaching and academic support for about nine hundred students. We will surely see an increase of the student enrollment after this new SET program starts. Hiring two or three new full-time faculty in the field will be requested.

7. Acknowledgments

The proposers would like to acknowledge the following persons for their sincere support of this proposed program.

Within City Tech:

- Pamela Brown, Interim Provost and Vice President of Academic Affairs
- Gerarda Shields, Dean of the School of Technology and Design
- Prof. Ashwin Satyanarayana, Chairperson of Dept. of Computer Systems Technology
- Prof. Jonathan Natov, Chairperson of Dept. of Mathematics
- Prof. Masato R. Nakamura, Chairperson of Dept. of Mechanical Engineering Technology

Out of City Tech:

- Tracy Applegate, AWS Academy Program, AWS, **Amazon**
- Brendan Collins, Google University Program, **Google**
- Ming Lu, Department of Investment Communication Service, **Broadridge**
- Remko de Knikker, Hybrid Cloud Build Team, IBM Cloud, **IBM**
- Prof. Ching-Song Wei, Chairperson, Department of Computer Information Systems, **Borough of Manhattan Community College/CUNY**
- Prof. Haishen Yao, Chair, Department of Mathematics and Computer Sciences, **Queensborough Community College/CUNY**
- Prof. Hamid Namdar, Chair, Department of Engineering Technology, **Queensborough Community College/CUNY**
- Prof. Sebastian Benjamin Murolo, Chair, Department of Business, **Queensborough Community College/CUNY**

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New Course Proposal: CET1100 Introduction to Computer & Software Engineering Technology

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Introduction to Computer & Software Engineering Technology
Proposal Date	April 8, 2021
Proposer's Name	Chen Xu, Lili Ma, Xiaohai Li, Robert Armstrong, Ohbong Kwon
Course Number	CET1100
Course Credits, Hours	2 credits, 1 class hours and 2 lab hours
Course Pre-Requisites	None
Course Co-Requisites	
Catalog Course Description	Introduction to computer and software engineering technology, and the degree programs in the Computer Engineering Technology (CET) Department. This course introduces the basics of computer hardware and software systems, and prepares students to achieve academic success in CET majors. Topics include history of computing and computer, basic computer organization and components, survey of various computing machines and platforms, discrete mathematics, introduction to programming languages and development tools, basic system administration, software categories, overview of software development life cycle, copyrights, security, and ethical issues. Education resources in CET Department and City Tech are also introduced for student's academic success.
Brief Rationale	This course will be the first fundamental major

Provide a concise summary of why this course is important to the department, school or college.

course for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It is also a common core course that will be taken by the students majored in Computer Engineering Technology. It introduces freshmen to the fields of computer and software engineering.

CUNY – Course Equivalencies

Provide information about equivalent courses within CUNY, if any. No

Intent to Submit as Common Core

If this course is intended to fulfill one of the requirements in the common core, then indicate which area. No

For Interdisciplinary Courses:

Not applicable

Date submitted to ID Committee for review

Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course

No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
<ul style="list-style-type: none"> Discipline Specific General Education Specific Learning Outcome and Assessment Tables 	✓
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓

Where does this course overlap with other courses, both within and outside of the department? ✓

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? ✓

If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. NA

Course Design

Describe how this course is designed. ✓

Course Context (e.g. required, elective, capstone) ✓

Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? ✓

Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) ✓

How does this course support Programmatic Learning Outcomes? ✓

Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. ✓

Additional Forms for Specific Course Categories NA

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#)) NA

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Software Engineering Technology
Course Prefix	CET
Course Number	1100
Course Title	Introduction to Computer & Software Engineering Technology
Catalog Description	Introduction to computer and software engineering technology, and the degree programs in the Computer Engineering Technology (CET) Department. This course introduces the basics of computer hardware and software systems, and prepares students to achieve academic success in CET majors. Topics include history of computing and computer, basic computer organization and components, survey of various computing machines and platforms, discrete mathematics, introduction to programming languages and development tools, basic system administration, software categories, overview of software development life cycle, copyrights, security, and ethical issues. Education resources in CET Department and City Tech are also introduced for student's academic success.
Prerequisite	None
Corequisite	
Pre- or corequisite	
Credits	2
Contact Hours	1 Class Hours, 2 Lab Hours
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World
Effective Term	Fall 2023

Rationale: This course will be the first major courses for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It will also be taken by the students majored in Computer Engineering Technology.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal CET 1100 – Introduction to Computer & Software Engineering Technology	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology (SET)
Proposed by (include email & phone) Prof. Xiaohai Li, xhli@citytech.cuny.edu Prof. Chen Xu, cxu@citytech.cuny.edu Prof. Armstrong, barmstrong@citytech.cuny.edu Prof. Lili Ma, lma@citytech.cuny.edu Prof. Ohbong Kwon okwon@citytech.cuny.edu Tel: 718-260-5885	Expected date course(s) will be offered Fall 2023 # of students 22

2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (http://cityte.ch/curriculum) for articles and ebooks for your courses, or our open educational resources (OER) guide (http://cityte.ch/oer). Have you considered using a freely-available OER or an open textbook in this course? As to the proposer’s knowledge, there is no open textbook available for this course, but plenty OER and open-source tech documentations available online which will be used in the class.

3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook,
--

journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.

A search of the CityTech/CUNY library catalog and database with the keyword “introduction to computer engineering”, “introduction to software engineering” or “introduction to software technology” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After surveying the collection, I believe the library can adequately support this course. Upon approval of this course, I feel it may be necessary to add monographs pertaining to computer science history to the collection. Since this is an introductory course, there may be OER textbooks available through the Open Textbook Library - <https://open.umn.edu/opentextbooks> - that may prove useful to faculty and students.

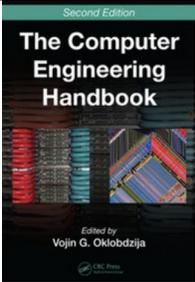
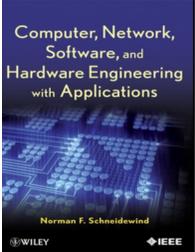
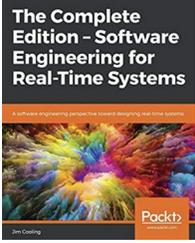
09.01.21

Computer Engineering Technology Department
Computer Engineering Technology Program

Sample Course Outline

Prepared by	Chen Xu, Lili Ma, Xiaohai Li, Robert Armstrong, Ohbong Kwon	Revision date	9/5/2021
Course No. & Title	CET 1100 Introduction to Computer and Software Engineering Technology		
Course Description	Introduction to computer and software engineering technology, and the degree programs in the Computer Engineering Technology (CET) Department. This course introduces the basics of computer hardware and software systems, and prepares students to achieve academic success in CET majors. Topics include history of computing and computer, basic computer organization and components, survey of various computing machines and platforms, discrete mathematics, introduction to programming languages and development tools, basic system administration, software categories, overview of software development life cycle, copyrights, security, and ethical issues. Education resources in CET Department and City Tech are also introduced for student's academic success.		
Hours / Credits	1 lecture hr, 2 lab hrs / 2 credits		
Pre-requisite	None		
Co-requisite			
Gen-Ed Objectives	<p>[1] SKILLS/Communication: Students will communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means.</p> <p>[2] INTEGRATION/Integrate learning: Students will resolve difficult issues creatively by employing multiple tools.</p> <p>[3] VALUES, ETHICS, RELATIONSHIPS / Professional/Personal Development: Students will work with teams, including those of diverse composition. Build consensus. Respect and use creativity.</p>		
Course Objectives/ Student Learning Outcomes	<p>Upon successful completion of this course, students shall be able to:</p> <ol style="list-style-type: none"> 1. Understand the basic components of a computer system; 2. Describe the function and integration of computer hardware and 		

	<p>software systems;</p> <ol style="list-style-type: none"> 3. Understand the applications of computer engineering technology; 4. Understand the curriculum of CET program; 5. Have a career goal for themselves, and make a plan toward it.
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Textbook	None. Course materials will be provided by the instructor.	
Reference:	<p>The Computer Engineering Handbook Author: Vojin G. Oklobdzija Publisher: CRC Press ISBN 9780849386008</p>	
	<p>Computer, Network, Software, and Hardware Engineering with Applications Author: Norman F. Schneidewind Publisher: Wiley ISBN: 9781118181270</p>	
	<p>The Complete Edition – Software Engineering for Real-Time Systems, Author: Jim Cooling, Publisher: Packt Publishing, ISBN: 978- 1839216589</p>	

Weekly Topics

Week #	Lecture	Lab
1	Overview of the City Tech resources (admission and financial aid offices, student center, printing services, tutoring, library, computer labs); Introduction to the CET department (mission, majors, curriculum, program objectives, faculty & staff members, lab facilities, students' clubs)	Getting familiar with: <ul style="list-style-type: none"> • City Tech email • CUNYFirst • Blackboard • OpenLab
2	CET advisement (program coordinators, advisors, DegreeWorks, roles of student and faculty, academic planner, degree maps, course selection and registration)	Knowing how to use: <ul style="list-style-type: none"> • DegreeWorks to monitor academic progress • CUNYFirst to search & register classes
3	Soft skills (communication skills, documentation, team-building, time management, good learning strategies)	Introduction of some commonly-used editing software, such as: <ul style="list-style-type: none"> • Word: Track changes, references, save as PDF, insert table, picture, header/footer, double-column. • PDF: add/delete pages, merge files, add signature, edit PDF.
4	Associate Degree (AAS) courses (a one-page overview of each course illustrating sample lecture/lab/project/hardware platform/software programming & tools)	Introduction of some commonly-used software, such as: <ul style="list-style-type: none"> • MATLAB/Simulink
5	Bachelor Degree (BTech) courses (a one-page overview of each course illustrating sample lecture/lab/project/hardware platform/software programming & tools)	<ul style="list-style-type: none"> • MultiSim • LabView • C/C++, Java, Python • SolidWorks, AutoCAD
6	Introduction to Computer Engineering	Simulation of DC and AC circuits in MultiSim
7	Current computing machines and platforms	Lab exercise on building/measuring DC and AC circuits
8	Basics of computer organization and computer components	Lab exercise on electronics
9	Survey of operating systems; Introduction to computer programming languages	Lab exercise on computer hardware components/system
10	Basic procedural programming; Introduction to programming tools	Lab exercise on Operating System
11	Introduction to software engineering field	Sample lab of programming under Linux/Unix
12	Software categories and architectures	Sample lab of programming in Java

13	Software life cycle and copyrights	Sample lab of programming in Python
14	Security issues in computers and software	Sample lab of networking
15	Ethical issues in computers and software	Sample lab of security

COURSE POLICIES:

Grading:

- Quizzes 45%
- Labs: 45%
- Class Participation: 10%
- Total: 100%

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

- Desktop/laptop or single-board computer can be used for the lab and course project.
- Other open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Lab Reports:

- Students are expected to perform each lab activity individually.
- All lab reports must be submitted through Blackboard.
- Each lab report is due one week after the lab work is performed.
- Any late lab report will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.
- Additional requirements regarding lab report's content and format will be posted on Blackboard.

Class Participation:

- Attendance and class participation are essential and excessive absences will affect the

final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

- Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods:

General Education Learning Outcomes	Assessment Methods
SKILLS/Communication: Students will communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means.	Project and lab. Students will form a team to work on project and labs. They will write lab reports and project report, and present their project in the final presentation.
INTEGRATION/Integrate learning: Students will resolve difficult issues creatively by employing multiple tools.	HW, Quiz, Exams, project, labs.
VALUES, ETHICS, RELATIONSHIPS / Professional/Personal Development: Students will work with teams, including those of diverse composition. Build consensus. Respect and use creativity.	Labs and project.

Course Specific Learning Outcomes	Assessment Methods
Understand the basic components of a computer system	HW, Quiz, and Lab
Describe the function and integration of computer hardware and software systems	HW, Quiz, and Exam
Understand the applications of computer engineering technology	Lab and HW

Understand the curriculum of CET program	HW and Quiz
Have a career goal for themselves, and make a plan toward it	HW and reflection

Course Design

The course will be offered to the freshmen students in the AAS in Computer Engineering Technology Program in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture/tutorial/seminar series and hands-on lab/workshop sessions. The lecture series introduce students to City Tech and CET resources so that they will quickly adapt to college life and learning, as well as provide a brief and broad overview of the hardware and software aspects of the CET field. The hands-on sessions expose students to commonly-adopted hardware components & devices and software programming languages & tools. Adequate equipment and resources in the CET Department are available for the course's hands-on components. Many CET full-time faculty members are qualified and available to teach this course.

New Course Proposal: SET2330 Cloud Database Fundamentals

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Cloud Database Fundamentals
Proposal Date	August 8, 2021
Proposer's Name	Benito Mendoza and Aparicio Carranza
Course Number	SET 2330
Course Credits, Hours	3 credits, 2 class hours and 2 lab hours
Course Pre/co-Requisites	Prerequisite: CET1211, MAT1375 or higher
Catalog Course Description	<p>Practical technical knowledge of cloud computing, relational databases, NoSQL databases, and Database-as-a-Service (DaaS). The architecture and features of different implementations of cloud databases, including their ability to effectively handle scalability and flexibility issues raised by modern applications. Students perform standard cloud databases management tasks, such as creating and replicating databases, loading and querying data, modifying database permissions, and indexing, aggregating and partitioning data.</p>
Brief Rationale	<p>This course will be one of the core courses for the proposed Software Engineering Technology (SET) BS program in the Department of Computer Engineering Technology.</p> <p>Many business organizations are moving towards the cloud because it provides flexibility, disaster recovery, security, collaboration, etc. Relational Databases ruled the IT Industries for almost 40 years. Limitations of relational databases lead to the rise of cloud databases. A cloud database is a database that typically runs on a cloud computing platform. Cloud databases are on the rise as more businesses look to capitalize on the advantages of cloud computing to power their business applications. Cloud databases are mainly used in data mining, data warehousing, and business intelligence. This course deals with different types of cloud databases and how databases</p>
Provide a concise summary of why this course is important to the department, school or college.	

influence capacity planning and improve application development.

CUNY – Course Equivalencies

Provide information about equivalent courses within CUNY, if any. No

Intent to Submit as Common

Core

No

If this course is intended to fulfill one of the requirements in the common core, then indicate which area.

For Interdisciplinary Courses:

Not applicable

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course

No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
<ul style="list-style-type: none"> 7. Discipline Specific 8. General Education Specific Learning Outcome and Assessment Tables 	✓
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓

Where does this course overlap with other courses, both within and outside of the department? ✓

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? ✓

If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. NA

Course Design

Describe how this course is designed. ✓

Course Context (e.g. required, elective, capstone) ✓

Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? ✓

Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) ✓

How does this course support Programmatic Learning Outcomes? ✓

Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. ✓

Additional Forms for Specific Course Categories NA

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#)) NA

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	2330		
Course Title	Cloud Database Fundamentals		
Catalog Description	Practical technical knowledge of cloud computing, relational databases, NoSQL databases, and Database-as-a-Service (DaaS). The architecture and features of different implementations of cloud databases, including their ability to effectively handle scalability and flexibility issues raised by modern applications. Students perform standard cloud databases management tasks, such as creating and replicating databases, loading and querying data, modifying database permissions, and indexing, aggregating and partitioning data.		
Prerequisite	<i>CET1211, MAT1375 or higher</i>		
Corequisite			
Pre- or corequisite			
Credits	3		
Contact Hours	2 Class Hours, 2 Lab Hours		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g. Writing Intensive, etc)			
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

Rationale: A core course for the proposed BS program in Software Engineering Technology (SET) at the Department of Computer Engineering Technology. This topic is necessary for this major, since many business organizations are moving towards the cloud because it provides flexibility, disaster recovery, security, collaboration, etc. Relational Databases ruled the IT Industries for almost 40 years. Limitations of relational databases lead to the rise of cloud databases. A cloud database is a database that typically runs on a cloud computing platform. Cloud databases are on the rise as more businesses look to capitalize on their advantages.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal SET 2330- Cloud Database Fundamentals	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology(SET)
Proposed by (include email & phone) Prof. Benito Mendoza bmendoza@citytech.cuny.edu / 718-260-5437	Expected date course(s) will be offered Fall 2023 # of students 22

2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (http://cityte.ch/curriculum) for articles and eBooks for your courses, or our open educational resources (OER) guide (http://cityte.ch/oer). Have you considered using a freely-available OER or an open textbook in this course? As to the proposer's knowledge, there is no open textbook available for this course, but plenty OER and open-source tech documentations available online which will be used in the class.

3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g., eBook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.
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A search of the City Tech/CUNY library catalog and database with the keyword “cloud database” “cloud database fundamentals”, or “cloud computing” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 **Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 **Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After evaluating the collection, I believe that the library is adequate in supporting this course. However, upon course approval, I feel that it is important that the library update both ebooks and print materials to reflect more recent publications on cloud computing, especially on introductory books on the topic, cloud-based database design, cloud security, NoSQL, and possibly cloud server administration, in addition to any required texts for the course.

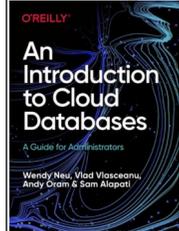
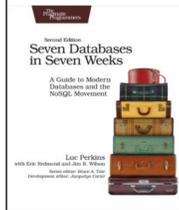
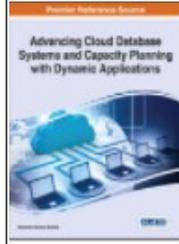
09.01.21

Computer Engineering Technology Department

Software Engineering Technology Program

Sample Course Outline

Prepared by	Benito Mendoza	Revision date	
Course No. & Title	SET 2330: Cloud Database Fundamentals		
Course Description	Practical technical knowledge of cloud computing, relational databases, NoSQL databases, and Database-as-a-Service (DaaS). The architecture and features of different implementations of cloud databases, including their ability to effectively handle scalability and flexibility issues raised by modern applications. Students perform standard cloud databases management tasks, such as creating and replicating databases, loading and querying data, modifying database permissions, and indexing, aggregating and partitioning data.		
Hours / Credits	2 class hrs, 2 lab hrs / 3 credits		
Pre-requisite	CET1211, MAT1375 or higher		
Pre- / Co-requisite			
Gen-Ed Objectives	<ul style="list-style-type: none"> • INTEGRATION/Systems: Understand and navigate systems • SKILLS/Communication: Communicate in diverse settings and groups, using written (both reading and writing) • SKILLS/Inquiry/Analysis: Use creativity to solve problems. 		
Course Objectives/ Student Learning Outcomes	<ul style="list-style-type: none"> • Recognize the different types of cloud service models • Understand the key business benefits of cloud services • Understand what virtualization is and how it relates to cloud computing • Design database services and accessed through a cloud platform • Work with relational databases • Work with non-relational databases • Implement and deploy cloud database applications. • Identify approaches for cloud database security 		

Textbook	Cloud Database Development and Management	
Author	Lee Chao	
Publisher / Year	CRC Press Taylor & Francis Group (2014)	
ISBN	ISBN-13: 978-1-4665-6506-7	
Reference Texts	<p>TITLE: Advancing Cloud Database Systems and Capacity Planning with Dynamic Applications</p> <p>AUTHORS: Narendra Kumar Kamila (ed)</p> <p>PUBLISHED BY: IGI Global</p> <p>PUBLICATION DATE: 2017</p>	
	<p>TITLE: Seven Databases in Seven Weeks, 2nd Edition</p> <p>AUTHORS: Luc Perkins, Eric Redmond, Jim Wilson</p> <p>PUBLISHED BY: Pragmatic Bookshelf</p> <p>PUBLICATION DATE: April 2018</p>	
	<p>TITLE: An Introduction to Cloud Databases</p> <p>AUTHORS: Vlad Vlasceanu, Wendy A. Neu, Andy Oram, Sam Alapati</p> <p>PUBLISHED BY: O'Reilly Media, Inc.</p> <p>PUBLICATION DATE: November 2019</p>	

Class Schedule

Week	Topic, Reading, and References
1	Introduction and Motivation Overview of Cloud Computing
2	Virtualization and Cloud Deployment
3	Cloud Development
4	Exam I Introduction to Database Systems and Database as a Service
5	Introduction to SQL (DDL vs DML)
6	Database Design and Cloud Data Storage
7	Table Normalization and Cloud SQL Database
8	Database Development and Management with SQL
9	Exam II Importing and Exporting Cloud Database Objects
10	Cloud SQL Database Procedures and Functions
11	Cloud Database Systems—NoSQL
12	Cloud Database Systems—NewSQL, Hybrid
13	Cloud Database Applications Development and Deployment
14	Exam III Final Project Working Time
15	Final Project Presentation

COURSE POLICIES:

Grading:

- | | |
|------------------|------|
| 3. Exams (3) | 30 % |
| 4. Final Project | 30 % |

5. Lab Exercises/projects and Lab Reports: 25 %
6. Homework Assignments: 15 %
7. Total: 100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

8. Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login is working in the beginning of the course.

Reading and Reference Material:

9. Reading and reference material will be provided in Blackboard and OpenLab– Contents section as needed.

Software for Lab / Project:

10. Free or open-source software applications will be used in the labs and course project. The main programming language is Python (Open source). The links to download the software will be posted in Blackboard.

Lab Reports:

11. Lab reports must be in Word .doc file format.
12. All lab reports must be submitted through Blackboard – Assignments section.
13. Additional requirements on lab report's content and format will be posted on Blackboard. Please read them carefully.

Library Usage:

4. Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

Classroom Conduct Policy:

Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.

Any activity that threatens the college academic integrity will result in a disciplinary action.

Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
INTEGRATION/Systems: Understand and navigate systems	Students will demonstrate practical skills to navigate and administrate cloud database management systems. This

	will be demonstrated by homework, lab work, and final project.
SKILLS/Communication: Communicate in diverse settings and groups, using written (both reading and writing)	Students will demonstrate their written and oral communication abilities. This will be assessed by their final project report and the presentation of their final project.
SKILLS/Inquiry/Analysis: Use creativity to solve problems.	Students will develop creative solutions to complex problem. This will be demonstrated by the lab work and final project.

Course Specific Learning Outcomes	Assessment Methods
Recognize the different types of cloud service models	Homework and Exams
Understand the key business benefits of cloud services	Homework and Exams
Understand what virtualization is and how it relates to cloud computing	Lab and homework
Design database services and accessed through a cloud platform	Lab, homework, final project
Work with relational databases	Exams, and Labs
Work with non-relational databases	Exams, and Labs
Implement and deploy cloud database applications	Homework, Labs, Final Project
Identify approaches for cloud database security	Labs, Homework

Course Need Assessment

The course will be offered to sophomore students of the Software Engineering Technology Program in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

There is no similar course available within CITY TECH; this course is particularly designed for software engineers. It brings together the understanding the principles cloud computing, relational databases, NoSQL Databases, and Database-as-a-Service. Relational Databases ruled the IT Industries for almost 40 years. Limitations of relational databases lead to the rise of cloud databases. Many business organizations have moved towards the cloud because it provides flexibility, disaster recovery, security, collaboration, etc. Cloud databases are on the rise as more businesses look to capitalize on the advantages of cloud computing to power their business applications. The course provides practical skills demanded by business such as performing standard cloud databases management tasks, such as creating and replicating databases, loading and querying data, modifying database permissions, indexing, and aggregating and partitioning data.

Course Design

As mentioned before this course is planned to be a core course. The course will be primarily delivered through three activities:

- Lectures
- Labs/Tutorials
- Homework Assignments

Programmatic course learning outcomes will be assessed through exams, lab/tutorials assignments, homework, and quizzes.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The hands-on sessions include lab exercises, experiments and group projects. The design of this course will allow to teach the course online or in-person.

No additional physical resources are required since students will take the course in one of the computer labs in the CET department. Students just need a computer with Internet connection. The software and development tools used for projects are Open Source or free.

Existing faculty in the CET department is qualified and available to teach this course. Adequate equipment and lab resources are also available for the hands-on component of the course.

New Course Proposal: SET2340 Computer Architecture

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the Curriculum Modification Proposal Form and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Computer Architecture
Proposal Date	November 11, 2020
Proposer's Name	Farrukh Zia, Yu Wang, Ed Morton
Course Number	SET 2340
Course Credits, Hours	3 credits, 2 class hours, 2 lab hours
Course Pre / Co-Requisites	Pre-req: CET1250, MAT1375 or higher
Catalog Course Description	An introduction to modern computer architecture and organization, principles and practices. covers essential knowledge related to the interdependencies of computer software and hardware that underlie the design, implementation and maintenance of high performance, efficient and state-of-the-art computer systems.
Brief Rationale Provide a concise summary of why this course is important to the department, school or college.	This course will be one of the required courses for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students to the subject of modern Computer architecture and organization principles and practices. This course covers essential knowledge related to the interdependencies of computer software and hardware needed by software engineering professionals to design, implement and maintain high performance, efficient and state of the art computer systems.
CUNY – Course Equivalencies Provide information about equivalent courses within CUNY, if any.	No

<p>Intent to Submit as Common Core</p> <p>If this course is intended to fulfill one of the requirements in the common core, then indicate which area.</p>	No
<p>For Interdisciplinary Courses:</p> <ul style="list-style-type: none"> • Date submitted to ID Committee for review • Date ID recommendation received <p>- Will all sections be offered as ID? Y/N</p>	Not Applicable
<p>Intent to Submit as a Writing Intensive Course</p>	No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL. Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
9. Title, Number, Credits, Hours, Catalog course description	✓
10. Brief Rationale	✓
11. CUNY – Course Equivalencies	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	✓
Discipline Specific General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	✓
Describe the need for this course. Include in your statement the following information.	
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓

Where does this course overlap with other courses, both within and outside of the department?	✓
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	✓
If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need.	NA
Course Design	✓
Describe how this course is designed.	
Course Context (e.g. required, elective, capstone)	✓
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	✓
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	✓
How does this course support Programmatic Learning Outcomes?	✓
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	✓
Additional Forms for Specific Course Categories	NA
Interdisciplinary Form (if applicable)	
Interdisciplinary Committee Recommendation (if applicable and if received)* *Recommendation must be received before consideration by full Curriculum Committee	
Common Core (Liberal Arts) Intent to Submit (if applicable)	
Writing Intensive Form if course is intended to be a WIC (under development)	
If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.	
(Additional materials for Curricular Experiments)	NA
Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).	
Established Timeline for Curricular Experiment	

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	2340		
Course Title	Computer Architecture		
Catalog Description	An introduction to modern computer architecture and organization, principles and practices. covers essential knowledge related to the interdependencies of computer software and hardware that underlie the design, implementation and maintenance of high performance, efficient and state-of-the-art computer systems.		
Prerequisite	CET1250, MAT1375 or higher		
Corequisite			
Pre- or corequisite			
Credits	3		
Contact Hours	2 Class Hours, 2 Lab Hours		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g. Writing Intensive, etc)			
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

Rationale: This course will be one of the required courses for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students to the subject of modern Computer architecture and organization principles and practices. This course covers essential knowledge related to the interdependencies of computer software and hardware needed by software engineering professionals to design, implement and maintain high performance, efficient and state of the art computer systems.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal SET 2340 – Computer Architecture	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology (SET)
Proposed by (include email & phone) Prof. Farrukh Zia, fzia@citytech.cuny.edu Prof. Yu Wang, ywang@citytech.cuny.edu Prof. Edward Morton, emorton@citytech.cuny.edu Tel: 718-260-5885	Expected date course(s) will be offered Fall 2023 # of students 22

- 2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**

As to the proposer's knowledge, there is no open textbook available for this course, but there are plenty of OER and open-source technology documentation available online which may be used for this course.

- 3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**

A search of the CityTech/CUNY library catalog and database with the keyword “computer architecture” or “computer organization” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After surveying the collection, I believe that the library will need more updated materials on computer software and hardware to fully support this course. Many of the print books in the collection are outdated and I recommend that, upon course approval, that more recently published monographs (both print and ebooks) related to computer architecture be added and outdated and obsolete books be removed.

09.01.21

Computer Engineering Technology Department

Software Engineering Technology Program

Sample Course Outline

Prepared by	Farrukh Zia, Yu Wang, Ed Morton	Revision date	August 2021
Course No. & Title	SET 2340 Computer Architecture		
Course Description	An introduction to modern computer architecture and organization, principles and practices. covers essential knowledge related to the interdependencies of computer software and hardware that underlie the design, implementation and maintenance of high performance, efficient and state-of-the-art computer systems.		
Hours / Credits	2 class hrs, 2 lab hrs / 3 credits		
Pre-requisite	CET1250, MAT1375 or higher		
Co-requisite			
Gen-Ed Objectives	<ul style="list-style-type: none"> -Acquire discipline-specific knowledge. -Gather, interpret and evaluate information from a variety of sources. -Have effective reading and written/oral communication skills. -Function as an effective team member. 		
Course Objectives/ Student Learning Outcomes	<ul style="list-style-type: none"> • Recognize and use technical terms in the field of computer architecture and computer system design. • Understand the basics of CPU and memory system considerations in designing a computer system architecture. • Understand and compare different computer architecture designs. • Acquire the skills to analyze and simulate different computer architecture designs. • Be able to select and apply appropriate system analysis techniques to gain an understanding of a particular computer architecture. 		
Textbook	Computer Organization and Design 5 th Edition		
Author	David A. Patterson, John L. Hennessy		
Publisher / Year	Morgan Kaufmann (Elsevier) / 2014		
ISBN	978-0-12-407726-3 (paperback)		
Lab Ref. Book	Laboratory exercises are included in the textbook		
Author	David A. Patterson, John L. Hennessy		
Publisher / Year	Morgan Kaufmann (Elsevier) / 2014		

ISBN	978-0-12-407726-3 (paperback)	
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Wk	Weekly Topics
1	Introduction to course and syllabus History of computers and computer architecture evolution
2	Computer Abstractions and Technology
3	Instructions: Language of the Computer
4	Instructions: Language of the Computer (cont.)
5	Arithmetic for Computers
6	Arithmetic for Computers (cont.)
7	Midterm exam
8	Logic Design of the Processor (CPU)
9	Logic Design of the Processor (CPU) (cont.)
10	Exploiting Memory Hierarchy
11	Exploiting Memory Hierarchy (cont.)
12	Parallel Process from Client to Cloud
13	Parallel Process from Client to Cloud (cont.)
14	Project Hours
15	Final demonstration and presentation

Reading and Reference Materials:

William Stallings, COMPUTER ORGANIZATION AND ARCHITECTURE 9th Edition,
 Pearson Education (Prentice Hall) 2013.
 ISBN 10: 0-13-293633-X, ISBN 13: 978-0-13-293633-0.

Additional reading and reference materials will be provided on Blackboard (under *Contents* section) as needed.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:**Grading:**

Midterm Exam:	25 %
Final Project:	25 %
Laboratory Exercises:	20 %
Homework Assignments:	20 %
Class Participation:	10 %
 Total:	 100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

Desktop/laptop computer can be used for the labs and course project.

Other open-source or free software/libraries will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Lab Reports:

Lab reports must be submitted INDIVIDUALLY.

All lab reports must be submitted through Blackboard – Assignments section.

Each lab report is due one week after the lab work is performed.

Any late lab report will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.

Additional requirements regarding lab report's content and format will be posted on Blackboard.

Homework:

3~5 assignments will be assigned. Each homework assignment equally contributes to the final grade.

Homework will be done in a group or individually. See Blackboard for detailed instructions.

All homework must be submitted through Blackboard.

Any late homework will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.

Project:

2~3 students form a team to propose, develop and finish a project during the semester. The project needs to be approved by the instructor before proceeding.

Each team needs to submit a midterm project report. The report should be submitted in Blackboard.

Final project demonstration/presentation will be done on the last week of the class. All team members in a team need to be present for the demonstration/presentation except emergencies.

Class Participation:

Attendance and class participation are essential and excessive absences will affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

Cell phone use and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be removed from class.

Any activity that threatens the college academic integrity will result in a disciplinary action.

Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
Acquire discipline specific knowledge.	Students will at minimum, demonstrate knowledge of basic technical terms related to computer architecture such as those found in a job interview in the software

	engineering field. Students who excel will be able to use logical thinking and reasoning to find answers to new questions. This will be demonstrated by homework, midterm exam and final project presentation.
Have effective reading and written communication skills.	Effective reading will be demonstrated by accurate interpretation of reading/reference materials and weekly lab procedures. Effective writing will be demonstrated in lab reports, midterm exam and project/lab documentation.
Have effective oral communication skills. Gather, interpret and evaluate information from a variety of sources.	Students will verbally discuss computer system architecture and explain basic concepts to the class. Each group of students will give a brief oral presentation on their project at the end of the semester. Students will also demonstrate their projects at the end of semester.
Be able to work in a team and group while being aware of the ethical and conflict related situations in group dynamics.	Students will work together in groups to analyze and demonstrate/present a particular computer system architecture. Teamwork rubrics will be used for the assessment.

Course Specific Learning Outcomes	Assessment Methods
Recognize and use technical terms in the field of computer architecture and computer system design.	Analysis of student performance on lab reports, homework, midterm exam and final project presentation.
Understand the basics of CPU and memory system considerations in designing a computer system architecture.	Analysis of student performance on homework, lab reports, and midterm exam.
Understand and compare different computer architecture designs.	Analysis of student performance on homework, hands-on lab exercises, lab reports and final project presentation.
Acquire the skills to analyze and simulate different computer architecture designs.	Analysis of student performance on hands-on lab exercises, lab reports, midterm exam and final project.
Be able to select and apply appropriate system analysis techniques to gain an understanding of a particular computer architecture.	Students will select and apply appropriate system analysis techniques through different stages of the project. Analysis of student performance on project exercises, midterm exam, lab reports and final demonstration /presentation of project.

Course Need Assessment

This course provides an introduction to modern Computer architecture and organization, principles and practices. It covers essential knowledge related to the interdependencies of computer software and hardware needed by software engineering professionals to design, implement and maintain high performance, efficient and state of the art computer systems.

In this course, students will learn fundamental concepts and knowledge related to computer architecture as required by the software industry. It directly supports one of the program educational objectives, which states that graduates of the SET BS program are expected to be employed, as software engineer or the equivalent, in positions beyond the entry-level for which this program has prepared them.

This course has no overlap with any other courses offered in the CET Department. According to the current College Catalog, this course also does not overlap with any course offered in any other departments at City Tech.

Course Design

The course will be offered to the SET BS sophomore students in the Computer Engineering Technology Department. It is expected that a section (maximum 22 students) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The hands-on sessions include lab exercises, experiments and group projects. This course is not designed to be online.

Besides access to online resources, no physical resources are required since students will take this course in lieu of existing courses in the CET Department. Adequate computer equipment in the CET Department is available for the hands-on components (lab experiments and course project) of this course. Several existing CET full-time faculty are qualified and available to teach this course every semester.

References:

- [1] Patterson and Hennessy, Computer Organization and Design 5th Edition
Morgan Kaufmann (Elsevier) / 2014
978-0-12-407726-3 (paperback)
- [2] William Stallings, COMPUTER ORGANIZATION AND ARCHITECTURE 9th Edition,
Pearson Education (Prentice Hall) 2013.
ISBN 10: 0-13-293633-X, ISBN 13: 978-0-13-293633-0.

New Course Proposal: SET2430 Algorithmic Design & Data Structures

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Algorithmic Design and Data Structures
Proposal Date	August 1, 2021
Proposer's Name	Benito Mendoza and Ohbong Kwon
Course Number	SET 2430
Course Credits, Hours	3 credits, 2 class hours and 2 lab hours
Course Pre/co-Requisites	Pre: CET1211 Pre/Co: SET2440
Catalog Course Description	Fundamental algorithmic techniques and ideas for computational problems which arise in practical applications such as sorting and searching data. Common data structures used in various computational problems and typical use cases. Students learn how these data structures are implemented, which helps understand what happens inside a particular built-in implementation and what to expect from it.
Brief Rationale	Software Engineers should know and practice solving computational problems, designing new algorithms, and implementing solutions efficiently. Good algorithms come together with suitable data structures that allow them to manipulate the data efficiently. This course considers the common data structures used in various computational problems and introduces the algorithmic design practices that will help engineers be software designers and tackle more complex problems.
Provide a concise summary of why this course is important to the department, school or college.	

CUNY – Course Equivalencies

Provide information about equivalent courses within CUNY, if any. No

Intent to Submit as Common

Core No

If this course is intended to fulfill one of the requirements in the common core, then indicate which area.

For Interdisciplinary Courses:

Not applicable

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course

No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
12. Discipline Specific	✓
13. General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓

Where does this course overlap with other courses, both within and outside of the department? ✓

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? ✓

If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. NA

Course Design

Describe how this course is designed. ✓

Course Context (e.g. required, elective, capstone) ✓

Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? ✓

Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) ✓

How does this course support Programmatic Learning Outcomes? ✓

Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. ✓

Additional Forms for Specific Course Categories

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#))

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Software Engineering Technology
Course Prefix	SET
Course Number	2430
Course Title	Algorithmic Design and Data Structures
Catalog Description	Fundamental algorithmic techniques and ideas for computational problems which arise in practical applications such as sorting and searching data. Common data structures used in various computational problems and typical use cases. Students learn how these data structures are implemented, which helps understand what happens inside a particular built-in implementation and what to expect from it.
Prerequisite	CET1211
Corequisite	
Pre- or corequisite	SET2440
Credits	3
Contact Hours	2 Class Hours, 2 Lab Hours
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World
Effective Term	Fall 2023

Rationale: This course is designed as a core course for the Software Engineering Technology Bachelor of Science program. The primary purpose of most computer programs is not to perform calculations but to store and retrieve information—usually as fast as possible. Today’s software engineers must be trained to understand the principles behind efficient algorithm design. Good algorithms come together with suitable data structures that allow them to manipulate the data efficiently. This course considers the common data structures used in various computational problems and introduces the algorithmic design practices that will help engineers be better software designers and tackle the complex problems facing our ever-changing technology and society.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline**.

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal SET 2430 – Algorithmic Design and Data Structures	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology(SET)
Proposed by (include email & phone) Prof. Benito Mendoza bmendoza@citytech.cuny.edu / 718-260-5XXX	Expected date course(s) will be offered Fall 2023 # of students 22

- 2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**

The text book is an open courseware available for free to the students that will be available through blackboard or canvas. There is also a pdf version this book that can be used as reference book.

- 3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**

A search of the CityTech/CUNY library catalog and database with the keyword “data structures” or “data structures and algorithms” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

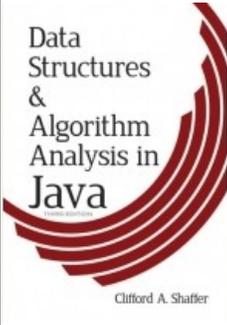
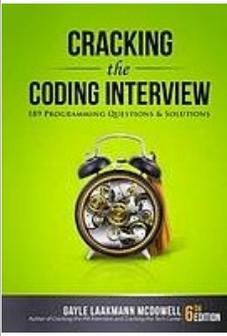
Comments and Recommendations

After surveying the collection, I feel that the library needs updated text and resources to fully support this course. I recommend that the library acquire texts regarding ethics in algorithmic design as well as books on data structures for specific programming languages taught in the course.

09.01.21

Computer Engineering Technology Department
Software Engineering Technology Program
Sample Course Outline

Prepared by	Benito Mendoza	Revision date	New
Course No. & Title	SET 2430 Algorithmic Design and Data Structures		
Course Description	Fundamental algorithmic techniques and ideas for computational problems which arise in practical applications such as sorting and searching data. Common data structures used in various computational problems and typical use cases. Students learn how these data structures are implemented, which helps understand what happens inside a particular built-in implementation and what to expect from it.		
Hours / Credits	2 class hrs, 2 lab hrs / 3 credits		
Pre-requisite	CET1211		
Pre- / Co-requisite	SET2440		
Gen-Ed Objectives	<ul style="list-style-type: none"> • KNOWLEDGE/Depth of knowledge. Engage in an in-depth, focused, and sustained program of study. • KNOWLEDGE/Lifelong learning. Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources. • SKILLS/Inquiry/Analysis. Employ scientific reasoning and logical thinking. • INTEGRATION/Integrate Learning. Resolve difficult issues creatively by employing multiple systems and tools. • VALUES, ETHICS, AND RELATIONSHIPS/Professional/Personal Development. Demonstrate Intellectual honesty and personal responsibility. 		
Course Learning Outcomes	<p>Upon successful completion of this course, the students will be able to:</p> <ul style="list-style-type: none"> • Explain basic concepts related to algorithms and data structures. • Understand how different data structures are used to store and retrieve data. • Understand different methods used to manipulate data structures and examine the 		

	<p>efficiency.</p> <ul style="list-style-type: none"> • Understand basic algorithms such as searching and sorting on different data structures and examine the efficiency. • Understand hashing and its applications. • Explain the basic structure of binary search trees. • Approach open-ended problems by selecting appropriate data structures and designing algorithms based on requirements. 	
Textbook	<p>OpenDSA Data Structure and Algorithms Courseware</p> <p>https://opendsa-server.cs.vt.edu/</p>	
Ref. Text Book	<p>Data Structures and Algorithm Analysis Edition 3.2 (Java Version) by Clifford A. Shaffer</p> <p>ISBN: 9780486485812</p> <p>Available free at:</p> <p>https://people.cs.vt.edu/shaffer/Book/JAVA3elatest.pdf</p>	
Ref. Text Book	<p>Cracking the coding interview: 189 programming questions and solutions. McDowell, G. L. (2021). Palo Alto, CA : CareerCup, LLC.</p>	

Week	Lecture	Lab
1	<p>Introduction: Introduction to the course, syllabus, objectives, how you will be assessed, academic integrity, and policies.</p> <p>Data Structures and Algorithms</p> <ul style="list-style-type: none"> • A Philosophy of Data Structures • The Need for Data Structures • Costs and Benefits • Abstract Data Types and Data Structures 	Lab 1: Testing for Code Coverage
2	<p>Preliminaries</p> <ul style="list-style-type: none"> • Design Patterns • Flyweight • Visitor • Composite • Strategy • Problems, Algorithms, and Programs 	Lab 2: Comparing Records
3	<p>Algorithm Analysis I</p> <ol style="list-style-type: none"> 1. Introduction 2. Best, Worst, and Average Cases 3. A Faster Computer, or a Faster Algorithm? 4. Asymptotic Analysis <ol style="list-style-type: none"> 2.1. Upper Bounds 2.2. Lower Bounds 2.3. Θ Notation 2.4. Simplifying Rules 2.5. Classifying Functions 	Lab 3: Comparing Algorithms
4	<p>Algorithm Analysis II</p> <ol style="list-style-type: none"> 14. Calculating the Running Time for a Program 	Lab 4: Calculating Program Running Time

	<p>15. Analyzing Problems</p> <p>16. Common Misunderstandings</p> <p>17. Multiple Parameters</p> <p>18. Space Bounds</p> <p>19. Speeding Up Your Programs</p> <p>20. Empirical Analysis</p>	
5	<p>Fundamental Data Structures I</p> <p>5. Lists</p> <p>Array-Based List Implementation</p> <p>Linked Lists</p> <p>Comparison of List Implementations</p> <p>Element Implementations</p> <p>Doubly Linked Lists</p>	Lab 5: Comparison of List Implementations
6	<p>Fundamental Data Structures II</p> <ul style="list-style-type: none"> • Stacks <ul style="list-style-type: none"> • Array-Based Stacks • Linked Stacks • Comparison of Array-Based and Linked Stacks • Implementing Recursion • Queues <ul style="list-style-type: none"> • Array-Based Queues • Linked Queues • Comparison of Array-Based and Linked Queues • Dictionaries and Comparators Nested conditional 	Lab 6: Working with Linear Structures
7	<p>Binary Trees</p> <ul style="list-style-type: none"> • Definitions and Properties • Binary Tree Traversals 	Lab 7: Binary Tree Traversals

	<ul style="list-style-type: none"> • Binary Tree Implementations • Binary Search Trees • Heaps and Priority Queues 	
8	Mid-Term Exam	
9	Non-Binary Trees <ul style="list-style-type: none"> • General Tree Definitions and Terminology • The Parent Pointer Implementation • General Tree Implementations 	Lab 8: Sequential Tree Representations
10	Sorting I <ul style="list-style-type: none"> • Sorting Terminology and Notation • Three $\Theta(n^2)$ Sorting Algorithms <ul style="list-style-type: none"> • Insertion Sort • Bubble Sort • Selection Sort 	Lab 9: The Cost of Exchange Sorting
11	Sorting II <ul style="list-style-type: none"> • Shellsort • Mergesort • Quicksort • Heapsort • Binsort and Radix Sort 	Lab 10: An Empirical Comparison of Sorting Algorithms
12	Searching <ul style="list-style-type: none"> • Searching Unsorted and Sorted Arrays • Self-Organizing Lists • Bit Vectors for Representing Sets 	Lab 11: Searching in an Array

13 Hashing <ul style="list-style-type: none"> •Hash Functions •Open Hashing •Closed Hashing •Analysis of Closed Hashing •Deletion 	Lab 12: Collision Resolution
14 Graphs <ul style="list-style-type: none"> •Terminology and Representations •Graph Implementations •Graph Traversals •Shortest-Paths Problems •Minimum-Cost Spanning Trees 	Lab 13: Minimum-Cost Spanning Trees
15 Review	Final Exam

Reading and Reference Materials:

- [1] Harel, D. F. Y. (2014). Algorithmics: The Spirit of Computing. Berlin: Springer.
- [2] Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (2009). Data Structures and algorithms. Reading, Mass. Addison-Wesley.
- [3] Skiena, S. S. (2020). The Algorithm Design Manual. Cham Springer International Publishing
- [4] Chawdhuri, D. R. (2017). Java 9 data structures and algorithms: A step-by-step guide to data structures and algorithms. Birmingham, UK : Packt Publishing
- [5] Goodrich, M. T., & Tamassia, R. (2015). Data structures and algorithms in Java. New York: John Wiley.
- [6] Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2017). Introduction to algorithms. Cambridge, Mass. MIT Press

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:**Grading:**

- Midterm: 20 %
- Final Exam: 20 %
- Quizzes: 15 %
- Labs: 25 %
- Homework Assignments: 20 %

- Total: 100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

- Desktop/laptop can be used for the lab and course project.
- Open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Lab Reports:

- Lab reports must be submitted INDIVIDUALLY.
- All lab reports must be submitted through Blackboard or Content Management System– Assignments section.
- Lab due dates are already pre-established and are due by the end of the date.
- Any late lab report will have a 5% late penalty per day; a submission will not be accepted if it is more than 1 week late.

- Additional requirements regarding lab report's content and format will be posted on Blackboard.

Homework:

- Weekly homework assignments will be posted. Each homework assignment equally contributes to the final grade.
- Homework will be done individually. See Blackboard for detailed instructions.
- All homework must be submitted through Blackboard.
- No late homework submission will be accepted.

Mid Term and Final Exam:

- The Mid-Term exam will cover content from weeks 1 to 7.
- The Final Exam will be cumulative.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor’s goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
KNOWLEDGE/Depth of knowledge. Engage in an in-depth, focused, and sustained program of study.	Students will at minimum, demonstrate knowledge of basic technical terms related to data structures and algorithm design such as those found in a job interview for software engineering positions. This will be demonstrated by quizzes, midterm and final exams, and lab work.
KNOWLEDGE/Lifelong learning. Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources.	Students will learn how to learn or acquire new knowledge and skills demanded by the Tech industry. This will be demonstrated by the lab work and homework assignments.
SKILLS/Inquiry/Analysis. Employ scientific reasoning and logical thinking.	Students will write solutions to complex problems and demonstrate that efficiency of their solutions. This will be demonstrated by the lab work and exams.
<u>INTEGRATION</u> /Integrate Learning. Resolve difficult issues creatively by employing multiple systems and tools.	Students will use creative, scientific, and logical thinking for selecting the data structures and designing algorithms that solve complex problems. This will be demonstrated by the lab work, homework, and exams.

Course Specific Learning Outcomes	Assessment Methods
Explain basic concepts related to algorithms and data structures.	Quizzes and Exams
Understand how different data structures are used to store and retrieve data.	Labs
Understand different methods used to manipulate data structures and examine the efficiency.	Labs and exams
Understand basic algorithms such as searching and sorting on different data structures and examine the efficiency.	Lab, homework
Understand hashing and its applications.	Quizzes, Exams, and Labs
Explain the basic structure of binary search trees.	Homework and Lab
Approach open-ended problems by selecting appropriate data structures and designing algorithms based on requirements.	Homework, Labs

Course Need Assessment

The course will be offered to sophomore or junior students of the Software Engineering Technology Program offered in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

There is no similar course available within CITY TECH; this course is particularly designed for engineers. It brings together the understanding the principles behind efficient algorithm design and the practical skills demanded by the Tech industry. This course considers the common data structures used in various computational problems and introduces the algorithmic design practices that will help engineers be better software designers and tackle the complex problems facing our ever-changing technology and society

Course Design

As mentioned before this course is planned to be a core course. The course will be primarily delivered through three activities:

- Lectures
- Labs/Tutorials
- Homework Assignments

Programmatic course learning outcomes will be assessed through exams, lab/tutorials assignments, homework, and quizzes.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The hands-on sessions include lab exercises, experiments and group projects. The design of this course will allow to teach the course online or in-person.

No additional physical resources are required since students will take the course in one of the computer labs in the CET department. Students just need a computer with Internet connection. The software and development tools used for projects are Open Source or free, including the textbook.

Existing faculty in the CET department is qualified and available to teach this course. Adequate equipment and lab resources are also available for the hands-on component of the course.

References

1. McDowell, G. L. (2021). *Cracking the coding interview: 189 programming questions and solutions..* Palo Alto, CA : CareerCup, LLC
2. Harel, D. F. Y. (2014). *Algorithmics: The Spirit of Computing.* Berlin: Springer.
3. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (2009). *Data Structures and algorithms.* Reading, Mass. Addison-Wesley.
4. Skiena, S. S. (2020). *The Algorithm Design Manual.* Cham Springer International Publishing
5. Chawdhuri, D. R. (2017). *Java 9 data structures and algorithms: A step-by-step guide to data structures and algorithms.* Birmingham, UK : Packt Publishing
6. Goodrich, M. T., & Tamassia, R. (2015). *Data structures and algorithms in Java.* New York: John Wiley.
7. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2017). *Introduction to algorithms.* Cambridge, Mass. MIT Press

New Course Proposal: SET2440 System Programming

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	System Programming
Proposal Date	January 5, 2021
Proposer's Name	Xiaohai Li and Lili Ma
Course Number	SET 2440
Course Credits, Hours	3 credits, 2 class hours and 2 lab hours
Course Pre-Requisites	SET 2340
Course Pre- or co-Requisites	SET 2430
Catalog Course Description	Introduction to the fundamentals of operating systems and system programming in a Linux or Unix system. Topics include system calls, files and directories, file I/O, memory management, process and threads, inter-process communication, signals, exceptions, sockets and networking, shell scripting, etc. All topics are viewed from a UNIX/Linux system programming perspective.
Brief Rationale	This course will be one of the fundamental core courses for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students to the subject of operating systems and system programming.
Provide a concise summary of why this course is important to the department, school or college.	
CUNY – Course Equivalencies	
Provide information about equivalent courses within CUNY, if any.	No
Intent to Submit as Common Core	
If this course is intended to fulfill one of the requirements in the common	No

core, then indicate which area.

For Interdisciplinary Courses:

Not applicable

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course

No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL. Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
14. Discipline Specific	✓
15. General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓
Where does this course overlap with other courses, both within and outside of the	✓

department?

Does the Department currently have full time faculty qualified to teach this course?
If not, then what plans are there to cover this? ✓

If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. NA

Course Design

Describe how this course is designed. ✓

Course Context (e.g. required, elective, capstone) ✓

Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? ✓

Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) ✓

How does this course support Programmatic Learning Outcomes? ✓

Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. ✓

Additional Forms for Specific Course Categories NA

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#)) NA

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	2440		
Course Title	System Programming		
Catalog Description	Introduction to the fundamentals of operating systems and system programming in a Linux or Unix system. Topics include system calls, files and directories, file I/O, memory management, process and threads, inter-process communication, signals, exceptions, sockets and networking, shell scripting, etc. All topics are viewed from a UNIX/Linux system programming perspective.		
Prerequisite	SET 2340		
Corequisite			
Pre- or corequisite	SET 2430		
Credits	3		
Contact Hours	2 Class Hours, 2 Lab Hours		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g. Writing Intensive, etc)			
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

Rationale: This course will be one of the fundamental core courses for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students to the subject of operating systems and system programming.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline**.

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal SET 2440 – System Programming	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology (SET)
Proposed by (include email & phone) Dr. Xiaohai Li xhli@citytech.cuny.edu Dr. Lili Ma lma@citytech.cuny.edu Tel: 718-260-5885	Expected date course(s) will be offered Fall 2023 # of students 22

2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?

As to the proposer’s knowledge, there is no open textbook available for this course, but plenty OER and open-source tech documentations available online which will be used in the class.

3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook,

journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.

A search of the CityTech/CUNY library catalog and database with the keyword “system programming” or “operating systems” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After surveying the library’s collection, I feel that additional materials on the Linux operating system, such as books and films, may be necessary to fully support this course. Since there are several different distributions of Linux, it may be necessary to select those used in course work. There are books on the system in the collection, but I feel it is important to remove older and outdated editions and replace them with more current literature. Based on the course topics, I feel that students would benefit greatly from introductory texts of the OS.

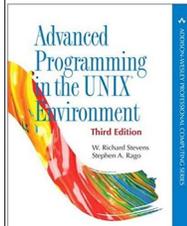
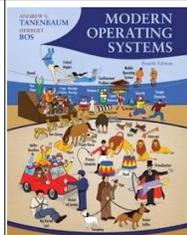
09.01.21

Computer Engineering Technology Department

Computer Engineering Technology Program

Sample Course Outline

Prepared by	Xiaohai Li and Lili Ma	Revision date	05/20/2021
Course No. & Title	SET 2440 System Programming		
Course Description	Introduction to the fundamentals of operating systems and system programming in a Linux or Unix system. Topics include system calls, files and directories, file I/O, memory management, process and threads, inter-process communication, signals, exceptions, sockets and networking, shell scripting, etc. All topics are viewed from a UNIX/Linux system programming perspective.		
Hours / Credits	2 class hrs, 2 lab hrs / 3 credits		
Pre-requisite	SET 2340		
Pre- / Co-requisite	SET 2430		
Gen-Ed Objectives	<p>Acquire discipline-specific knowledge.</p> <p>Gather, interpret and evaluate information from a variety of sources.</p> <p>Have effective reading and written/oral communication skills.</p> <p>Function as an effective team member.</p>		
Course Objectives/ Student Learning Outcomes	Understand operating system's structure and standardization.		

	<p>Be able to create simple Shell script programs on Linux.</p> <p>Be able to use programming, compiling and debugging tools for system programming.</p> <p>Be able to implement, compile, and test a C++ program which uses system calls.</p> <p>Be able to develop a C++ system program portable to another POSIX compliant operating system.</p>	
Textbook	Advanced Programming in the UNIX Environment, 3rd Edition	
Author	W. Richard Stevens, Stephen A. Rago	
Publisher / Year	Addison-Wesley / 2013	
ISBN	ISBN-10 : 0321637739 ISBN-13 : 978-0321637734	
Lab Ref. Book	Modern Operating Systems 4th Edition	

Author	Andrew Tanenbaum, Herbert Bos	
Publisher / Year	Pearson / 2014	
ISBN	ISBN-10 : 013359162X ISBN-13 : 978-0133591620	

Wk	Weekly Topics
1	Introduction to the course; Review of C++ Programming
2	Review of C++ Programming (Contd) Review of Object Oriented Programming Lab: Practice of OOP
3	Introduction to operating systems: history, computer architecture, OS structure, portability and POSIX, introduction to Unix/Linux; Lab: Get started with Linux
4	File systems, directories, permissions; User management; Lab: Introduction to Shell and scripting
5	System calls, system data files Lab: Make, Makefile and CMake
6	Memory management Lab: Allocators hands-on
7	Process and process control Lab: Process control (process creation, process termination, execution)
8	Daemon process Lab: Creating and managing a daemon process
9	Midterm Signals, pipes, coprocesses, and FIFOs.
10	Interprocess communication (semaphore, mutexes, messaging, etc.) Lab: Practice on IPC
11	Threads Lab: Creating a program with multi threads

12	Network IPC and programming: socket Lab: Practice on socket programming
13	I/O: memory mapping, DMA, interrupt; I/O software principle and design Lab: Interrupt-driven device I/O
14	Course project hours
15	Final project demonstration

Reading and Reference Materials:

- Onorato Vaticone, *C++ System Programming Cookbook*, Packt Publishing, 2020, ISBN-10: 1838646558, ISBN-13: 978-1838646554
- Robert Love, *Linux System Programming: Talking Directly to the Kernel and C Library* Second Edition, O'Reilly Media, 2013, ISBN-10: 1449339530 ISBN-13: 978-1449339531
- Kaiwan N Billimoria, *Hands-On System Programming with Linux: Explore Linux system programming interfaces, theory, and practice*, Packt Publishing, 2018, ISBN-10 : 1788998472 ISBN-13 : 978-1788998475
- Rian Quinn, *Hands-On System Programming with C++: Build performant and concurrent Unix and Linux systems with C++17*, Packt Publishing, 2018, ISBN-10 : 1789137888 ISBN-13 : 978-1789137880
- Adam Hoover, *System Programming with C and Unix* 1st Edition, Pearson, 2009, ISBN-10: 0136067123, ISBN-13:978-0136067122
- Randal Bryant and David O'Hallaron, *Computer Systems: A Programmer's Perspective* 3rd Edition, Pearson, March, 2015. ISBN-10 : 013409266X; ISBN-13 : 978-0134092669.
- William Stallings , *Operating Systems: Internals and Design Principles*, Fifth Edition, Prentice Hall ISBN 0-13-147954-7.
- Kay A. Robbins and Steven Robbins, *UNIX Systems Programming: Communication, Concurrency and Threads*, Prentice Hall ISBN 0-13-042411-0
- Additional reading and reference materials will be provided on Blackboard (under *Contents* section) as needed.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:**Grading:**

•Midterm:	20 %
•Final Project:	30 %
•Labs:	20 %
•Homework Assignments:	20 %
•Class Participation:	10 %
•Total:	100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

•Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

- Desktop/laptop or single-board computer can be used for the lab and course project.
- Other open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Lab Reports:

- Lab reports must be submitted INDIVIDUALLY.
- All lab reports must be submitted through Blackboard – Assignments section.
- Each lab report is due one week after the lab work is performed.
- Any late lab report will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.
- Additional requirements regarding lab report's content and format will be posted on Blackboard.

Homework:

- 3~5 assignments will be assigned. Each homework assignment equally contributes to the final grade.
- Homework will be done in a group or individually. See Blackboard for detailed instructions.
- All homework must be submitted through Blackboard.
- Any late homework will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.

Project:

- 2~3 students form a team to propose, develop and finish a project during the semester. The project needs to be approved by the instructor before proceeding.
- Each team needs to submit a midterm project report at the middle of semester. The report should be submitted to Blackboard.
- Final project demonstration/presentation will be done on the last week of the class. All team members in a team need to be present for the demonstration/presentation except emergencies.

Class Participation:

- Attendance and class participation are essential and excessive absences will affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
Acquire discipline specific knowledge.	Students will at minimum, demonstrate knowledge of basic technical terms related to operating systems and system programming such as those found in a job interview in the technology field. This will be demonstrated by homework, labs, midterm and final project presentation.
Have effective reading and written communication skills. Have effective oral communication skills.	Effective reading will be demonstrated by accurate interpretation of reading/reference materials and lab experiments. Effective writing will be demonstrated in lab reports, homework, midterm and project documentation.
Gather, interpret and evaluate information from a variety of sources.	Students will verbally discuss a system program and explain basic concepts to the class. Each group of students will give a brief oral presentation on their project at the end of the semester. Students will also demonstrate their projects at the end of semester.
Be able to work in a team and group while being aware of the ethical and conflict related situations in group dynamics.	Students will work together in groups to design, build and demonstrate/present a system program. Teamwork rubrics will be used for the assessment.

Course Specific Learning Outcomes	Assessment Methods
Understand operating system's structure and standardization.	Analysis of student performance on related questions in homework and midterm.
Be able to create simple Shell script programs on Linux.	Analysis of student performance on homework, lab reports, and midterm.
Be able to use programming, compiling and debugging tools for system programming.	Students will apply proper tools in labs, homework and different stages of the project. Analysis of student performance in hand-on lab experiments, homework, and final demonstration/ presentation of project.
Be able to implement, compile, and test a C++ program which uses system calls.	Analysis of student performance in related lab lab experiments and final project.
Be able to develop a C++ system program portable to another POSIX compliant operating system.	Analysis of student performance in midterm, related labs, project exercises and project demonstration.

Course Need Assessment

The need to offer a course on Systems Programming is presented by the current and leading technologies.

Modern computers are based on NUMA processors (chips with multiple CPUs in the single machine), and leveraging NUMA sometimes entails writing programs with multiple threads running in parallel while sharing memory. NUMA computers have a variety of interesting features that include hardware support for parallelism (such as for image processing, computer vision tasks, machine learning), multiple levels of hardware caching (important for performance), and many styles of synchronization. A capable software engineer needs to have a deep understanding of how "real world" computing systems are built besides developing software for general applications. This requires knowledge on programming in and for an operating system, ie, system programming.

Note that this is really not an operating system course, nor a programming course only. The core intellectual material focuses on challenges and techniques in programming a computer system: sharing resources among programs; preventing malicious/incorrect programs from interfering with other programs; combining two or more programs, coordinating operations of multiple programs; communicating information between programs; etc. We will discuss the best ways of building machine-independent applications that use these technologies.

This *System Programming* course will not only help students understand the inside of a modern operating systems, but prepare them to use the Unix/Linux system as a way to create high quality software. This pair of technologies has gained nearly universal adoption at every level, from small devices hidden within "smart things" to the world's largest cloud computing systems. The skills the student will gain in this course are very broadly relevant, no matter what the students will do in their future career.

Course Design

The course will be offered to the SET BS sophomore students in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The hands-on sessions include lab exercises, experiments and group projects. This course is not designed to be online.

No additional physical resources are required since students will take this course in lieu of existing courses in the CET Department. Adequate equipment and resources in the CET Department are available for the hands-on components (lab experiments and course project) of this course. Several existing CET full-time faculty are qualified and available to teach this course every semester.

New Course Proposal: SET3530 Cloud Computing & Networking

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Cloud Computing and Networking
Proposal Date	December 10, 2020
Proposer's Name	Xiaohai Li and Aparicio Carranza
Course Number	SET 3530
Course Credits, Hours	3 credits, 2 class hours and 2 lab hours
Course Pre/co-Requisites	Prerequisite: SET 2430 Pre/Co-requisite: SET 3510
Catalog Course Description	Introduction to cloud computing and network virtualization. Networking theory and concepts from the perspective of hands-on practices in a cloud-based computing environment. Topics include overview of cloud computing and networking, network protocols, concepts and design, cloud computing service models, cloud deployment models, directory services, dynamic host service and name service, internet data transaction protection, protocol security, routing and remote access service, virtual private network and hybrid cloud. Students use cloud services (AWS, Google Cloud, Microsoft Azure, or IBM Cloud) to conduct case studies.
Brief Rationale	This course will be one of SET Cores for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students to the basics of computer networks and provides a detailed overview of the fundamental cloud computing concepts.
Provide a concise summary of why this course is important to the department, school or college.	

**CUNY – Course
Equivalencies**

No

Provide information about equivalent courses within CUNY, if any.

**Intent to Submit as Common
Core**

No

If this course is intended to fulfill one of the requirements in the common core, then indicate which area.

**For Interdisciplinary
Courses:**

Not applicable

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID? Y/N

**Intent to Submit as a Writing
Intensive Course**

No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	√
• Title, Number, Credits, Hours, Catalog course description	√
• Brief Rationale	√

• CUNY – Course Equivalencies	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
16. Discipline Specific	✓
17. General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓
Where does this course overlap with other courses, both within and outside of the department?	✓
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	✓
If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need.	NA
Course Design	✓

Describe how this course is designed.	
Course Context (e.g. required, elective, capstone)	√
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	√
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	√
How does this course support Programmatic Learning Outcomes?	√
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	√
Additional Forms for Specific Course Categories	NA
Interdisciplinary Form (if applicable)	
Interdisciplinary Committee Recommendation (if applicable and if received)*	
*Recommendation must be received before consideration by full Curriculum Committee	
Common Core (Liberal Arts) Intent to Submit (if applicable)	
Writing Intensive Form if course is intended to be a WIC (under development)	
If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.	
(Additional materials for Curricular Experiments)	NA
Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).	
Established Timeline for Curricular Experiment	

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	3530		
Course Title	Cloud Computing & Networking		
Catalog Description	Introduction to cloud computing and network virtualization. Networking theory and concepts from the perspective of hands-on practices in a cloud-based computing environment. Topics include overview of cloud computing and networking, network protocols, concepts and design, cloud computing service models, cloud deployment models, directory services, dynamic host service and name service, internet data transaction protection, protocol security, routing and remote access service, virtual private network and hybrid cloud. Students use cloud services (AWS, Google Cloud, Microsoft Azure, or IBM Cloud) to conduct case studies.		
Prerequisite	SET2430		
Corequisite			
Pre- or corequisite	SET3510		
Credits	3		
Contact Hours	2 Class Hours, 2 Lab Hours		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g. Writing Intensive, etc)			
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

Rationale: This course will be one of SET Cores for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students to the basics of computer networks and provides a detailed overview of the fundamental cloud computing concepts.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal SET 3530 – Cloud Computing & Networking	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology (SET)
Proposed by (include email & phone) Dr. Xiaohai Li xhli@citytech.cuny.edu 718-260-5885 Dr. Aparicio Carranza ACarranza@citytech.cuny.edu 718-260-5897	Expected date course(s) will be offered Fall 2023 # of students 22

- 2** **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**

As to the proposer's knowledge, there is no open textbook available for this course, but plenty OER and open-source tech documentations available online which will be used in the class.

- 3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**

A search of the CityTech/CUNY library catalog and database with the keyword "cloud computing foundations", "introduction to cloud computing", and "computer networks" shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After surveying the collection, I feel that the library can adequately support this course. Upon course approval, I would recommend acquiring more monographs on cloud networking and server administration in addition to the required texts.

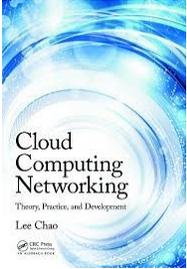
09.01.21

Computer Engineering Technology Department

Computer Engineering Technology Program

Sample Course Outline

Prepared by	Xiaohai Li Aparicio Carranza	Revision date	07/30/2021
Course No. & Title	SET 3530 Cloud Computing & Networking		
Course Description	Introduction to cloud computing and network virtualization. Networking theory and concepts from the perspective of hands-on practices in a cloud-based computing environment. Topics include overview of cloud computing and networking, network protocols, concepts and design, cloud computing service models, cloud deployment models, directory services, dynamic host service and name service, internet data transaction protection, protocol security, routing and remote access service, virtual private network and hybrid cloud. Students use cloud services (AWS, Google Cloud, Microsoft Azure, or IBM Cloud) to conduct case studies.		
Hours / Credits	2 class hrs, 2 lab hrs / 3 credits		
Pre-requisite	SET 2430		
Pre- / Co-requisite	SET 3510		
Gen-Ed Objectives	<p>Acquire discipline-specific knowledge.</p> <p>Gather, interpret and evaluate information from a variety of sources.</p> <p>Have effective reading and written/oral communication skills.</p> <p>Function as an effective team member.</p>		
Course Objectives/ Student Learning	Recognize and use technical terms in the field of cloud computing.		

Outcomes	<p>Understand networks' role in a cloud-based IT infrastructure; understand how networks are used to construct cloud services.</p> <p>Be able to get a quick start in deploying cloud services.</p> <p>Be able to develop a fully functioning cloud-based IT infrastructure.</p> <p>Be able to describe security compliance and understand different types of security credentials.</p>	
Textbook	<p>Cloud Computing Networking: Theory, Practice, and Development</p>	
Author	Lee Chao	
Publisher / Year	CRC Press: Taylor & Francis Group / 2015	
ISBN	978-1-4822-5482-2 (eBook - PDF)	
Lab Ref. Book		
Author		
Publisher / Year		
ISBN		

Wk	<i>Weekly Lecture Topics</i>	<i>Weekly Lab/Activities</i>
1	Overview on Cloud and Networking	Preparing for Hands-On Activities
2 - 4	Network Protocols Network Concepts and Design	* Exploring Windows Server * Viewing IP Configuration in the Command Prompt Window * Viewing Protocols with Network Monitor * Implementing Simple Network
5	Network Directory Services	Active Directory Domain Services
6	Dynamic Host Service and Name Service	Network Services
7	Mid Term Exam	
8	Networking with Windows Powershell	Using Microsoft Azure PowerShell
9	Internet Data Transaction Protection	Certificate Services
10	Internet Protocol Security	* IPsec Implementation with IP Security Policy * IPsec Implementation with Windows Firewall with Advanced Security
11	Routing and Remote Access Service	* Routing * NAT
12	Virtual Private Network	* Point-to-Site Connection between Local Computer and Microsoft Azure * Site-to-Site Connection between Microsoft Azure and On-Premises Network
13	Hybrid Cloud	* Developing Hybrid Cloud with System Center
14	Final Exam	

15	Final Project	
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Reading and Reference Materials:

- Additional reading and reference materials will be provided on Blackboard (under *Contents* section) as needed.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:

Grading:

- Midterm: 20 %
- Final Project: 30 %
- Labs: 20 %
- Homework Assignments: 20 %
- Class Participation: 10 %

- Total: 100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

- Desktop/laptop or single-board computer can be used for the lab and course project.
- Other open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Lab Reports:

- Lab reports must be submitted INDIVIDUALLY.
- All lab reports must be submitted through Blackboard – Assignments section.
- Each lab report is due one week after the lab work is performed.
- Any late lab report will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.
- Additional requirements regarding lab report's content and format will be posted on Blackboard.

Homework:

- 3~5 assignments will be assigned. Each homework assignment equally contributes to the final grade.
- Homework will be done in a group or individually. See Blackboard for detailed instructions.
- All homework must be submitted through Blackboard.
- Any late homework will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.

Project:

- 2~3 students form a team to finish a project during the semester.
- The project needs to be approved by the instructor before proceeding.
- Each team needs to submit a midterm project report at the middle of semester. The report should be submitted to Blackboard.
- Final project demonstration/presentation will be done on the last week of the class. All team members in a team need to be present for the demonstration/presentation except emergencies.

Class Participation:

- Attendance and class participation are essential and excessive absences will affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
Demonstrate acquisition of discipline specific knowledge.	Students will demonstrate knowledge of basic technical terms relating to cloud computing and networking. Students who excel will be able to use logic and reasoning to find answers to new questions. These will be demonstrated by homework, labs, midterm and final project.
Demonstrate effective reading, written and oral communication skills.	Effective reading will be demonstrated by accurate interpretation of reading assignments and lab experiments. Effective writing will be demonstrated in homework and lab reports. Oral communication skills will be demonstrated in the final project presentation.
Gather, interpret, evaluate information from a variety of sources.	Students will propose, design and develop a cloud computing project for a certain application. They need to gather, interpret, and evaluate obtained information for their use. These will be assessed by the project presentation and final project report.
Demonstrate to function as an effective team member.	Students will work together in groups to design and build a course project. The working system will be built in stages and the functionality of each stage will be demonstrated in labs. Teamwork rubrics will be used for the assessment.

Course Specific Learning Outcomes	Assessment Methods
Recognize and use technical terms in the field of cloud computing	Analysis of student performance on questions in midterm, use of the terms in homework, lab reports and final project presentation.
Understand networks' role in a cloud-based IT infrastructure; understand how networks are used to construct cloud services	Analysis of student performance on homework, related questions in midterm and related lab experiments.
Be able to get a quick start in deploying cloud services	Analysis of student performance in hand-on lab experiments and preparation of lab reports.
Be able to develop a fully functioning cloud-based IT infrastructure	Analysis of student performance in lab experiments and final project.
Be able to describe security compliance and understand different types of security credentials	Analysis of student's related homework and lab reports; analysis of student performance on related questions in midterm.

Course Need Assessment

The need to offer a course on Cloud Computing is presented by the current and leading technologies. Cloud and cloud applications have become an integral and critical component in numerous industrial, military and civilian application areas, such as virtual video conferencing (Zoom, Webex, Google Meet) etc. Many of these application are built and operate on a cloud.

In this course, students will learn fundamental concepts and terms of cloud computing. It directly supports one of the program educational objectives, which states that graduates of the SET BS program are expected to be employed, as software engineer or the equivalent, in positions beyond the entry-level for which this program has prepared them.

This course has no overlap with any other courses offered in the CET Department. According to the current College Catalog, this course also does not overlap with any course offered in any other departments at City Tech.

Course Design

The course will be offered to the SET BS students in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The hands-on sessions include lab exercises, experiments and group projects. This course is not designed to be online.

Besides access to a cloud service, no physical resources are required since students will take this course in lieu of existing courses in the CET Department. Adequate equipment in the CET Department are available for the hands-on components (lab experiments and course project) of this course. Several existing CET full-time faculty are qualified and available to teach this course every semester.

References

- [1] Google Cloud Computing Foundations, <https://cloud.google.com/edu/curriculum>
- [2] AWS Academy Cloud Foundations, <https://aws.amazon.com/training/awsacademy/>
- [2] Tamer Nadeem, CMSC 491–Introduction to Cloud Computing, School of Engineering, Virginia Commonwealth University.

New Course Proposal: SET3630 Cybersecurity Foundations

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Cybersecurity Foundations
Proposal Date	August 16, 2021
Proposer's Name	Aparicio Carranza
Course Number	SET 3630
Course Credits, Hours	3 credits, 2 class hours and 2 lab hours
	Pre: SET3530
Course Pre/co-Requisites	Pre/Co: SET3610

Catalog Course Description

Concepts, skills, and tools needed to survive and thrive in today's threat-ridden and target-rich cyber environment. A focus on practical, useful real-world skills for the protection of networks, systems and data against innovative cyber threats. Cyber network security concepts will be presented first, followed by cyber network security hands-on and culminating with cyber network application domains.

Brief Rationale

Provide a concise summary of why this course is important to the department, school or college.

This course will be one of SET Cores for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students the Cyber Network Security Concepts, Hand-On and the Application Domain.

CUNY – Course Equivalencies

Provide information about equivalent courses within CUNY, if any.

No

Intent to Submit as Common Core

If this course is intended to fulfill one

No

of the requirements in the common core, then indicate which area.

For Interdisciplinary Courses: Not applicable

Date submitted to ID Committee for review

Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course Yes

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
<ul style="list-style-type: none"> Discipline Specific General Education Specific Learning Outcome and Assessment Tables 	✓
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓

Where does this course overlap with other courses, both within and outside of the department? ✓

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? ✓

If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. NA

Course Design

Describe how this course is designed. ✓

Course Context (e.g. required, elective, capstone) ✓

Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? ✓

Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) ✓

How does this course support Programmatic Learning Outcomes? ✓

Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. ✓

Additional Forms for Specific Course Categories

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#))

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	3630		
Course Title	Clybersecurity Foundations		
Catalog Description	Concepts, skills, and tools needed to survive and thrive in today's threat-ridden and target-rich cyber environment. A focus on practical, useful real-world skills for the protection of networks, systems and data against innovative cyber threats. Cyber network security concepts will be presented first, followed by cyber network security hands-on and culminating with cyber network application domains.		
Prerequisite	SET3530		
Corequisite	SET3610		
Pre- or corequisite			
Credits	3		
Contact Hours	2 Class Hours, 2 Lab Hours		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g. Writing Intensive, etc)	Writing Intensive		
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

Rationale: This course will be one of SET Cores for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students the Cyber Network Security Concepts, Hand-On and the Application Domain.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1	Title of proposal	Department/Program
	SET 3630 – Cybersecurity Foundations	Computer Engineering Technology (CET) / BS in Software Engineering Technology (SET)
	Proposed by (include email & phone)	Expected date course(s) will be offered
	Dr. Aparicio Carranza ACarranza@citytech.cuny.edu 718-260-5897	Fall 2023 # of students 22

2	<p>The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (http://cityte.ch/curriculum) for articles and ebooks for your courses, or our open educational resources (OER) guide (http://cityte.ch/oer). Have you considered using a freely-available OER or an open textbook in this course?</p> <p>As to the proposer's knowledge, there is no open textbook available for this course, but plenty OER and open-source tech documentations available online which will be used in the class.</p>
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3	<p>Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.</p>
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A search of the CityTech/CUNY library catalog and database with the keyword “cyber security”, “introduction to network security” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After surveying the collection, I feel that the library does not have the resources to adequately support this course. I feel it is imperative that the library update its collection on cyber security and computer security in general.

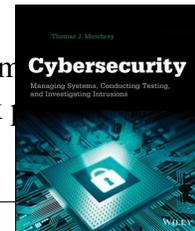
09.14.2021

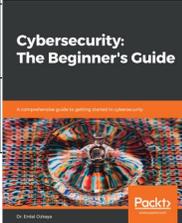
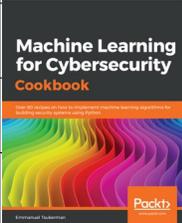
Computer Engineering Technology Department

Computer Engineering Technology Program

Sample Course Outline

Prepared by	Aparicio Carranza	Revision date	
Course No. & Title	SET 3630 Cybersecurity Foundations		
Course Description	<p>Concepts, skills, and tools needed to survive and thrive in today's threat-ridden and target-rich cyber environment. A focus on practical, useful real-world skills for the protection of networks, systems and data against innovative cyber threats. Cyber network security concepts will be presented first, followed by cyber network security hands-on and culminating with cyber network application domains.</p>		
Hours / Credits	2 class hrs, 2 lab hrs / 3 credits		
Pre-requisite	SET3530		
Pre- / Co-requisite			
Gen-Ed Objectives	<p>Acquire discipline-specific knowledge.</p> <p>Gather, interpret and evaluate information from a variety of sources.</p> <p>Have effective reading and written/oral communication skills.</p> <p>Function as an effective team member.</p>		
Course Objectives/ Student Learning Outcomes	<p>Overview the Cybersecurity domain and some of its key challenges.</p> <p>Review networking essentials and network security program practical skills in network administration, explain network and vulnerability testing.</p>		



	Describe several important security application domains, such as small businesses, data centers, and healthcare IT. Become proficient on hands-on exercises with online software resources	
Textbook	Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions	
Author	Thomas J. Mowbray	
Publisher / Year	John Wiley & Sons, 2014	
ISBN	978-1-118-69711-5	
Reference Book 1	Cybersecurity – The Beginners Guide	
Author	Erdal Ozkaya	
Publisher / Year	Packt Publishing, 2019	
ISBN	978-1-78961-619-4	
Reference Book 2	Machine Learning for Cybersecurity	
Author	Emmanuel Tsukerman	
Publisher / Year	Packt Publishing, 2019	
ISBN	978-1-78961-467-1	

Wk	<i>Weekly Lecture Topics</i>	<i>Weekly Lab</i>
1	Executive Summary	Refactored Solution: Security Training Roadmap
2	The Problems: Cyber Antipatterns	Virtual Laboratory Implementation
3	Enterprise Security Using the Zachman Framework	Virtual Laboratory Implementation
4	Network Administration for Security Professionals	Network Administration Knowledge Base
5	Customizing Security Tools	Security Tools Familiarization
6	Protocol Analysis and Network Programming	Network Programming Tasks
7	Mid Term Exam	
8	Reconnaissance, Vulnerability Assessment, and Cyber Testing	Understanding the Cybersecurity Testing Methodology
9	Penetration Testing	Testing Methodologies
10	Cyber Network Defense Using Advanced Log Analysis	Investigations, Analysis and Reporting
11	Cybersecurity for End Users, Social Media, and Virtual Worlds	Understanding the Virtual World
12	Cybersecurity Essentials for Small Business	Education to the End Users
13	Healthcare Information Technology Security	Authentication and Access Control
14	Cyber Warfare: An Architecture for Deterrence	Final Project
15	Final Exam	Final Project

Reading and Reference Materials:

- Erdal Ozkaya, *Cybersecurity – The Beginners Guide*, 2019, Packt Publishing, ISBN 978-1-78961-619-4
- Emmanuel Tsukerman, *Machine Learning for Cybersecurity*, 2019, Packt Publishing, ISBN 978-1-78961-467-1
- Additional reading and reference materials will be provided on Blackboard (under *Contents* section) as needed.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:**Grading:**

- Midterm: 25 %
- Final Project: 35 %
- Labs: 20 %
- Homework Assignments: 20 %
- Total: 100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.
- **Hardware and Software for Lab/Project:**
- Desktop/laptop or single-board computer can be used for the lab and course project.

- Other open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

-

Lab Reports:

- Lab reports must be submitted INDIVIDUALLY.
- All lab reports must be submitted through Blackboard – Assignments section.
- Each lab report is due one week after the lab work is performed.
- Any late lab report will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.
- Additional requirements regarding lab report's content and format will be posted on Blackboard.

-

Homework:

- 3~5 assignments will be assigned. Each homework assignment equally contributes to the final grade.
- Homework will be done in a group or individually. See Blackboard for detailed instructions.
- All homework must be submitted through Blackboard.
- Any late homework will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.

Project:

- 2~3 students form a team to finish a project during the semester.
- The project needs to be approved by the instructor before proceeding.
- Each team needs to submit a midterm project report at the middle of semester. The report should be submitted to Blackboard.
- Final project demonstration/presentation will be done on the last week of the class. All team members in a team need to be present for the demonstration/presentation except emergencies.

Class Participation:

Attendance and class participation are essential and excessive absences may affect the final grade.

Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

1. Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
2. Any activity that threatens the college academic integrity will result in a disciplinary action.
3. Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

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Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
Acquire discipline specific knowledge.	Students will demonstrate knowledge of basic technical terms related to Cybersecurity such as those found in a job interview in the technology field. Students who excel will be able to use logic and reasoning to find answers to new questions. This will be demonstrated by homework, midterm and final project presentation.
Have effective reading and written communication skills. Have effective oral communication skills.	Effective reading will be demonstrated by accurate interpretation of reading/reference materials and lab procedures.
Gather, interpret and evaluate information from a variety of sources.	Students will verbally discuss about cybersecurity and explain basic concepts to the class. Each group of students will give a brief oral presentation on their project at the end of the semester.
Be able to work in a team and group while being aware of the ethical and conflict related situations in group dynamics.	Students will work in groups to design, build and demonstrate/present cybersecurity techniques as solutions.
Recognize and use technical terms in the field of embedded systems and embedded operating systems.	Analysis of student performance on lab reports, homework, midterm and final project presentation
Acquire skills to work with Kali Linux embedded tools	Analysis of student performance in hand-on lab experiments, lab reports, midterm and final project.

Course Need Assessment

The need to offer a course on Cybersecurity is presented by the current and leading technologies. Security Tools, Protocol Analysis, Reconnaissance, Vulnerability Assessment and Cyber Testing, have become an integral and critical component in numerous industrial, military and civilian application areas.

In this course, students will learn fundamental concepts and terms of cybersecurity, penetration testing and analysis. It directly supports one of the program educational objectives, which states that graduates of the SET BS program are expected to be employed, as software engineer or the equivalent, in positions beyond the entry-level for which this program has prepared them.

This course has no overlap with any other courses offered in the CET Department. According to the current College Catalog, this course also does not overlap with any course offered in any other departments at City Tech.

Course Design

The course will be offered to the SET BS junior or senior students in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The hands-on sessions include lab exercises, experiments and group projects. This course is not designed to be online.

Besides access to a cloud service, no physical resources are required since students will take this course in lieu of existing courses in the CET Department. Adequate equipment in the CET Department are available for the hands-on components (lab experiments and course project) of this course. Several existing CET full-time faculty are qualified and available to teach this course every semester.

References

- [1] Erdal Ozkaya, *Cybersecurity – The Beginners Guide*, 2019, Packt Publishing,
- [2] Emmanuel Tsukerman, *Machine Learning for Cybersecurity*, 2019, Packt Publishing,
- [3] Digital Forensics Research Workshop (DFRWS) standards (2018), <http://www.dfrws.org>
- [4] Scientific Working Group on Digital Evidence (SWGDE) (2018), <http://www.swgde.org>

New Course Proposal: SET3510 Software Requirements Engineering

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the Curriculum Modification Proposal Form and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Software Requirements Engineering
Proposal Date	08/18/2021
Proposer's Name	José M. Reyes Álamo
Course Number	SET 3510
Course Credits, Hours	3 credits, 3 hours
Course Pre / Co-Requisites	Pre: SET2430, MAT1475 or higher Pre/Co: SET3530
Catalog Course Description	An important step in the software development life cycle (SDLC). Topics include the requirements process, identifying stakeholders and goals, modeling of the current system, proposing solutions, eliciting functional and non-functional requirements.
Brief Rationale	<p>Provide a concise summary of why this course is important to the department, school or college.</p> <p>This course is a necessary component for the new BS in Software Engineering Technology degree program and it will be part of the core of the new program.</p>
CUNY – Course Equivalencies	No
Provide information about equivalent courses within CUNY, if any.	
Intent to Submit as Common Core	No
If this course is intended to fulfill one of the requirements in the common core, then indicate which area.	
For Interdisciplinary Courses:	No

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID? Y/N

Intent to Submit as a Writing Intensive Course No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM

- Title, Number, Credits, Hours, Catalog course description Y
- Brief Rationale Y
- CUNY – Course Equivalencies Y

Completed Library Resources and Information Literacy Form Y

Course Outline

Include within the outline the following.

Hours and Credits for Lecture and Labs Y

If hours exceed mandated Carnegie Hours, then rationale for this

Prerequisites/Co- requisites

Detailed Course Description Y

Course Specific Learning Outcome and Assessment Tables

- Discipline Specific Y
- General Education Specific Learning Outcome and Assessment Tables

Example Weekly Course outline Y

Grade Policy and Procedure Y

Recommended Instructional Materials (Textbooks, lab supplies, etc) Y

Library resources and bibliography Y

Course Need Assessment.

Describe the need for this course. Include in your statement the following information.

Target Students who will take this course. Which programs or departments, and how many anticipated? Y

Documentation of student views (if applicable, e.g. non-required elective).

Projected headcounts (fall/spring and day/evening) for each new or modified course. Y

If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction. N

Where does this course overlap with other courses, both within and outside of the department? N

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? Y

If needs assessment states that this course is required by an accrediting body, then N/A

provide documentation indicating that need.

Course Design

Describe how this course is designed.

Course Context (e.g. required, elective, capstone)	Y
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	Y
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	Y
How does this course support Programmatic Learning Outcomes?	Y
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	Y

Additional Forms for Specific Course Categories

N/A

Interdisciplinary Form (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

Common Core (Liberal Arts) Intent to Submit (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for Curricular Experiments)

N/A

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

CHANCELLOR'S REPORT SECTION AIV: NEW COURSES

CUNYfirst Course ID	
Department(s)	Computer Engineering Technology
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Computer Engineering Technology
Course Prefix	SET
Course Number	3510
Course Title	Software Requirements Engineering
Catalogue Description	An important step in the software development life cycle (SDLC). Topics include the requirements process, identifying stakeholders and goals, modeling of the current system, proposing solutions, eliciting functional and non-functional requirements.
Pre/ Co Requisites	Pre: SET2430, MAT1475 or higher Pre/Co: SET3530
Credits	3
Contact Hours	3 hours
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, Honors, etc)	N/A
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures College Option Detail _____ <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World
Effective Term	TBA

Rationale:

Software requirements analysis is one of the essential component in SDLC (software development life cycle). This course is one of the SET core courses for the proposed SET BS program.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. **Library faculty subject specialist:** please complete box 5.

1	Title of proposal SET 3510: Software Requirements Engineering	Department/Program Computer Engineering Technology/BS in Software Engineering Technology
	Proposed by (include email & phone) José M. Reyes Álamo Email: jreyesalamo@citytech.cuny.edu Phone: 718-260-5036	Expected date course(s) will be offered Fall 2023 # of students 22

2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?

Yes

3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.

Yes

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching the course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist _____ Junior Tidal**

Comments and Recommendations

I feel that the library's collection is inadequate to support this course. I believe that more monographs and research materials related to software development, in addition to the required texts, are needed.

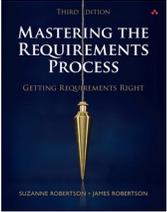
Date 09.21.21

Computer Engineering Technology Department

Software Engineering Technology Program

Sample Course Outline

Prepared by	José M. Reyes Álamo	Revision date	
Course No. & Title	SET 3510: Software Requirements Engineering		
Course Description	An important step in the software development life cycle (SDLC). Topics include the requirements process, identifying stakeholders and goals, modeling of the current system, proposing solutions, eliciting functional and non-functional requirements.		
Hours / Credits	3 class hrs, 3 credits		
Pre-requisite	SET2430, MAT1475 or higher		
Pre- / Co-requisite	SET3530		
Gen-Ed Objectives	<p>SKILLS/Communication/Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means, and in more than one language.</p> <p>SKILLS/Inquiry & Analysis/Derive meaning from experience, as well as gather information from observation.</p> <p>INTEGRATION/Information Literacies/Gather, interpret, evaluate, and apply information discerningly from a variety of sources</p> <p>INTEGRATION/Integrate Learning/Resolve difficult issues creatively by employing multiple systems and tools.</p>		
Course Objectives/ Student Learning Outcomes	<p>Learn the importance of software requirement in the software development cycle</p> <p>Learn to create models of system and processes</p> <p>Elicit functional requirements</p> <p>Elicit non-functional requirement</p> <p>Elicit the software requirements of a system based on observation of</p>		

	current processes and suggest improvements	
Textbook	Mastering the Requirements Process: Getting Requirements Right, 3rd Edition	
Author	Suzanne Robertson, James Robertson	
Publisher / Year	Addison-Wesley Professional/ 2013	
ISBN	ISBN-13: 9780132942843	

Weekly Topics:

Week	Topic	Chapter	Lab/Assignment/Deliverable
1	Requirement definition and the requirements process	1/2	Lab 1 – Study the Project Template in Chapter 2 and provide project ideas and motivation
2	Scope, Stakeholders and Goals	3	
3	Business Use Cases	4	Lab 2 – Decide the topic/project you will work on
4	Investigating the Work	5	Lab 3 – Provide a rough model of the current system
5	Scenarios	6	
6	Understanding the real problem	7	Continue filling the Project Template with the new material learned as it will be used as the basis for your final report
7	Midterm Exam		
8	Starting the solution	8	Lab 4 – Provide ideas to solve the problem based on the

			previous analysis
9	Strategies	9	
10	Functional Requirements	10	Lab 5 – Provide a list of functional requirements
11	Non-Functional Requirements	11	Lab 6 - Provide a list of non-functional requirements
12	Fit Criteria and Rationale	12	Work on your presentation
13	The Quality Gateway	13	
14	Requirements and Iterative Development/Projects Presentations	14	Project Presentation
15	Final Exam		Project Report Due

Reading and Reference Materials:

- The textbook and any material provided by the instructor.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:

Grading:

- Midterm Exam: 20%
- Project: 30%
- Labs/Homework: 25%
- Final Exam 25%
- Total: 100%

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Homework and Project:

- A Windows or Mac desktop or laptop computer can be used for the homework and course project.
- You must be able to install software in the computer you will use.
- It is expected that the student is familiar and well-versed in computer programming.

Grading Criteria:

- Homework/Labs:** Homework/Labs assignment will consist of problems where the students will have to solve using the different techniques and strategies learned in class. Each homework assignment contributes proportionally to the final homework grade. Homework may be in group or individually. Late homework may not be accepted. If accepted a points deduction may be imposed at the discretion of the instructor.
- Midterm Exam:** A midterm exams will be administered to test the knowledge acquired up to the middle of the semester. Students are required to take exam the day and time it is scheduled. There is no make-up exam unless you have a valid reason according to CityTech's policy.
- Final Exam:** A comprehensive/cumulative final exam will be administered at the end of the semester. Students are required to take the exam the day and time scheduled. There is no make-up exam unless you have a valid reason according to CityTech's policy.

Project:

- Students will work in teams of 3-5 members to develop a project. The teams will prepare a proposal that will have to be approved by the instructor. Students must incorporate the material learned in class into their projects and provide reports as requested by the instructor. A final project presentation will be done towards the end of the semester.

Delivery Method (In-Person/Online):

- This course delivery can be either online or in-person. The content of this course as well as the deliverables does not require a physical laboratory setup. Therefore, this course is designed to be offered in a classroom setting if space is available, and circumstances permit but can also be offered completely online.

Class Participation:

Attendance and class participation are essential and excessive absences may affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

- Students must show respect to each other and to the professor. Students may not interrupt the class. Students must follow instructions from the instructor. The use of smartphones, cameras, and other electronic devices during class is prohibited. Please put devices away and on silent mode or turn them off. The use of the computers and the Internet is solely for work related to the class.

Academic Integrity Policy:

- Students and other individuals who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Academic dishonesty is prohibited in The

City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
SKILLS/Communication/Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means, and in more than one language.	Project Presentation
SKILLS/Inquiry & Analysis/Derive meaning from experience, as well as gather information from observation.	Lab 5
INTEGRATION/Information Literacies/Gather, interpret, evaluate, and apply information discerningly from a variety of sources	Lab 6
INTEGRATION/Integrate Learning/Resolve difficult issues creatively by employing multiple systems and tools.	Project Report

Course Specific Learning Outcomes	Assessment Methods
Learn the importance of software requirement in the software development cycle	Lab 1
Learn to create models of system and processes	Lab 3
Elicit functional requirements	Lab 5
Elicit non-functional requirement	Lab 6
Elicit the software requirements of a system based on observation of current processes and suggest improvements	Project Report

Rationale

The Department of Computer Engineering Technology is proposing a new Bachelor of Science in Software Engineering Technology. This new program will fill the gap at City Tech and CUNY by offering students this important field of study that has become one of the most pursued by students with interest in a career in technology.

Software Requirements is one of the fundamental aspects of software. Teaching concepts in software requirement is of paramount importance in this area of study. This course will teach students what are software requirements, how to identify stakeholder, different ways of modelling a system, as well as different methods to elicit software requirements.

There is currently no similar course in software requirements engineering offered at City Tech. The purpose of this proposal is to fill that gap and have a course that will cover this material.

Course NEED Assessment

This course will be a core course for the new Bachelor of Science in Software Engineering Technology proposed by the Department of Computer Engineering Technology. Students will be required to take this course as part of their program.

The expectation for this course is that each section will have capacity for 22 students. The course will be offered in both Spring and Fall semesters every academic year.

As this course is heavily software based, we do not anticipate an additional need for physical resources other than a regular PC. Adequate equipment and resources in the CET Department are available for the completion of the course work such as labs and assignments.

There are at least three existing CET full-time faculty with the expertise to teach this course who are available to every semester.

This course has no overlap with any other courses offered in the CET Department or courses offered in other departments.

Course Design

This course will be a core course in the new Bachelor of Science in Software Engineering Technology degree program proposed by the Department of Computer Engineering Technology.

The course is structured as a combination of lecture sessions and assignments/labs embedded in each lesson. The lecture focuses on the theory and principles of software architecture and the assignments and will serve as practices and application of the principles learned. The course will also have a midterm partial exam and a final cumulative exam to test students' knowledge and understanding. A team project will also be required where students will apply the concepts learned in a comprehensive way.

To support the learning and general education outcomes this course requires satisfactory completion of individual assignments, labs, the exams, and the final team project.

This course is designed to be taught online or in a classroom if there is space available.

New Course Proposal: SET3610 Software Architecture & Design

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](#) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

Title of Proposal Proposal for a new course: SET 3610: Software Architecture and Design

Date 08/20/2021

Major or Minor Major

Proposer's Name José M. Reyes Álamo

Department Computer Engineering Technology

Date of Departmental Meeting in which proposal was approved 09/09/2021

Department Chair Name Sunghoon Jang

Department Chair Signature and Date

Academic Dean Name Gerarda M. Shields

Academic Dean Signature and Date

Brief Description of Proposal

(Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body.)

The CET Department proposes a new BS in Software Engineering Technology program. This course is one of the SET core courses.

Brief Rationale for Proposal

(Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body.)

Software Architecture and Design is one of the fundamental aspects of SDLC and software technology. This course does not exist, and its creation is necessary.

Proposal History

This is a new proposal.

(Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list).

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

ALL PROPOSAL CHECK LIST

Completed CURRICULUM MODIFICATION FORM including:

- | | |
|--|---|
| 4. Brief description of proposal | Y |
| 5. Rationale for proposal | Y |
| 6. Date of department meeting approving the modification | |
| 7. Chair's Signature | |
| 8. Dean's Signature | |

Evidence of consultation with affected departments

List of the programs that use this course as required or elective, and courses that use this as a prerequisite.

Documentation of Advisory Commission views (if applicable).

Completed [Chancellor's Report Form](#). Y

EXISTING PROGRAM MODIFICATION PROPOSALS

Documentation indicating core curriculum requirements have been met for new programs/options or program changes.

Detailed rationale for each modification (this includes minor modifications)

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title Software Architecture and Design

Proposal Date 08/20/2021

Proposer's Name José M. Reyes Álamo

Course Number SET 3610

Course Credits, Hours 3 credits, 3 hours

Course Pre / Co-Requisites Pre: SET 3510, MAT1475 or higher

Pre/Co: SET 3630

Catalog Course Description Identification, analysis and evaluation of different architectural styles for software , including object-oriented and component-based. Students design software to meet criteria such as safety, security, performance, and reliability.

Brief Rationale

Provide a concise summary of why this course is important to the department, school or college.

Software architecture and design is one of the fundamental aspects in SDLC. This course does not exist, and its creation is necessary for the new program.

CUNY – Course Equivalencies No

Provide information about equivalent courses within CUNY, if any.

Intent to Submit as Common Core No

If this course is intended to fulfill one of the requirements in the common core, then indicate which area.

For Interdisciplinary Courses: No

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL. Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	
• Title, Number, Credits, Hours, Catalog course description	Y
• Brief Rationale	Y
• CUNY – Course Equivalencies	Y
Completed Library Resources and Information Literacy Form	Y
Course Outline	
Include within the outline the following.	
Hours and Credits for Lecture and Labs	Y
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	
Detailed Course Description	Y
Course Specific Learning Outcome and Assessment Tables	
•Discipline Specific	Y
•General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	Y
Grade Policy and Procedure	Y
Recommended Instructional Materials (Textbooks, lab supplies, etc)	Y
Library resources and bibliography	Y
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	
Target Students who will take this course. Which programs or departments, and how many anticipated?	Y
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	Y
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	N
Where does this course overlap with other courses, both within and outside of the department?	N
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	Y
If needs assessment states that this course is required by an accrediting body, then	N/A

provide documentation indicating that need.

Course Design

Describe how this course is designed.

Course Context (e.g. required, elective, capstone)	Y
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	Y
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	Y
How does this course support Programmatic Learning Outcomes?	Y
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	Y

Additional Forms for Specific Course Categories

N/A

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for Curricular Experiments)

N/A

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

CHANCELLOR'S REPORT SECTION AIV: NEW COURSES

CUNYfirst Course ID	
Department(s)	Computer Engineering Technology
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Computer Engineering Technology
Course Prefix	SET
Course Number	3610
Course Title	Software Architecture and Design
Catalogue Description	Identification, analysis and evaluation of different architectural styles for software , including object-oriented and component-based. Students design software to meet criteria such as safety, security, performance, and reliability.
Pre/ Co Requisites	Pre: SET 3510, MAT1475 or higher Pre/Co: SET 3630
Credits	3
Contact Hours	3 hours
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, Honors, etc)	N/A
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures College Option Detail <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World
Effective Term	TBA

Rationale: Software architecture and design is one of the fundamental aspects in Software Development Life Cycle (SDLC). This is one of the SET core courses for the SET BS program.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. **Library faculty subject specialist:** please complete box 5.

1	Title of proposal SET 3610 – Software Architecture and Design	Department/Program Computer Engineering Technology/B.S. In Software Engineering Technology
	Proposed by (include email & phone) José M. Reyes Álamo Email: jreyesalamo@citytech.cuny.edu Phone: 718-260-5036	Expected date course(s) will be offered Fall 2023 # of students 22

2	<p>The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (http://cityte.ch/curriculum) for articles and ebooks for your courses, or our open educational resources (OER) guide (http://cityte.ch/oer). Have you considered using a freely-available OER or an open textbook in this course?</p> <p>Yes</p>
----------	--

3	<p>Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.</p>
----------	--

Yes

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching the course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist _____ Junior Tidal _____**

Comments and Recommendations

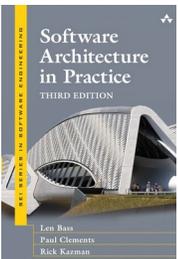
I believe that the library's collection is inadequate to fully support this course. I feel that the collection requires more texts on team-based software development, as well as other materials related to group collaboration (documenting processes, testing, project development, etc.).

Date 09.21.21

Computer Engineering Technology Department

Software Engineering Technology Program

Sample Course Outline

Prepared by	José M. Reyes Álamo	Revision date	
Course No. & Title	SET 3610 – Software Architecture and Design		
Course Description	Identification, analysis and evaluation of different architectural styles for software , including object-oriented and component-based. Students design software to meet criteria such as safety, security, performance, and reliability.		
Hours / Credits	3 class hrs, 3 credits		
Pre-requisite	SET 3510, MAT1475 or higher		
Pre- / Co-requisite	SET 3630		
Gen-Ed Objectives	<p>SKILLS/ Inquiry/ Analysis/ Use creativity to solve problems</p> <p>SKILLS/ Communication/ Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means, and in more than one language</p> <p>INTEGRATION/ Information Literacies/ Gather, interpret, evaluate, and apply information discerningly from a variety of sources</p>		
Course Objectives/ Student Learning Outcomes	<p>Have knowledge and understanding of different software architectures</p> <p>Use the appropriate architecture for a specific problem</p> <p>Learn to use the different tools for architecture design</p> <p>Learn how to design software to meet different criteria</p>		
Textbook	Software Architecture in Practice, 3rd Edition		

Author	Len Bass, Paul Clements, Rick Kazman	
Publisher / Year	Addison-Wesley Professional/ 2013	
ISBN	ISBN-13: 9780133153125	

Weekly Topics:

Week	Topic	Chapter
1	What is Software Architecture	1
2	The Importance and Contexts of Software Architecture	2/3
3	Understanding Quality Attributes, Availability	4/5
4	Interoperability	6
5	Modifiability	7
6	Performance	8
7	Midterm Exam	
8	Security	9
9	Testability and Usability	10/11
10	Architecture in Agile Projects	15
11	Architecture and Requirements	16
12	Designing and Architecture	17
13	Documenting Software Architecture	18
14	Architecture, Implementation, and Testing	19
15	Final Exam	

Reading and Reference Materials:

- The textbook and any material provided by the instructor.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:**Grading:**

- Midterm Exam: 20%
- Project: 30%
- Homework: 20%
- Final Exam 30%

- Total: 100%

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

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- You must be able to install software in the computer you will use.
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- **Homework:** Homework assignment will consist of problems where the students will have to solve using the different techniques and strategies learned in class. Each homework assignment contributes proportionally to the final homework grade. Homework may be in group or individually. Late

homework may not be accepted. If accepted a points deduction may be imposed at the discretion of the instructor.

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- **Final Exam:** A comprehensive/cumulative final exam will be administered at the end of the semester. Students are required to take the exam the day and time scheduled. There is no make-up exam unless you have a valid reason according to CityTech's policy.

Project:

•Students will work in teams of 3-5 members to develop a project. The teams will prepare a proposal that will have to be approved by the instructor. Students must incorporate the material learned in class into their projects and provide reports as requested by the instructor. A final project presentation and demo will be done towards the end of the semester.

Delivery Method (In-Person/Online):

•This course delivery can be either online or in-person. The content of this course as well as the deliverables does not require a physical laboratory setup. Therefore, this course is designed to be offered in a classroom setting if space is available, and circumstances permit but can also be offered completely online.

Class Participation:

Attendance and class participation are essential and excessive absences may affect the final grade.

Classroom Conduct Policy:

•Students must show respect to each other and to the professor. Students may not interrupt the class. Students must follow instructions from the instructor. The use of smartphones, cameras, and other electronic devices during class is prohibited. Please put devices away and on silent mode or turn them off. The use of the computers and the Internet is solely for work related to the class.

Academic Integrity Policy:

•Students and other individuals who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Academic dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor’s goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
SKILLS/ Inquiry/ Analysis/ Use creativity to solve problems	Midterm exam
SKILLS/ Communication/ Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means, and in more than one language	Project final written report
INTEGRATION/ Information Literacies/ Gather, interpret, evaluate, and apply	Application of the techniques learned in the requirements course as part of the architecture

information discerningly from a variety of sources	project.
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Course Specific Learning Outcomes	Assessment Methods
Have knowledge and understanding of different software architectures	The beginning of the semester will cover the different types of architectures. Homework assigned during that time will assess this outcome.
Use the appropriate architecture for a specific problem	When students select a project and provide a proposal, they will have to show competence in selecting the appropriate architecture.
Learn to use the different tools for architecture design	Different tools will be assigned specially in the middle of the semester as we study different topics and the assignments will assess this.
Learn how to design software to meet different criteria	The project report will assess this.

Rationale

The Department of Computer Engineering Technology is proposing a new program of a Bachelor of Science in Software Engineering Technology. This new program will fill the gap at City Tech and CUNY by offering students this important field of study that has become one of the most pursued by students with interest in a career in technology.

Software Architecture and Design is one of the fundamental aspects of SDLC. Teaching concepts in software architecture and design is of paramount importance in this area of study. This course will teach students what is software architecture, the importance of it as well as well as how to apply in a project.

There is currently no similar course in software architecture and design offered at City Tech. The purpose of this proposal is to fill that gap and have a course that will cover this material.

Course Need Assessment

This course will be a core course for the new Bachelor of Science in Software Engineering Technology degree program proposed by the Department of Computer Engineering Technology. Students will be required to take this course as part of their program.

The expectation for this course is that each section will have capacity for 22 students. The course will be offered in both Spring and Fall semesters every academic year.

As this course is heavily software based, we do not anticipate an additional need for physical resources other than a regular PC. Adequate equipment and resources in the CET Department are available for the completion of the course work such as labs and assignments.

There are at least three existing CET full-time faculty with the expertise to teach this course who are available to every semester.

This course has no overlap with any other courses offered in the CET Department or courses offered in other departments.

Course Design

This course will be a core course in the new Bachelor of Science in Software Engineering Technology degree program proposed by the Department of Computer Engineering Technology.

The course is structured as a combination of lecture sessions and assignments/labs embedded in each lesson. The lecture focuses on the theory and principles of software architecture and the assignments and will serve as practices and application of the principles learned. The course will also have a midterm partial exam and a final cumulative exam to test students' knowledge and understanding. A team project will also be required where students will apply the concepts learned in a comprehensive way.

To support the learning and general education outcomes this course requires satisfactory completion of individual assignments, labs, the exams, and the final team project.

This course is designed to be taught online or in a classroom if there is space available.

New Course Proposal: SET4710 Software Testing and Quality Assurance

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title SET4710 Software Testing and Quality Assurance

Proposal Date August 22, 2021

Proposer's Name Yu Wang, Seymour Blank

Course Number SET 4710

Course Credits, Hours 3 Class hour, 3 Credits

Course Pre-Requisites SET 3610, MAT1475 or higher

Course Pre/co-Requisites

Catalog Course Description The theory and principles of software testing and quality assurance, from integration to execution and automation. The topics cover the basics of test design, test automation, and test-driven development, agile principles, values, techniques, practices, procedures, and tools. In addition, metrics and models for software quality as a product, in process, and in maintenance.

Brief Rationale Testing has evolved from afterthought to a central activity in certain development methods, particularly agile methods. This course allows students to develop their knowledge further to design tests in the phases of software development. An understanding of Agile allows our CET students to work on any project in any sector in the tech field.

Provide a concise summary of why this course is important to the department, school or college.

CUNY – Course Equivalencies

Provide information about equivalent courses within CUNY, if any. N/A

Intent to Submit as Common

Core No

If this course is intended to fulfill one of the requirements in the common core, then indicate which area.

For Interdisciplinary Courses: Not applicable

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
9. Discipline Specific	✓
10. General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for	✓

Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.

Where does this course overlap with other courses, both within and outside of the department? ✓

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? ✓

If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. NA

Course Design

Describe how this course is designed. ✓

Course Context (e.g. required, elective, capstone) ✓

Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? ✓

Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) ✓

How does this course support Programmatic Learning Outcomes? ✓

Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. ✓

Additional Forms for Specific Course Categories NA

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#)) NA

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	4710		
Course Title	Software Testing and Quality Assurance		
Catalog Description	The theory and principles of software testing and quality assurance, from integration to execution and automation. The topics cover the basics of test design, test automation, and test-driven development, agile principles, values, techniques, practices, procedures, and tools. In addition, metrics and models for software quality as a product, in process, and in maintenance.		
Prerequisite	SET 3610, MAT1475 or higher		
Corequisite			
Pre- or corequisite			
Credits	3		
Contact Hours	3 Class Hours		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g. Writing Intensive, etc)			
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College C <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

Rationale: There are many software testing techniques. The tester needs to understand when and how to use them. The role of testing in software development has undergone radical changes in recent years. Testing has evolved from afterthought to a central activity in certain development methods, particularly agile methods. This course is designed SET BS junior students in the Computer Engineering Technology (CET) Department. This course allows students to develop their knowledge further to design tests in the phases of software development. An understanding of Agile allows our CET students to get entry point in tech fields.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline**.

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal SET 4710 Software Testing and Quality Assurance	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology(SET)
Proposed by (include email & phone) Yu Wang, Seymour Blank ywang@citytech.cuny.edu / 718-260-5893	Expected date course(s) will be offered Fall 2023 # of students 22

- 2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**

The text book is an open courseware available for free to the students that will be available through blackboard or canvas. There is also a pdf version this book that can be used as reference book.

- 3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.**

A search of the CityTech/CUNY library catalog and database with the keyword “Software Testing” or “Software Quality” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After surveying the library’s collection, I feel that the collection can adequately support this course. However, I do recommend that upon course approval that additional materials related to software programming, specifically to quality assurance, be added to augment current library resources. It may also be useful to acquire texts that examine the importance of software testing and failure.

09.14.2021

Computer Engineering Technology Department
Software Engineering Technology Program
Sample Course Outline

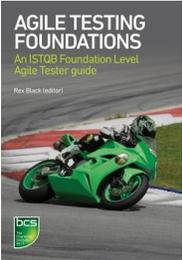
Prepared by	Yu Wang, Seymour Blank	Revision date	New
Course No. & Title	SET 4710 Software Testing and Quality Assurance		
Course Description	The theory and principles of software testing and quality assurance, from integration to execution and automation. The topics cover the basics of test design, test automation, and test-driven development, agile principles, values, techniques, practices, procedures, and tools. In addition, metrics and models for software quality as a product, in process, and in maintenance.		
Hours / Credits	3 Class Hours, 3 credits		
Pre-requisite	SET 3610, MAT1475 or higher		
Pre- / Co-requisite			
Gen-Ed Objectives	8. SKILLS/Inquiry/Analysis: Students will employ scientific reasoning and logical thinking. 9. INTEGRATION/Integrate learning: Students will resolve difficult issues creatively by employing multiple systems and tools. 10. SKILLS/Communication: Students will communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means 11. VALUES, ETHICS, RELATIONSHIPS / Professional/Personal Development: Students will work with teams, including those of diverse composition. Build consensus. Respect and use creativity.		
Course Learning Outcomes	Upon successful completion of this course, the students will be able to: <ul style="list-style-type: none"> • Demonstrate knowledge of fundamental testing principles and software testing techniques • Describe the quality assurance process and its role in software development. • Understand life-cycle models for requirements, defects, test cases, and test results 		

- Apply a variety of testing techniques, methods, and tools.
- Apply Agile software principles into practice and procedure

Recommended Instructional Materials

Textbook and Reference Books

Text book	Introduction to Software Testing	
Author	Paul Ammann (Author), Jeff Offutt (Author)	
Publisher	Cambridge University Press 2 edition 2016	
ISBN	ISBN-10: 9781107172012 ISBN-13: 978-1107172012	

Reference book	Agile Testing Foundations: An ISTQB Foundation Level Agile Tester guide	
Author	Rex Black	
Publisher	BCS Learning & Development Limited 2017	
ISBN	ISBN: 9781780173368	

Reading and Reference Materials:

Foundations of Software Testing, by Aditya P. Mathur, Addison-Wesley Professional, @2014, ISBN ISBN-10: 8131794768, ISBN-13: 978-8131794760

Test-Driven Java Development , by Alex Garcia, Packt Publishing, 2nd edition, 2018, ISBN-10: 1788836111, ISBN-13: 978-1788836111 <https://www.astqb.org/istqb-foundation-level>

IEEE Standard for Software and System Test Documentation. Institute of Electrical and Electronic Engineers, New York. IEEE Std 829-2008.

Grindal, M., Offutt, J., and Andler, S. F. (2005). Combination testing strategies: A survey. Software Testing, Verification, and Reliability, 15(2):97–133, Wiley

Mathur, A. P. (2014). Foundations of Software Testing. Addison-Wesley Professional, Indianapolis, IN, second edition.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

Weekly Topics

Week	Topic
1	Course outline, classroom conduct, academic integrity, attendance, and grading policy. Intro to testing and class overview. The goal of testing software and why test (Chapter 1)
2	Model driven test design, testing activities, testing levels, faults, failures, and errors (Chapter 2)
3	A test automation framework and JUnit (Chapter 3.1-3.3)
4	Putting testing first, system tests in Agile methods (Chapters 4)
5	Criteria based test design (Chapter 5)
6	Input space partitioning and input domain model (Chapter 6.1 -6.3)
7	Midterm
8	Graph coverage – control flow criteria (Chapters 7.1, 7.2, 7.3)
9	More graph coverage for specifications and use case (Chapters 7.5 and 7.6)
10	Semantic logic coverage and coverage criterion

	(Chapter 8.1)
11	Syntactic logic coverage and coverage criterion (Chapter 8.2)
12	Applying logic criteria Chapter 8.3
13	Managing the test process (Chapters 10.1. 10.2 10.3)
14	Test planning and implementing (Chapters 11 and Chapter 12)
15	Final exam

Rationale

Software testing can be performed manually or by using automated software testing tools. There are many software testing techniques. The tester needs to understand when and how to use them. The role of testing in software development has undergone radical changes in recent years. Testing has evolved from afterthought to a central activity in certain development methods, particularly agile methods.

Over the past decade or more, the software team has benefited from an Agile method. Agile testing brings many advantages to teams, from increasing overall product quality to providing greater scope for flexibility. According to VersionOne - State of Agile Survey 2017, 52% of respondents stated that more than half of the teams in their organizations are using Agile practices. There is 75% engineering practice in unit testing to use Agile method and 35% engineering practice to employ TDD (Test-driven development). Agile methodology has been widely adopted in software development and testing.

The principles of Agile testing in software are applicable everywhere. An understanding of Agile allows our CET students to get entry point jobs in tech fields and to work on any project in any sector. Indeed, search for Software testing Tech job in New York shows that 40.2% job descriptions require Agile testing experience (2847 job requires Agile testing experience over 7079 jobs of software testing in New York). Agile testing knowledge is essential for CET students who want to become better software engineers or technicians. Agile testing makes students understand better at software debugging, which in turn leads to better projects. This understanding can enable students to their ideas from inception to release, create better systems, and communicate on a professional team. Students have an option to get the career booster of software testing –ISTQB Foundation Level software testing certification (CTFL) after taking this course. This certification gives students a common

testing vocabulary and principles and opens a software and embedded testing career path for our CET students.

The course will serve SET BS junior students in the Computer Engineering Technology (CET) Department. It is intended to be offered every semester in both fall and spring semesters each year, with a maximum of 22 students per course.

The course is designed to implement fundamental knowledge of software testing in the major. The lecture will focus on the theory and principles of software testing and quality. The project and assignments provide students with the opportunity to apply the theory in practical ways to design and implement test cases.

The course is expected to be offered in Fall 2023. Existing CET faculty are eligible to teach this course. The current lab facility is sufficient to run hands-on lab components and project. Students have an option to get the career booster of software testing –ISTQB Foundation Level software testing certification (CTFL) after taking this course. This certification gives students a common testing vocabulary and principles and opens a software testing career path for our CET students.

COURSE POLICIES:

Grading:

- Midterm: 20 %
- Final Exam: 30 %
- Quizzes: 15 %
- Assignments: 20 %
- Group Project 15 %
- Total: 100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

- Desktop/laptop can be used for the lab and course project.
- Open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Reading and Reference Material:

- Reading and reference material will be provided in Blackboard and OpenLab.

Software for Lab / Project:

- Software applications will be used in the labs and course project. The links to download the software will be posted in Blackboard

Library Usage:

- Students are encouraged to use the library for supplementary resources in support of the courses.

Assignments:

- Weekly assignments will be posted. Each assignment equally contributes to the final grade.
- Assignments will be done individually. See Blackboard for detailed instructions.
- All weekly assignments must be submitted through Blackboard.
- No late submission will be accepted.

Mid Term and Final Exam:

- The Mid-Term exam will cover content from weeks 1 to 7.
- The Final Exam will be cumulative.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Course Need Assessment

The course will be offered to junior or senior students of the Software Engineering Technology Program and Computer Engineering Program in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

There is no similar course with 3 credits available within CITY TECH; this course is particularly designed for software engineers. It brings together the understanding of software testing principles, different testing techniques and the practical skills demanded by the Tech industry.

Course Design

The course will be primarily delivered through three activities:

- Lectures
- Projects
- Homework Assignments

Programmatic course learning outcomes will be assessed through exams, projects/tutorials assignments, homework, and quizzes.

The course is structured as lecture sessions and hands-on project. The design of this course will allow instructors to teach the course online or in-person.

No additional physical resources are required since students can take the course in one of the computer labs in the CET department or online. Students need a computer with Internet connection. The software and development tools used for projects are Open Source or free.

Existing faculty in the CET department is qualified and available to teach this course. Adequate equipment, classroom, and lab resources are also available for the hands-on component of the course.

Assessment Methods

Upon successful completion of this course, students shall be able to	Evaluation methods and criteria
Demonstrate knowledge of fundamental testing principles and software testing techniques	Analysis of student performance on multiple choice questions, short answer questions on quizzes, homework, project proposal and final project presentation.
Describe the quality assurance process and its role in software development.	Analysis of student performance on multiple choice questions, short answer questions on quizzes, exams, and projects.
Understand life-cycle models for requirements, defects, test cases, and test results	Analysis of student performance on multiple choice questions, short answer questions on quizzes, final exam.
Apply a variety of testing techniques, methods, and tools.	Students will demonstrate their ability to use test-driven design to write and implement additional functionality incrementally in projects.
Apply Agile software principles into practice and procedure	The team will understand each member's role. Students will complete project assignment in a group.

General Education Outcomes and Assessment:

Learning Outcomes	Assessment Method
SKILLS/Inquiry/Analysis: Students will employ scientific reasoning and logical thinking.	Students will identify software system faults and failures by using correct input harness and generating different test cases for given system requirements. This will be demonstrated by the assignments, quizzes, and exams.
SKILLS/Communication: Students will communicate in diverse settings and	In group projects, students will present testing practice project and how it was implemented using

<p>groups, using written (both reading and writing), oral (both speaking and listening), and visual means</p>	<p>testing principles. Student will demonstrate oral presentation skills through Power Point presentations. The formal project report in groups will be used to assess communication skills in writing and collaboration</p>
<p>INTEGRATION/Integrate learning: Students will resolve difficult issues creatively by employing multiple systems and tools.</p>	<p>The agile community has developed several The agile community has developed several processes and tools to manage automating system tests and integrating the implementation as it is developed. This will be demonstrated by the exams and group projects.</p>
<p>VALUES, ETHICS, RELATIONSHIPS / Professional/Personal Development: Students will work with teams, including those of diverse composition. Build consensus. Respect and use creativity.</p>	<p>Students will work in Agile team, build consensus and respect and use creativity in the final project</p>

New Course Proposal: SET4810 Software Capstone Design

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](#) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

Project

Title of Proposal	Proposal for a new course: SET 4810: Software Capstone Design
Date	09/08/2021
Major or Minor	Major
Proposer's Name	José M. Reyes Álamo and Aparicio Carranza
Department	Computer Engineering Technology
Date of Departmental Meeting in which proposal was approved	09/09/2021
Department Chair Name	Sunghoon Jang
Department Chair Signature and Date	
Academic Dean Name	Gerarda M. Shields
Academic Dean Signature and Date	

Brief Description of Proposal

(Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body.

The Department of Computer Engineering Technology (CET) proposes a new course, *SET 4810: Software Capstone Design*, for the new Bachelor of Science in Software Engineering Technology program.

Brief Rationale for Proposal

(Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the

Software Capstone Design is the culmination of a career in software engineering field where students will be able to apply all the knowledge and techniques learned throughout their course of study in a single course preparing them for their career after they graduate.

proposal body).

Proposal History

This is a new proposal.

(Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list).

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

ALL PROPOSAL CHECK LIST

Completed CURRICULUM MODIFICATION FORM including:

Brief description of proposal	Y
Rationale for proposal	Y
Date of department meeting approving the modification	
Chair's Signature	
Dean's Signature	
Evidence of consultation with affected departments	
List of the programs that use this course as required or elective, and courses that use this as a prerequisite.	
Documentation of Advisory Commission views (if applicable).	
Completed Chancellor's Report Form .	Y

EXISTING PROGRAM MODIFICATION PROPOSALS

Documentation indicating core curriculum requirements have been met for new programs/options or program changes.

Detailed rationale for each modification (this includes minor modifications)

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the Curriculum Modification Proposal Form and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Software Capstone Design
Proposal Date	09/08/2021
Proposer's Name	José M. Reyes Álamo
Course Number	SET 4810
Course Credits, Hours	3 credits, 2 class hours and 2 lab hours
Course Pre / Co-Requisites	Pre: SET4710, MAT1575 or higher
Catalog Course Description	A comprehensive course where students apply knowledge and techniques learned throughout their course of study. Topics include requirements analysis and elicitation, architecture and design, development, validation and verification, testing, project management, and reporting in a project of their choosing addressing a real-world problem.

Brief Rationale

Provide a concise summary of why this course is important to the department, school or college.

This course is a necessary component for the new BS in Software Engineering Technology and it will be part of the core of the new program.

CUNY – Course Equivalencies No

Provide information about equivalent courses within CUNY, if any.

Intent to Submit as Common Core No

If this course is intended to fulfill one of the requirements in the common core, then indicate which area.

For Interdisciplinary Courses: No

- Date submitted to ID Committee for review

- Date ID recommendation received

- Will all sections be offered as ID? Y/N

Intent to Submit as a Writing Intensive Course No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL. Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	
Title, Number, Credits, Hours, Catalog course description	Y
Brief Rationale	Y
CUNY – Course Equivalencies	Y
Completed Library Resources and Information Literacy Form	Y
Course Outline	
Include within the outline the following.	
Hours and Credits for Lecture and Labs	Y
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	
Detailed Course Description	Y
Course Specific Learning Outcome and Assessment Tables	
<ul style="list-style-type: none"> • Discipline Specific • General Education Specific Learning Outcome and Assessment Tables 	Y
Example Weekly Course outline	Y
Grade Policy and Procedure	Y
Recommended Instructional Materials (Textbooks, lab supplies, etc)	Y
Library resources and bibliography	Y
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	
Target Students who will take this course. Which programs or departments, and how many anticipated?	Y
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	Y
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	N
Where does this course overlap with other courses, both within and outside of the department?	N
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	Y
If needs assessment states that this course is required by an accrediting body, then	N/A

provide documentation indicating that need.

Course Design

Describe how this course is designed.

Course Context (e.g. required, elective, capstone)	Y
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	Y
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	Y
How does this course support Programmatic Learning Outcomes?	Y
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	Y

Additional Forms for Specific Course Categories

N/A

Interdisciplinary Form (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

Common Core (Liberal Arts) Intent to Submit (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for Curricular Experiments)

N/A

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

CHANCELLOR'S REPORT SECTION AIV: NEW COURSES

CUNYfirst Course ID	
Department(s)	Computer Engineering Technology
Career	<input checked="" type="checkbox"/> Undergraduate <input type="checkbox"/> Graduate
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Computer Engineering Technology
Course Prefix	SET
Course Number	4810
Course Title	Software Capstone Design
Catalogue Description	A comprehensive course where students apply knowledge and techniques learned throughout their course of study. Topics include requirements analysis and elicitation, architecture and design, development, validation and verification, testing, project management, and reporting in a project of their choosing addressing a real-world problem.
Pre/ Co Requisites	Pre: SET4710, MAT1575 or higher
Credits	3
Contact Hours	2 class hours and 2 lab hours
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, Honors, etc)	N/A
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures College Option Detail _____ <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World
Effective Term	TBA

Rationale:

This course is a necessary component for the new BS in Software Engineering Technology and it will be part of the core of the new program.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. **Library faculty subject specialist:** please complete box 5.

1	Title of proposal SET 4810: Software Capstone Design	Department/Program Computer Engineering Technology/BS in Software Engineering Technology
	Proposed by (include email & phone) José M. Reyes Álamo Email: jreyesalamo@citytech.cuny.edu Phone: 718-260-5036 Aparicio Carranza Email acarranza@citytech.cuny.edu Phone:	Expected date course(s) will be offered Fall 2023 # of students 22

2	<p>The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (http://cityte.ch/curriculum) for articles and ebooks for your courses, or our open educational resources (OER) guide (http://cityte.ch/oer). Have you considered using a freely-available OER or an open textbook in this course?</p> <p>Yes</p>
----------	--

3	<p>Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details</p>
----------	--

(e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.

Yes

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching the course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

I believe that the library's collection is inadequate to fully support this course. I feel that the collection requires more texts on team-based software development, as well as other materials related to group collaboration (documenting processes, testing, project development, etc.).

Date 09.21.21

Computer Engineering Technology Department

Software Engineering Technology Program

Sample Course Outline

Prepared by	José M. Reyes Álamo	Revision date	
Course No. & Title	SET 4810 Software Capstone Design		
Course Description	A comprehensive course where students apply knowledge and techniques learned throughout their course of study. Topics include requirements analysis and elicitation, architecture and design, development, validation and verification, testing, project management, and reporting in a project of their choosing addressing a real-world problem.		
Hours / Credits	2 class hrs and 2 lab hours, 3 credits		
Pre-requisite	SET4710, MAT1575 or higher		
Pre- / Co-requisite			
Gen-Ed Objectives	<p>SKILLS/Communication/Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means, and in more than one language.</p> <p>SKILLS/Inquiry & Analysis/ Understand and employ both quantitative and qualitative analysis to describe and solve problems, both independently and cooperatively.</p> <p>INTEGRATION/Information Literacies/Gather, interpret, evaluate, and apply information discerningly from a variety of sources</p> <p>INTEGRATION/Integrate Learning/Resolve difficult issues creatively by employing multiple systems and tools.</p> <p>VALUES, ETHICS, AND RELATIONSHIPS/ Professional/Personal Development/Work with teams, including those of diverse composition. Build consensus.</p>		
Course Objectives/ Student Learning Outcomes	<p>Identify a real-world problem solvable within the time frame of the course</p> <p>Requirement's elicitation of the chosen problem</p>		

	Create the architecture and design of the solution Develop a software solution for the problem Present and defend your solution to your peers Create a detailed report and documentation of the problem and the steps leading to the solution.	
Textbook	NONE, Instructor Notes	
Author		
Publisher / Year		
ISBN		

Weekly Topics:

Week	Topic	Lab/Assignment/Deliverable
1	Introduction to software capstone project	Brainstorm topics/problems Networking to form teams
2	Problem identification review	Form teams Brainstorm topics/problems
3	Proposal details	Begin proposal draft
4	Requirement's elicitation process review	Proposal due
5	Proposal presentation/Report	Requirement's draft
6	Architecture Review	Requirements due
7	Design Review	Architecture & Design draft
8	Design Review Cont.	Architecture & Design draft
9	Implementation Review	Architecture & Design due
10	Implementation Review Cont./Report	Implementation (partial) Verification
11	Testing & Debugging Review	Implementation (partial)

12	Written Report Review	Implementation (partial)/Start Written Report draft
13	Presentation & Demo	Implementation (partial)/ Written Report draft
14	Presentation & Demo	Presentation Slides/ Written Report draft
15	Career advice (industry, academia, non-profit), Interview Process Review	Final Written Report and Software Implementation Due

Reading and Reference Materials:

- The textbook and any material provided by the instructor.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:

Grading:

- Proposal: 5%
- Requirements: 10%
- Architecture & Design: 15%
- Software Implementation: 30%
- Presentation & Demo: 20%
- Final Written Report: 20%
- Total: 100%

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Homework and Project:

- A Windows or Mac desktop or laptop computer can be used for the homework and course project.
- You must be able to install software in the computer you will use.
- It is expected that the student is familiar and well-versed in computer programming.

Grading Criteria:

- Proposal
- Requirements
- Architecture & Design
- Software Implementation
- Presentation & Demo
- Final Written Report

Project:

- Students will work in teams of 3-5 members to develop a project. The teams will prepare a proposal that will have to be approved by the instructor. Students must incorporate the material learned in class into their projects, especially the requirements and the architecture and design, and provide reports as requested by the instructor. A final project presentation will be done towards the end of the semester.

Delivery Method (In-Person/Online):

- This course delivery can be either online or in-person. The content of this course as well as the deliverables does not require a physical laboratory setup. Therefore, this course is designed to be offered in a classroom setting if space is available, and circumstances permit but can also be offered completely online.

Class Participation:

Attendance and class participation are essential and excessive absences may affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

- Students must show respect to each other and to the professor. Students may not interrupt the class. Students must follow instructions from the instructor. The use of smartphones, cameras, and other electronic devices during class is prohibited. Please put devices away and on silent mode or turn them off. The use of the computers and the Internet is solely for work related to the class.

Academic Integrity Policy:

Students and other individuals who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Academic dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
SKILLS/Communication/Communicate in diverse settings and groups, using written (both reading and writing),	Project Presentation

oral (both speaking and listening), and visual means, and in more than one language.	
SKILLS/Inquiry & Analysis/Understand and employ both quantitative and qualitative analysis to describe and solve problems, both independently and cooperatively.	Written Report
INTEGRATION/Information Literacies/Gather, interpret, evaluate, and apply information discerningly from a variety of sources	Requirements
INTEGRATION/Integrate Learning/Resolve difficult issues creatively by employing multiple systems and tools.	Project Implementation
VALUES, ETHICS, AND RELATIONSHIPS/ Professional/Personal Development/Work with teams, including those of diverse composition. Build consensus.	Presentation & Demo, Written Report

Course Specific Learning Outcomes	Assessment Methods
Identify a real-world problem solvable within the timeframe of the course.	Proposal
Requirement's elicitation of the chosen problem	Requirements Report
Create the architecture and design of the solution	Architecture & Design Report
Develop a software solution for the problem	Software Implementation
Present and defend your solution to your peers	Project Presentation
Create a detailed report and documentation of the problem and the steps leading to the solution	Written Report

Rationale

The Department of Computer Engineering Technology is proposing a new Bachelor of Science in Software Engineering Technology. This new program will fill the gap at City Tech and CUNY by offering students this important field of study that has become one of the most pursued by students with interest in a career in technology.

Software Capstone Design is a comprehensive course where students will apply the knowledge and techniques learned throughout their course of study such as problem identification, requirements elicitation, architecture and design, development, verification, testing for validation, and reporting in a project of their choosing addressing a real-world problem.

There is currently no similar course in software requirements engineering offered at City Tech. The purpose of this proposal is to fill that gap and have a course that will cover this material.

Course Need Assessment

This course will be a core course for the new Bachelor of Science in Software Engineering Technology proposed by the Department of Computer Engineering Technology. Students will be required to take this course as part of their program.

The expectation for this course is that each section will have capacity for 22 students. The course will be offered in both Spring and Fall semesters every academic year.

As this course is heavily software based, we do not anticipate an additional need for physical resources other than a regular PC. Adequate equipment and resources in the CET Department are available for the completion of the course work such as labs and assignments.

There are at least three existing CET full-time faculty with the expertise to teach this course who are available to every semester.

This course has no overlap with any other courses offered in the CET Department or courses offered in other departments.

Course Design

This course will be a core course in the new Bachelor of Science in Software Engineering Technology proposed by the Department of Computer Engineering Technology.

The course is structured as a combination of lecture sessions and a project divided in multiple stages. The lecture focuses on a review of the material learned in previous courses and how to apply these concepts into the student's project. The project will consist of selecting a real-world challenge where all stages of the software development cycle are applicable, guided by the instructor and it will be divided in stages. The culmination of the course will include a written report, a project presentation, and the software implementation of the solution.

To support the learning and general education outcomes this course requires satisfactory completion of all stages of the project.

This course is designed to be taught online or in a classroom if there is space available.

New Course Proposal: SET4940 Embedded Operating Systems

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Embedded Operating Systems
Proposal Date	February 25, 2020
Proposer's Name	Xiaohai Li
Course Number	SET 4940
Course Credits, Hours	3 credits, 2 class hours and 2 lab hours
Course Pre-requisite	SET 2440 and SET 3510
Catalog Course Description	A practical understanding of embedded operating systems used in embedded and real-time applications. Topics include embedded operating systems kernel architectures and examples, embedded Linux component stack, real-time scheduling, synchronization, communication, storage, process and memory management, hardware interfacing and device drivers, and real-time operating system performance analysis. Students use the latest tools to customize open-source systems and build a processor-independent embedded operating system.
Brief Rationale	This course will be one of the technical electives for the proposed Software Engineering Technology BS program in the Department of Computer Engineering Technology. It introduces students to the subject of embedded operating systems that are broadly used in various embedded and real-time applications such as consumer electronics, avionics, robotics, automotive, medical imaging equipment and space exploration.
Provide a concise summary of why this course is important to the department, school or college.	

CUNY – Course Equivalencies

Provide information about equivalent courses within CUNY, if any. No

Intent to Submit as Common Core

No
If this course is intended to fulfill one of the requirements in the common core, then indicate which area.

For Interdisciplinary Courses:

Not applicable

- Date submitted to ID Committee for review
- Date ID recommendation received

- Will all sections be offered as ID?
Y/N

Intent to Submit as a Writing Intensive Course

No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL. Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	✓
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	✓
Completed Library Resources and Information Literacy Form	✓
Course Outline	✓
Include within the outline the following.	
Hours and Credits for Lecture and Labs	✓
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables	
11. Discipline Specific	✓
12. General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	✓
Course Need Assessment.	
Describe the need for this course. Include in your statement the following information.	✓
Target Students who will take this course. Which programs or departments, and how many anticipated?	✓
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	✓
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	✓

Where does this course overlap with other courses, both within and outside of the department? ✓

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this? ✓

If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need. NA

Course Design

Describe how this course is designed. ✓

Course Context (e.g. required, elective, capstone) ✓

Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)? ✓

Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture) ✓

How does this course support Programmatic Learning Outcomes? ✓

Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program. ✓

Additional Forms for Specific Course Categories NA

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received)*

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#)) NA

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	4940		
Course Title	Embedded Operating Systems		
Catalog Description	A practical understanding of embedded operating systems used in embedded and real-time applications. Topics include embedded operating systems kernel architectures and examples, embedded Linux component stack, real-time scheduling, synchronization, communication, storage, process and memory management, hardware interfacing and device drivers, and real-time operating system performance analysis. Students use the latest tools to customize open-source systems and build a processor-independent embedded operating system.		
Prerequisite	SET 2440 and SET 3510		
Corequisite			
Pre- or corequisite			
Credits	3		
Contact Hours	2 Class Hours, 2 Lab Hours		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g. Writing Intensive, etc)			
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

Rationale: This course is designed as a technical elective in the proposed Software Engineering Technology Bachelor of Science program. It introduces students to the subject of embedded operating systems for embedded and real-time applications.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline**.

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1 Title of proposal SET 4940 – Embedded Operating Systems	Department/Program Computer Engineering Technology (CET) / BS in Software Engineering Technology (SET)
Proposed by (include email & phone) Prof. Xiaohai Li xhli@citytech.cuny.edu / 718-260-5885	Expected date course(s) will be offered Fall 2023 # of students 22

2 The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?

As to the proposer’s knowledge, there is no open textbook available for this course, but plenty OER and open-source tech documentations available online which will be used in the class.

3 Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.

A search of the CityTech/CUNY library catalog and database with the keyword “embedded operating systems” or “embedded Linux” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

- 4 Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.**

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

- 5 Library Faculty Subject Specialist Junior Tidal**

Comments and Recommendations

After surveying the library’s collection, I believe that the resources available are sufficient to support this course. It is recommended that the library acquire supplementary materials, such as monographs that examine various Linux/Unix distributions, open-hardware, and open-source software, in addition to the required texts for the course.

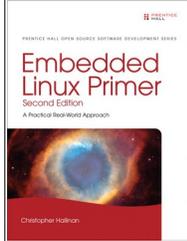
August 4, 2020.

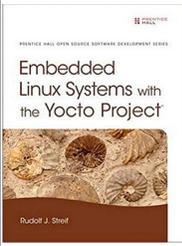
Computer Engineering Technology Department

Computer Engineering Technology Program

Sample Course Outline

Prepared by	Xiaohai Li	Revision date	05/12/2021
Course No. & Title	SET 4940 Embedded Operating Systems		
Course Description	<p>A practical understanding of embedded operating systems used in embedded and real-time applications. Topics include embedded operating systems kernel architectures and examples, embedded Linux component stack, real-time scheduling, synchronization, communication, storage, process and memory management, hardware interfacing and device drivers, and real-time operating system performance analysis. Students use the latest tools to customize open-source systems and build a processor-independent embedded operating system.</p>		
Hours / Credits	2 class hrs, 2 lab hrs / 3 credits		
Pre-requisite	SET 2440 and SET 3510		
Pre- / Co-requisite			
Gen-Ed Objectives	<p>Acquire discipline-specific knowledge.</p> <p>Gather, interpret and evaluate information from a variety of sources.</p> <p>Have effective reading and written/oral communication skills.</p> <p>Function as an effective team member.</p>		
Course Objectives/ Student Learning Outcomes	Recognize and use technical terms in the field of embedded systems and embedded operating systems.		

	<p>Understand embedded operating system architectures, and Linux and RTOS kernel architecture.</p> <p>Understand and compare different scheduling algorithms and real-time and embedded kernel designs.</p> <p>Acquire the skill to develop Linux kernel modules and system calls</p> <p>Be able to select and apply tools to build and debug an open-source embedded operating system.</p>	
Textbook	Embedded Linux Primer: A Practical Real-World Approach, 2nd Edition	
Author	Christopher Hallinan	
Publisher / Year	Pearson / 2011	
ISBN	ISBN-13: 978-0137017836 ISBN-10: 0137017839	
Lab Ref. Book	Embedded Linux Systems with the Yocto Project	

		
Author	Rudolf J. Streif	
Publisher / Year	Prentice Hall / 2016	
ISBN	ISBN-13: 978-0133443240 ISBN-10: 0133443248	

Wk	Weekly Topics
1	Introduction to the course and Introduction to embedded systems; Course project examples and ideas; team formation for course project
2	Introduction to embedded operating systems: applications, architectures and examples Lab: Introduction to Git
3	Hardware platform: Processor architectures, MPU and SoC, buses and interfaces, storage Lab: Set up host-target hardware platform
4	Development toolchain: cross-platform compiler, debugger, tracing and profiling tools, binary utilities Lab: Install and setup cross-platform development toolchain
5	Linux kernel and Embedded Linux component stack Lab: Open-Source build systems
6	Kernel Initialization, initialization flow control, process and memory management,
7	User space initialization, root file system, initial RAM disk Lab: Porting Linux
8	Bootloader: U-Boot, Device Tree Blob and other boot loaders
9	Device drivers basics: architecture, building and loading modules, module parameters Lab: Device driver for a microSD card reader
10	MTD subsystem and BusyBox Lab: Use uDev with BusyBox
11	Kernel debugging techniques and hardware-assisted debugging (JTAG) Lab: Debugging with JTAG
12	Debugging embedded Linux applications

	Lab: Building a Ranging Sensor Kernel Module
13	RTOS and RT Linux: real-time scheduling, synchronization, kernel preemption, and real-time kernel patch
14	Real-Time kernel performance analysis Lab: Preemption off and wakeup latency measurement
15	Course project demonstration and presentation

Reading and Reference Materials:

- Alan Holt and Chi-Yu Huang, *Embedded Operating Systems: A Practical Approach*, 2014 edition, Springer. October 9, 2014. ISBN-10: 9781447166023 ISBN-13: 978-1447166023.
- Philippe Gerum, Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, *Building Embedded Linux Systems, 2nd Edition*, O'Reilly Media, 2008. ISBN: 9780596529680.
- Alex Gonzalez, *Embedded Linux Development Using Yocto Project Cookbook, 2nd Edition*. Packt Publishing, January 25, 2018. ISBN-10: 1788399218 ISBN-13: 978-1788399210.
- Craig Hollabaugh, *Embedded Linux: Hardware, Software, and Interfacing*, Pearson Education, 2002. ISBN-10: 8177584359, ISBN-13: 9788177584356.
- Daniel P. Bovet and Marco Cesati, *Understanding the Linux Kernel, 3rd Edition*, O'Reilly Media, November 2005. ISBN-10: 0596005652 ISBN-13: 978-0596005658.
- John Madieu, *Linux Device Drivers Development: Develop customized drivers for embedded Linux*, Packt Publishing, October 20, 2017. ISBN-10: 1785280007 ISBN-13: 978-1785280009.
- Chris Simmonds, *Mastering Embedded Linux Programming*, Packt Publishing; 2nd Edition, June 30, 2017. ISBN-10: 1787283283 ISBN-13: 978-1787283282.
- Jonathan W. Valvano, *Real-Time Operating Systems for ARM® Cortex™-M Microcontrollers*, Volume 3, Fifth edition, CreateSpace, January 2019. ISBN: 978-1466468863.
- Ivan Cibrario Bertolotti and Gabriele Manduchi, *Real-Time Embedded Systems: Open-Source Operating Systems Perspective*. CRC Press, January 27, 2012. ISBN-10: 1439841543 ISBN-13: 978-1439841549.
- Jim Cooling, *Software Engineering for Real-Time Systems*, Addison-Wesley; 1st edition, November 11, 2002. ISBN-10 : 0201596202 ISBN-13 : 978-0201596205.
- Jim Cooling, *Real-time Operating Systems Book 1: The Theory (The engineering of real-time embedded systems)*, Independently published, January 28, 2019. ISBN-10 : 1795340657 ISBN-13 : 978-1795340656.
- Jim Cooling, *The Complete Edition – Software Engineering for Real-Time Systems*, Packt Publishing, December 26, 2019. ISBN-10 : 1839216581 ISBN-13 : 978-1839216589.
- Additional reading and reference materials will be provided on Blackboard (under *Contents* section) as needed.

Library Resources:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:**Grading:**

•Midterm:	20 %
•Final Project:	30 %
•Labs:	20 %
•Homework Assignments:	20 %
•Class Participation:	10 %
•Total:	100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

•Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

- Desktop/laptop or single-board computer can be used for the lab and course project.
- Other open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Lab Reports:

- Lab reports must be submitted INDIVIDUALLY.
- All lab reports must be submitted through Blackboard – Assignments section.
- Each lab report is due one week after the lab work is performed.
- Any late lab report will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.
- Additional requirements regarding lab report's content and format will be posted on Blackboard.

Homework:

- 3~5 assignments will be assigned. Each homework assignment equally contributes to the final grade.
- Homework will be done in a group or individually. See Blackboard for detailed instructions.
- All homework must be submitted through Blackboard.
- Any late homework will have a 30% late penalty per week; a submission will not be accepted if it is more than three weeks late.

Project:

- 2~3 students form a team to propose, develop and finish a project during the semester. The project needs to be approved by the instructor before proceeding.
- Each team needs to submit a midterm project report at the middle of semester. The report should be submitted to Blackboard.
- Final project demonstration/presentation will be done on the last week of the class. All team members in a team need to be present for the demonstration/presentation except emergencies.

Class Participation:

Attendance and class participation are essential and excessive absences will affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty

is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
Acquire discipline specific knowledge.	Students will at minimum, demonstrate knowledge of basic technical terms related to embedded operating systems such as those found in a job interview in the technology field. Students who excel will be able to use logic and reasoning to find answers to new questions. This will be demonstrated by homework, midterm and final project presentation.
Have effective reading and written communication skills. Have effective oral communication skills.	Effective reading will be demonstrated by accurate interpretation of reading/reference materials and weekly lab procedures. Effective writing will be demonstrated in lab reports, midterm and online project/labs documentation.
Gather, interpret and evaluate information from a variety of sources.	Students will verbally discuss an embedded operating system and explain basic concepts to the class. Each group of students will give a brief oral presentation on their project at the end of the semester. Students will also demonstrate their projects at the end of semester.
Be able to work in a team and group while being aware of the ethical and conflict related situations in group dynamics.	Students will work together in groups to design, build and demonstrate/present a prototype embedded operating system. Teamwork rubrics will be used for the assessment.

Course Specific Learning Outcomes	Assessment Methods
Recognize and use technical terms in the field of embedded systems and embedded operating systems.	Analysis of student performance on lab reports, homework, midterm and final project presentation.
Understand embedded operating system architectures and RTOS kernel architecture.	Analysis of student performance on homework, lab reports, and midterm.
Understand and compare different scheduling algorithms and real-time and embedded kernel designs.	Analysis of student performance in homework, hand-on lab experiments, lab reports and final project presentation.
Acquire the skill to develop Linux kernel modules and system calls	Analysis of student performance in hand-on lab experiments, lab reports, midterm and final project.
Be able to select and apply tools to build and debug an open-source embedded operating system.	Students will select and apply appropriate tools through different stages of the project. Analysis of student performance in project exercises, midterm report and final demonstration/presentation of project.

Course Need Assessment

The need to offer a course on Embedded Operating Systems is presented by the current and leading technologies. Embedded and real-time systems have become an integral and critical component in numerous industrial, military and civilian application areas, such as flight controller in aircraft, Mars exploration robots, networking equipment (routers and switches), smart TV and MRI machine. Many of these embedded and real-time systems are built and operate on an embedded operating systems with limited physical resources or power. These physical limits severely constrain the processing speed, memory space, and other resources available to applications and present difficult challenges.

In this course, students will learn fundamental concepts and techniques of embedded operating system analysis, design and implementation for embedded and real-time applications. It directly supports one of the program educational objectives, which states that graduates of the SET BS program are expected to be employed, as software engineer or the equivalent, in positions beyond the entry-level for which this program has prepared them.

This course has no overlap with any other courses offered in the CET Department. According to the current College Catalog, this course also does not overlap with any course offered in any other departments at City Tech.

Course Design

The course will be offered to the SET BS junior or senior students in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The hands-on sessions include lab exercises, experiments and group projects. This course is not designed to be online.

No additional physical resources are required since students will take this course in lieu of existing courses in the CET Department. Adequate equipment and resources in the CET Department are available for the hands-on components (lab experiments and course project) of this course. Several existing CET full-time faculty are qualified and available to teach this course every semester.

References

- [1] Darrick Addison, *Embedded Linux applications: An overview*. IBM, 2001. Retrieved on January 15, 2020. URL: <https://www.ibm.com/developerworks/library/l-embl/index.html>
- [2] Andreas Gerstlauer, *Embedded and Real-Time Systems / Real-Time Operating Systems*. University of Texas in Austin, Retrieved on January 15, 2020. URL: http://users.ece.utexas.edu/~gerstl/ee445m_s19/index.html
- [3] Jonathan Valvano, *Embedded Systems: Real-Time Operating Systems for ARM Cortex-M Microcontrollers* (example files) Volume 3, fourth edition, January 2017. Retrieved on January 15, 2020. URL: <http://users.ece.utexas.edu/~valvano/arm/outline3.htm>
- [4] Real-Time Embedded Systems Lab, Arizona State University, CSE 530 Embedded Operating System Internals. Retrieved on January 15, URL: http://rts.lab.asu.edu/web_530/CSE530_Main_page.htm
- [5] Texas Instruments, Introduction to Embedded Linux Three-Day Workshop. Retrieved on January 15, 2020. URL: [https://processors.wiki.ti.com/index.php/Introduction_to_Embedded_Linux_Three-Day_Workshop_\(AM335x\)#Workshop_Downloads](https://processors.wiki.ti.com/index.php/Introduction_to_Embedded_Linux_Three-Day_Workshop_(AM335x)#Workshop_Downloads)
- [6] Drew Moseley, *4 tools for building embedded Linux systems*. OpenSource. 15 Jun 2018. Retrieved on January 15, 2020. URL: <https://opensource.com/article/18/6/embedded-linux-build-tools>
- [7] Embedded Linux, URL: https://www.elinux.org/Main_Page
- [8] Yocto Project, URL: <https://www.yoctoproject.org/>
- [9] OpenEmbedded, URL: http://www.openembedded.org/wiki/Main_Page

New Course Proposal: SET4955 Software Engineering Technology in Robotics

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Software Engineering Technology in Robotics
Proposal Date	9/7/2021
Proposer's Name	Lili Ma and Xiaohai Li
Course Number	SET 4955
Course Credits, Hours	3 credits, 2 lecture hours, 2 lab hours
Course Pre/Co-Requisites	Pre: SET 3610 Pre/Co: MAT 2580
Catalog Course Description	Application of software engineering and technology concepts and practice in robotics. Subjects cover the design, analysis, synthesis, and testing of software systems for real-world robotic applications such as navigation, localization, mapping, manipulation, and coordination.
Brief Rationale Provide a concise summary of why this course is important to the department, school or college.	This course will be one of the technical electives for the proposed Software Engineering Technology(SET) BS program in the Department of Computer Engineering Technology. It introduces students to the subjects of robotic software design that are typically concurrent, distributed, real-time, and data intensive. It will present a number of basic approaches (such as component-based and multi-modal communication) to implement knowledge representation, perception, decision making, and human-robot interaction that are needed in the process of developing application-driven and personal robots.
CUNY – Course Equivalencies Provide information about equivalent courses within CUNY, if any.	No
Intent to Submit as	No

Common Core If this course is intended to fulfill one of the requirements in the common core, then indicate which area.	
For Interdisciplinary Courses:	No
Date submitted to ID Committee for review	
Date ID recommendation received	
Will all sections be offered as ID? Y/N	
Intent to Submit as a Writing Intensive Course	No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	√
<ul style="list-style-type: none"> Title, Number, Credits, Hours, Catalog course description Brief Rationale CUNY – Course Equivalencies 	√
Completed Library Resources and Information Literacy Form	√
Course Outline	√
Include within the outline the following.	
Hours and Credits for Lecture and Labs	√
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	√
Detailed Course Description	√
Course Specific Learning Outcome and Assessment Tables	√

- Discipline Specific
- General Education Specific Learning Outcome and Assessment Tables

Example Weekly Course outline	√
Grade Policy and Procedure	√
Recommended Instructional Materials (Textbooks, lab supplies, etc.)	√
Library resources and bibliography	√

Course Need Assessment.

Describe the need for this course. Include in your statement the following information.

Target Students who will take this course. Which programs or departments, and how many anticipated?	√
Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	√
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	√
Where does this course overlap with other courses, both within and outside of the department?	√
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	√
If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need.	NA

Course Design

Describe how this course is designed.	√
Course Context (e.g. required, elective, capstone)	√
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	√
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	√
How does this course support Programmatic Learning Outcomes?	√
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	√

Additional Forms for Specific Course Categories

[Interdisciplinary Form](#) (if applicable)

Interdisciplinary Committee Recommendation (if applicable and if received) *

*Recommendation must be received before consideration by full Curriculum Committee

[Common Core \(Liberal Arts\) Intent to Submit](#) (if applicable)

Writing Intensive Form if course is intended to be a WIC (under development)

If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.

(Additional materials for [Curricular Experiments](#))

NA

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).

Established Timeline for Curricular Experiment

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology		
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial		
Subject Area	Software Engineering Technology		
Course Prefix	SET		
Course Number	SET 4955		
Course Title	Software Engineering Technology in Robotics		
Catalog Description	Application of software engineering and technology concepts and practice in robotics. Subjects cover the design, analysis, synthesis, and testing of software systems for real-world robotic applications such as navigation, localization, mapping, manipulation, and coordination.		
Prerequisite	SET 3610		
Corequisite			
Pre- or corequisite	MAT 2580		
Credits	3		
Contact Hours	4 contact hours (2-hour lecture and 2-hour lab per week)		
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Course Attribute (e.g., Writing Intensive, etc.)			
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World		
Effective Term	Fall 2023		

**LIBRARY RESOURCES & INFORMATION LITERACY:
MAJOR CURRICULUM MODIFICATION**

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline**.

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1	Title of proposal SET 4955: Software Engineering Technology in Robotics	Department/Program Computer Engineering Technology (CET) / BTech in Computer Engineering Technology; BS in Software Engineering Technology
	Proposed by (include email & phone) Dr. Lili Ma, lma@citytech.cuny.edu /718-260-5885 Dr. Xiaohai Li, xhli@citytech.cuny.edu /718-260-5885	Expected date course(s) will be offered Fall 2023 # Of students: 22

2	<p>The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (http://cityte.ch/curriculum) for articles and ebooks for your courses, or our open educational resources (OER) guide (http://cityte.ch/oer). Have you considered using a freely-available OER or an open textbook in this course?</p> <p>As to the proposer's knowledge, there is no open textbook available for this course, but plenty open-source tech documentations available online which will be used in the class.</p>
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3	<p>Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g., ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.</p> <p>A search of the CityTech/CUNY library catalog and database with the keyword "Robotics" shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.</p>
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4	<p>Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.</p> <p>Once the course is offered, the department faculty teaching the course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.</p>
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5	<p>Library Faculty Subject Specialist Junior Tidal</p>
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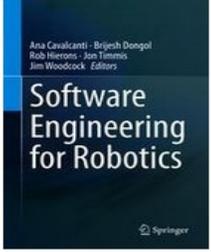
Comments and Recommendations

After surveying the collection, I believe that this course would benefit greatly with updated monographs and related materials related to modern robotics. It may be helpful for students to have supplementary texts in relation to topics in this course.

09.01.21

Sample Course Outline

Prepared by	Lili Ma and Xiaohai Li	Revision Date	9/7/2021
Course No. & Title	SET 4955: Software Engineering Technology in Robotics		
Course Description	Application of software engineering and technology concepts and practice in robotics. Subjects cover the design, analysis, synthesis, and testing of software systems for real-world robotic applications such as navigation, localization, mapping, manipulation, and coordination.		
Hours / Credits	3 credits, 2-hour lecture, 2-hour lab		
Pre-requisite	SET 3610		
Pre- / Co-requisite	MAT 2580		
Gen-Ed Objectives			
Course Objectives/ Student Learning Outcomes	<p>Upon successful completion of the course, students will obtain:</p> <ul style="list-style-type: none"> • Knowledge of basic software engineering principles and methods • Knowledge of how software engineering applies to robotics • Knowledge of the most common architectures, coordination and synchronization methods • Experience in design of robotic software systems with aspects of sensing, perception, and control 		
Gen-Ed Objectives	<ul style="list-style-type: none"> • Gather, interpret and evaluate information from a variety of sources • Have effective reading and written/oral communication skills • Function as an effective team member 		
Textbook	None		
Author			
Publisher / Year			
ISBN			
Reference Book	Software Engineering for Experimental Robotics		
Author	Davide Brugali (Editor)		
Publisher / Year	Spinger		
ISBN	ISBN-13: 978-3540689492 ISBN-10: 3540689494		

Reference Book	Software Engineering for Robotics	
Author	Ana Cavalcanti, Brijesh Dongol, Rob Hierons, Jon Timmis, Jim Woodcock (Editors)	
Publisher / Year	Springer, 2021	
ISBN	978-3-030-66493-0 978-3-030-66494-7	

Weekly Lesson Plan

Week #	Weekly Topics
1	Introduction to robotics and software engineering technology in robotics
2	Software engineering tools
3	Introduction to Robot Operating Systems (ROS)
4	Use of simulation for software development
5	Component-Based software design: Control structures; data flow
6	Inter-process communication
7	Software deployment and hardware integration
8	
9	Motion control and path planning for Autonomous Mobile Robot
10	
11	Kinematics, pick & place of a robotic Arm
12	
13	Image processing & computer vision for Robotics
14	
15	Artificial intelligence and deep learning for Robotics

COURSE POLICIES:**Grading:**

Midterm Exam	25%
Final Exam	25%
Labs	20%
Projects	20%
Classroom Participation	10%
Total	100%

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure that their Blackboard login works at the beginning of the course.
- Additional reading and reference materials will be directed to students for more information. The links to these materials will be posted on Blackboard as well.

Hardware and Software for Lab/Project:

- Desktop/laptop or single-board computer can be used for the lab and course project.
- Other open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard and/or installed on lab computers.

Submission of Lab Reports:

- Labs are supposed to be done individually.
- Projects are supposed to be done in groups with typically three students in one group.
- All lab/project reports need to be submitted on Blackboard before the specified due date & time.
- Any late reports will have a 30% late penalty per week. A submission that is more than three weeks late will not be taken.
- Additional requirements regarding lab report's content and format will be posted on Blackboard.

Class Participation:

Attendance and class participation are essential and excessive absences will affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to participation.

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Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
Have effective reading and written communication skills. Have effective oral communication skills.	Effective reading will be demonstrated by accurate interpretation of reading materials and lab experiments. Effective writing will be demonstrated in homework, exams and lab/project documentation.
Gather, interpret and evaluate information from a variety of sources.	Students will need to search and research of the current development in the field of robotics. Each group of students will give a brief oral presentation and live demonstration of their project.
Be able to work in a team and group while being aware of the ethical and conflict related situations in group dynamics.	Students will work together in groups to design and program a robotic system.

Course Specific Learning Outcomes	Assessment Methods
Knowledge of basic software engineering principles and methods	Analysis of student performance on related questions in homework and exams.
Knowledge of how software engineering applies to robotics	Analysis of student performance in labs/projects, presentation, and demonstration.
Knowledge of the most common architectures, coordination and synchronization methods	Analysis of student performance in labs/projects, presentation, and demonstration.
Experience in design of robotic software systems with aspects of sensing, perception, and control	Analysis of student performance in labs/projects, presentation, and demonstration.

Course Need Assessment

The need to offer a course on Software Engineering Technology in Robotics is presented by the current and leading technologies.

The synergy between robotics and software engineering is strategic. Their mutual benefit is to make it possible to build and evolve new software systems, to reduce their development cost, and to enhance their quality. The process of bringing intelligence to a robot requires strongly coupled capabilities of sensing, processing, and acting. In this scenario, software plays a key role as it is the medium to embody intelligence in the robotic systems [1].

The development of robotics drives the development of software design philosophy, architecture, and approaches, and vice versa. Due to the increasing complexity of tasks that are expected from robots, software design for robots need to consider many factors to make the software system efficient and easily-extendable, including for example, compatibility, integration of components, software architecture philosophy, reusability, and easy adaptation to newly-released hardware & software components.

This *Software Engineering Technology in Robotics* course provides opportunities for students to apply their knowledge of software engineering concepts and techniques to the challenging and fast evolving filed of robotics.

Course Design

The course will be offered to the SET senior students in the Computer Engineering Technology Dept. as a technical elective. It is expected that a section (22 students as maximum) will take this course in Spring and/or Fall semesters each year.

The course is structured as a combination of lecture sessions and hands-on lab/project sessions. This course can be offered both in-person and online. For online teaching, simulated robots will be used, instead of physical robots.

No additional physical resources are required since students will take this course in lieu of existing courses in the CET Department. Adequate equipment and resources in the CET Department are available for the hands-on experiments and projects. Several existing CET full-time faculty members are qualified and available to teach this course.

References

[1] Davide Brugali and Erwin Prassler, Software Engineering for Robotics, IEEE Robotics and Automation Magazine, March 2009.

New Course Proposal: SET4900 Internship in Software Engineering Technology

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM

This form is used for all new course proposals. Attach this to the [Curriculum Modification Proposal Form](#) and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Internship in Software Engineering Technology
Proposal Date	September 8, 2021
Proposer's Name	Farrukh Zia
Course Number	SET 4900
Course Credits, Hours	3 credits, 1 class hour*, 90 field work hours
Course Pre-Requisites	SET3610 and department approval
Catalog Course Description	<p>Assignment to field-work/study situations of a minimum of eight hours per week at one of the following: small, medium, or large companies or governmental institutions or non-profit organizations. Students may work in design, programming, software maintenance, debugging, or other appropriate activities related to the field of software engineering. Supervision provided by faculty and by the job supervisor.</p> <p>*Students keep a weekly log or journal shared and presented via Blackboard.</p>
<p>Brief Rationale</p> <p>Provide a concise summary of why this course is important to the department, school or college.</p>	<p>The objective of the internship is to give students the opportunity to:</p> <ul style="list-style-type: none"> • interact with knowledgeable and experienced professionals, • gain hands-on experience in their chosen field, • discuss their professional plans with their internship supervisor, and • develop professional relationships.
<p>CUNY – Course Equivalencies</p> <p>Provide information about equivalent courses within CUNY, if any.</p>	No
<p>Intent to Submit as Common Core</p> <p>If this course is intended to fulfill one</p>	No

of the requirements in the common core, then indicate which area.	
For Interdisciplinary Courses:	Not Applicable
Date submitted to ID Committee for review	
Date ID recommendation received	
- Will all sections be offered as ID? Y/N	
Intent to Submit as a Writing Intensive Course	No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL. Combine all information into a single document that is included in the Curriculum Modification Form.

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	√
Title, Number, Credits, Hours, Catalog course description	√
Brief Rationale	√
CUNY – Course Equivalencies	√
Completed Library Resources and Information Literacy Form	√
Course Outline	√
Include within the outline the following.	
Hours and Credits for Lecture and Labs	√
If hours exceed mandated Carnegie Hours, then rationale for this	
Prerequisites/Co- requisites	√
Detailed Course Description	√
Course Specific Learning Outcome and Assessment Tables	
Discipline Specific	√
General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	
Grade Policy and Procedure	√
Recommended Instructional Materials (Textbooks, lab supplies, etc)	
Library resources and bibliography	√
Course Need Assessment.	
Describe the need for this course. Include in your statement the following	

information.	
Target Students who will take this course. Which programs or departments, and how many anticipated? Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	
Where does this course overlap with other courses, both within and outside of the department?	
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	
If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need.	NA
Course Design	
Describe how this course is designed.	
Course Context (e.g. required, elective, capstone)	
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	
How does this course support Programmatic Learning Outcomes?	
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	
Additional Forms for Specific Course Categories	NA
Interdisciplinary Form (if applicable)	
Interdisciplinary Committee Recommendation (if applicable and if received)* *Recommendation must be received before consideration by full Curriculum Committee	
Common Core (Liberal Arts) Intent to Submit (if applicable)	
Writing Intensive Form if course is intended to be a WIC (under development)	
If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.	
(Additional materials for Curricular Experiments)	NA

Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).	
Established Timeline for Curricular Experiment	

Chancellor's Report Section AIV: New Courses

Department(s)	Computer Engineering Technology
Academic Level	<input checked="" type="checkbox"/> Regular <input type="checkbox"/> Compensatory <input type="checkbox"/> Developmental <input type="checkbox"/> Remedial
Subject Area	Software Engineering Technology
Course Prefix	SET
Course Number	4900
Course Title	Internship in Software Engineering Technology
Catalog Description	Assignment to field-work/study situations of a minimum of eight hours per week at one of the following: small, medium, or large companies or governmental institutions or non-profit organizations. Students may work in design, programming, software maintenance, debugging, or other appropriate activities related to the field of software engineering. Supervision provided by faculty and by the job supervisor. Students keep a weekly log or journal shared and presented via Blackboard.
Prerequisite	SET3610 and department approval
Corequisite	
Pre- or corequisite	
Credits	3
Contact Hours	1 class hour, 90 field work hours
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> English Composition <input type="checkbox"/> World Cultures <input type="checkbox"/> Speech <input type="checkbox"/> Mathematics <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Science <input type="checkbox"/> Creative Expression <input type="checkbox"/> Advanced Liberal Arts <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World

Effective Term	Fall 2023
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Rationale: The objective of the internship is to give students the opportunity to interact with knowledgeable and experienced professionals; gain hands-on experience in their chosen field; discuss their professional plans with their internship supervisor; and develop professional relationships.

LIBRARY RESOURCES & INFORMATION LITERACY: MAJOR CURRICULUM MODIFICATION

Please complete for **all** major curriculum modifications. This information will assist the library in planning for new courses/programs.

Consult with your library faculty subject specialist (<http://cityte.ch/dir>) **3 weeks before the proposal deadline.**

Course proposer: please complete boxes 1-4. Library faculty subject specialist: please complete box 5.

1	Title of proposal	Department/Program
	SET 4900	Computer Engineering Technology (CET) / BS in Software Engineering Technology (SET)
	Proposed by (include email & phone)	Expected date course(s) will be offered
	Prof. Farrukh Zia, fzia@citytech.cuny.edu Tel: 718-260-5885	Fall 2023 # of students 12

2 **The library cannot purchase reserve textbooks for every course at the college, nor copies for all students. Consult our website (<http://cityte.ch/curriculum>) for articles and ebooks for your courses, or our open educational resources (OER) guide (<http://cityte.ch/oer>). Have you considered using a freely-available OER or an open textbook in this course?**

As to the proposer's knowledge, a textbook is not required for this course, but there are plenty of OER available online which may be used in support of this course.

Beyond the required course materials, are City Tech library resources sufficient for course assignments? If additional resources are needed, please provide format details (e.g. ebook, journal, DVD, etc.), full citation (author, title, publisher, edition, date), price, and product link.

3

A search of the CityTech/CUNY library catalog and database with the keyword “software development career” or “software job market” shows sufficient print and electronic resources are available, some of which can be used as reference materials for this course.

Library faculty focus on strengthening students' information literacy skills in finding, critically evaluating, and ethically using information. We collaborate on developing assignments and customized instruction and research guides. When this course is offered, how do you plan to consult with the library faculty subject specialist for your area? Please elaborate.

4

Once the course is offered, the department faculty teaching this course may consult with the library faculty subject specialist to determine the future needs of textbook change or update, and acquisition of additional journals and online resources.

**Library Faculty Subject Specialist Junior Tidal
Comments and Recommendations**

I believe that the library’s collection is inadequate to fully support students who seek internships in today’s computer fields. I highly recommend that the library acquire more materials to aid students in various computer careers, internships, as well as resources to assist them in writing resumes and cover letters for those occupations. It may also be useful to add additional books related to technical writing and documentation.

5

09.14.21

Computer Engineering Technology Department
Software Engineering Technology Program

Sample Course Outline

Prepared by	Farrukh Zia	Revision date	August 2021
Course No. & Title	SET 4900 Internship in Software Engineering Technology		
Course Description	<p>Assignment to field-work/study situations of a minimum of eight hours per week at one of the following: small, medium, or large companies or governmental institutions or non-profit organizations. Students may work in design, programming, software maintenance, debugging, or other appropriate activities related to the field of software engineering. Supervision provided by faculty and by the job supervisor. Students keep a weekly log or journal shared and presented via Blackboard.</p>		
Hours / Credits	1 class hour, 90 field work hours / 3 credits		
Pre-requisite	SET3610 and department approval		
Co-requisite			
Gen-Ed Objectives	<ul style="list-style-type: none"> -Acquire discipline-specific knowledge. -Gather, interpret and evaluate information from a variety of sources. -Have effective reading and written/oral communication skills. 		
Course Objectives/ Student Learning Outcomes	<p>The objective of the internship is to give students the opportunity to:</p> <ul style="list-style-type: none"> • interact with knowledgeable and experienced professionals, • gain hands-on experience in their chosen field, • discuss their professional plans with their internship supervisor, and • develop professional relationships. 		
Textbook	Not Required		
Author			
Publisher / Year			
ISBN			

Lab Ref. Book	Not Required	
Author		
Publisher / Year		
ISBN		

Reading and Reference Materials:

- Katherine Murray, “Own Your Future”, Microsoft Press, 2010.
Library of Congress Control Number: 2010921007
- Additional reading and reference materials will be provided on Blackboard (under *Contents* section) as needed.
- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

COURSE POLICIES:

Grading:

The final grade (100%) depends upon:

- total number of weekly journal entries (30%),
- timeliness of weekly journal submission (30%),
- technical content of journal reports (30%),
- quality (spelling/grammar/formatting) of the journal reports (10%).

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

General Education Learning Outcomes	Assessment Methods
Acquire discipline specific knowledge.	Students will at minimum, demonstrate knowledge of basic technical terms related to the field of software engineering. This will be demonstrated by the

	contents of weekly journal reports.
Have effective reading and written communication skills.	Effective reading will be demonstrated by accurate interpretation of reading/reference materials and class instructions. Effective writing will be demonstrated in weekly journal reports.
Have effective oral communication skills. Gather, interpret and evaluate information from a variety of sources.	Students may be required to orally present their weekly journal reports in the form of an internship seminar to demonstrate effective communications skills while presenting information from a variety of internship work related sources.

Course Need Assessment

The objective of the internship is to give students the opportunity to gain hands-on experience in their chosen field; interact with knowledgeable and experienced professionals; discuss their professional plans with their internship supervisor; and develop professional relationships.

This course directly supports one of the program educational objectives, which states that graduates of the SWE BS program are expected to be employed, as software engineer or the equivalent, in positions beyond the entry-level for which this program has prepared them.

This course has no overlap with any other courses offered in the CET Department. According to the current College Catalog, this course also does not overlap with any course offered in any other departments at City Tech.

Course Design

The students will be able to research and apply to internship opportunities with external companies or organizations through the services and support provided by CUNY Internship Program (CIP) and City Tech Professional Development Center (PDC).

This course encompasses assignment to field-work/study situations of a minimum of eight hours per week at one of the following: small, medium, or large companies or governmental institutions or non-profit organizations. Students may work in design, programming, software maintenance, debugging, or other appropriate activities related to the field of software engineering. Supervision is provided by faculty and by the job supervisor. Students keep a weekly log or journal shared and presented via Blackboard.

The course will be offered as a technical elective to the SWE BS senior level students in the Computer Engineering Technology Department. It is expected that a section (11 or more students on average) will take this course when it is offered in both Spring and Fall semesters every year. Several existing CET full-time faculty with appropriate industry knowledge and experience, are qualified and available to supervise this internship course every semester.

Changes in Existing Courses

The proposed SET BS program will be hosted in the CET Department, along with CET degree program. To maximize the use of the education resources and take advantage of some existing courses in the department, CET Department decides to let these two degree programs share the same group of major courses in the first year. This will certainly provide students with more choice and opportunity to explore their interests and decide their career directions.

To facilitate the sharing of some major courses between CET program and the proposed SWE BS program, we propose to change five existing courses to the following courses: CET1111, CET1120, CET1150, CET1211, CET1250.

Changes in Existing Courses for CET 1111 Logic & Problem Solving

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](#) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

Title of Proposal	Logic and Problem Solving (CET 1111)
Date	July 2, 2021
Major or Minor	Major
Proposer's Name	Dr. Benito Mendoza Dr. Jose Reyes-Alamo
Department	Computer Engineering Technology
Date of Departmental Meeting in which proposal was approved	8/20/2020
Department Chair Name	Dr. Sunghoon Jang

Department Chair Signature and Date	
Academic Dean Name	Dr. Gerarda Shields
Academic Dean Signature and Date	
Brief Description of Proposal (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body).	Change in credit hours and catalog description. The change applied to the syllabus will allow the class to meet the requirements of the curriculum of the new Software Engineering Technology BS program and new AAS program in Computer Engineering Technology. The current EMT 1111 course is 1 credit 2 class hours. The change (CET1111) will allow for 3 credits and 2 class hours and 2 lab hours.
Brief Rationale for Proposal (Provide a concise summary of why this proposed change is important to the department. More detailed content will be provided in the proposal body).	We have found that 1 credit does not provides enough time to instruct and apply new hands-on practicum of engineering problem solving using computing and design thinking, for our first-year students. Ultimately, this change is part of a redistribution of credits in the program. The 2 credits will be taken from the Electrical Circuits course (EMT1150), going down from 5 to 3 credits.
Proposal History (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list).	This a modification for an existing course that will be used in a new program.

Changes to be offered in the Computer Engineering Technology Department

CUNYFirst Course ID	CET1111		
FROM:	EMT1111	TO:	<u>CET1111</u>
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	EMT 1111 Logic and Problem Solving	Course	<u>CET 1111 Logic and Problem Solving</u>
Prerequisite	CUNY proficiency in mathematics	Prerequisite	CUNY proficiency in mathematics
Corequisite		Corequisite	CET 1100
Pre- or corequisite		Pre- or corequisite	
Hours	2 hr. Lab, 1 cr.	Hours	<u>2 hr. Lecture, 2 hr. Lab, 3 cr.</u>
Credits	1	Credits	<u>3</u>
Description	This course introduces the foundations of problem-solving and computer programming as it is applied to electromechanical engineering technology. It provides a basic understanding of number systems and programming techniques with practical examples implemented in a modern programming language. Concepts are developed through hands-on laboratory exercises.	Description	<u>A practical introduction to the foundations of problem-solving and design thinking applied in computer and software engineering technology. Students are brought into the process of build physical computing systems that interact with the user or the environment through sensors and actuators. Students learn fundamental computational techniques, logic, creative problem solving, and iterative development through project-based learning.</u>
Requirement Designation	Required	Requirement Designation	Required
Liberal Arts	[] Yes [x] No	Liberal Arts	[] Yes [x] No

Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term	Fall 2023		Fall 2023

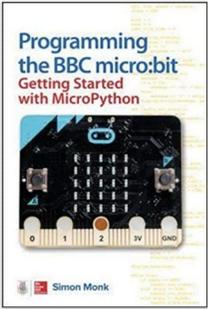
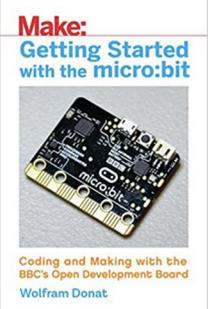
Rationale:

One of the main goals of a computer engineering technology program is to teach the technical skills to design and create computer systems composed of different types of hardware such as sensors, actuators, electronics, and networking devices, and software, following engineering principles. Perhaps, this is one of the main differences with other programs such as Computer Systems Technology and Computer Sciences, which are more focused on the software part. From the beginning of their studies, computer engineering technology students must learn to create solutions to problems or user needs using hardware and software systems that work efficiently. The original EMT1111 course is one credit and only two contact hours. The proposed course changes in credits and contact hours will allow to include project-based learning, design thinking, and

computational thinking to teach the foundations of technical skills our students need, and at the same time, get them excited about the program. With three credits and four contact hours, this is feasible. Ultimately, this change is part of a redistribution of credits in the program. The two credits will be taken from the Electrical Circuits course (EMT1150), going down from 5 to 3 credits.

Computer Engineering Technology Department
 AAS in Computer Engineering Technology
Sample Course Outline

Prepared by	Benito Mendoza	Revision date	8/2/2021
Course No. & Title	CET 1111 Logic and Problem-Solving		
Course Description	A practical introduction to the foundations of problem-solving and design thinking applied in computer and software engineering technology. Students are brought into the process of build physical computing systems that interact with the user or the environment through sensors and actuators. Students learn fundamental computational techniques, logic, creative problem solving, and iterative development through project-based learning.		
Hours / Credits	2 class hr., 2 lab hr. / 3 credits		
Pre-requisite	CUNY proficiency in mathematics		
Co-requisite	CET 1100		
Course Learning Outcomes	<p>Upon successful completion of this course, the students will be able to:</p> <ul style="list-style-type: none"> •Describe how internal and external parts of computing devices function to form a system. •Describe how computer hardware and software work together as a system to accomplish tasks. •Decompose problems into smaller, manageable subproblems to facilitate the program development process. •Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals, and functions. •Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. •Recognize different schemes used to represent data. •Use an iterative process to plan the development of a computer system or product by including others' perspectives and considering user preferences. •Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of computer system development. 		
Gen-Ed	SKILLS/Inquiry/Analysis: Employ scientific reasoning and logical thinking.		

Objectives	<p>SKILLS/Inquiry/Analysis: Use creativity to solve problems</p> <p>KNOWLEDGE/Lifelong learning: Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources.</p> <p>VALUES, ETHICS, AND RELATIONSHIPS/Professional/Personal Development: Demonstrate Intellectual honesty and personal responsibility.</p> <p>VALUES, ETHICS, AND RELATIONSHIPS/Professional/Personal Development: Work with teams, including those of diverse composition. Build consensus.</p>	
Textbook	None. Material will be provided by the instructor.	
References	<p>Programming the BBC micro:bit: Getting Started with MicroPython 1st Edition</p> <p>Author : Simon Monk</p> <p>Publisher : McGraw-Hill Education TAB; 1st edition (November 20, 2017)</p> <p>ISBN-10 : 1260117588</p> <p>ISBN-13 : 978-1260117585</p>	
	<p>Getting Started with the micro:bit: Coding and Making with the BBC's Open Development Board</p> <p>Author : Wolfram Donat</p> <p>Publisher : Make Community, LLC; 1st edition (September 19, 2017)</p> <p>ISBN-10 : 1680453025</p> <p>ISBN-13 : 978-1680453027</p>	
	<p>Making with MakeCode & Micro:bit</p> <p>Mary & Douglas Kiang</p> <p>Multiple formats available, some for free</p> <p>https://makecode.microbit.org/courses/csintro</p>	

Class Schedule

Week	Lecture	Lab
1	<p>Introduction: Introduction to the course, syllabus, objectives, how you will be assessed, academic integrity, and policies.</p> <p>How computers work</p> <ul style="list-style-type: none"> • Hardware and software • The Input, Process, Output (IPO) model • Algorithms and Programs 	<p>Lab 1: Getting started with MicroPython</p> <p>Mu – what is an IDE?</p> <p>The IPO model with Python</p> <p>When would you be 100 years old?</p>
2	<p>Computer programming I</p> <ul style="list-style-type: none"> • Variables and Data Types: Numbers, Strings, Booleans • Control Flow: sequence, conditionals, iterations 	<p>Lab 2: Getting started with Micro:Bit</p> <ul style="list-style-type: none"> • Importing • Scroll display • Input: Buttons / how they work • Events and Event handling (interrupts) • Vending Machine
3	<p>Functions</p> <ul style="list-style-type: none"> • Functions as commands, arguments • User defined functions • Returning values • Parameters, arguments, scope 	<p>Lab 3: Making a conductivity Tester</p> <p>micro:bit's pins as inputs</p> <p>micro:bits to test the electrical conductivity of materials</p>
4	<p>Computers and the technology around us</p> <ul style="list-style-type: none"> • Types of computers • What is a microcontroller? • Internet and the Cloud • Internet of Things (IoT) 	<p>Lab 4: Sensor gadget</p> <ul style="list-style-type: none"> • Types of sensors • Temperature sensor • Light Sensor • Microphone • Making a meter
5	<p>The Design Thinking Process</p> <p>5. Empathize, Define, Ideate, Prototype, Test</p> <p>6. Design thinking/coding by design</p>	<p>Project I - A Physical Digital Pet (micro:PET)</p> <ul style="list-style-type: none"> • Requirements • Success criteria • Project Brainstorming • Ideating a solution with a micro:bit
6	<p>Conditionals Revisited</p> <ul style="list-style-type: none"> • Nested conditional • Chain conditionals 	<p>micro:PET</p> <ul style="list-style-type: none"> • Designing the product [7] Making [8] Prototyping, testing, iterating
7	<p>Booleans</p> <ul style="list-style-type: none"> • Complex Boolean expressions 	<p>micro:PET</p> <ul style="list-style-type: none"> • Demo, Elevator speech

	<ul style="list-style-type: none"> • Logic Gates 	<ul style="list-style-type: none"> • Evaluation
8	Data Structures <ul style="list-style-type: none"> • Lists, Tuples, Sets 3. Dictionaries 	Project II - Energy awareness <ul style="list-style-type: none"> • Requirements • Success criteria • Project Brainstorming • Ideating a solution with a micro:bit
9	Iterations Revisited <ul style="list-style-type: none"> 4. Traversing Lists and Strings 5. While loop 21. Traversing Dictionaries 	Project II - Energy awareness <ul style="list-style-type: none"> • Designing the product [9] Making • Prototyping, testing, iterating
10	Searching algorithms <ul style="list-style-type: none"> 22. Linear search 6. Binary search 	Project II - Energy Awareness Project <ul style="list-style-type: none"> • Demo, Elevator speech • Evaluation
11	Data Representation <ul style="list-style-type: none"> • ASCII • Bitmaps • Sound 	Lab 5: Binary Watch <ul style="list-style-type: none"> • Understand why computers use binary numbers • Converting between denary and binary
12	Computer Networks and Communication <ul style="list-style-type: none"> • Radio communication • Channels and strength 	Lab 6: Transmitting messages <p>12. Ciphers</p>
13	Final Project: IoT-Smart Cities <ul style="list-style-type: none"> 13. Requirements 14. Success Criteria 15. Teams 16. Project Brainstorming: Choosing a goal 	Final Project: IoT-Smart Cities <ul style="list-style-type: none"> • Ideating a solution • Roles and responsibilities • Working in parallel • Designing the product
14	Final Project: IoT-Smart Cities <ul style="list-style-type: none"> • Make, coding, test, iterate 	Final Project: IoT-Smart Cities <ul style="list-style-type: none"> • Make, coding, preparing presentation
15	Presentations	Presentations <p>Wrap up and evaluation</p>

COURSE POLICIES:**Grading:**

•Quizzes	15 %
•Lab Exercises	15 %
•Project I:	20 %
•Project II:	20 %
•Final Project	30 %
•Total:	100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login is working in the beginning of the course.

Reading and Reference Material:

- Reading and reference material will be provided in Blackboard and OpenLab–Contents section as needed.

Software for Lab / Project:

- Free or open-source software applications will be used in the labs and course project. The main programming language is Python, Mu Editor (Both Open source). The links to download the software will be posted in Blackboard.

Lab and Project Reports:

- Lab reports must be in Word .doc file format.

- All lab reports must be submitted through Blackboard – Assignments section.
- Additional requirements on lab report's content and format will be posted on Blackboard. Please read them carefully.

Library Usage:

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

Statement of Diversity and Inclusive Education

This course welcomes students from all backgrounds, experiences and perspectives. In accordance with the City Tech and CUNY missions, this course intends to provide an atmosphere of inclusion, respect, and the mutual appreciation of differences so that together

we can create an environment in which all students can flourish. It is the instructor's goal to provide materials and activities that are welcoming and accommodating of diversity in all of its forms, including race, gender identity and presentation, ethnicity, national origin, religion, cultural identity, socioeconomic background, sexuality and sexual orientation, ability, neurodivergence, age, and etc. Your instructor is committed to equity and actively seeks ways to challenge institutional racism, sexism, ableism and other forms of prejudice. Your input is encouraged and appreciated. If a dynamic that you observe or experience in the course concerns you, you may respectfully inform your instructor without fear of how your concerns will affect your grade. Let your instructor know how to improve the effectiveness of the course for you personally, or for other students or student groups.

Assessment Methods

Course Learning Outcomes/assessment methods

Course Learning Outcomes	Assessment
Students will be able to ...	
Understand how internal and external parts of computing devices function to form a system.	Quiz and Labs 1 and 2
Describe how computer hardware and software work together as a system to accomplish tasks.	Lab 3 and Project 2
Decompose problems into smaller, manageable subproblems to facilitate the program development process.	Quiz and Lab 4
Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals, and functions.	Quiz, Projects 1, 2, and final project.
Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.	Quiz, Labs 5 and Lab 6.
Recognize different schemes used to represent data.	Quiz, Lab 5
Use an iterative process to plan the development of a computer system or product by including others' perspectives and considering user preferences.	Projects 1, 2, and Final Project

Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of computer system development.	Projects 1, 2, and Final Project
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General education learning outcomes/assessment methods

Learning outcomes

Assessment

SKILLS/Inquiry/Analysis: Employ scientific reasoning and logical thinking.

Projects and Labs: Observing at the logic, and the effectiveness of the solutions presented.

SKILLS/Inquiry/Analysis: Use creativity to solve problems

Final Project: Observing the creativity used to frame a problem and design a solution. This will be an element of the grading rubric.

KNOWLEDGE/Lifelong learning: Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources.

Final Project: Observing the analysis and design documentation and the list of resources from the library and internet used to complete the project.

VALUES, ETHICS, AND RELATIONSHIPS/Professional/Personal Development: Demonstrate Intellectual honesty and personal responsibility.

Projects and Lab Exercises: Reports and presentation most following the CUNY Academic Integrity policy

VALUES, ETHICS, AND RELATIONSHIPS/Professional/Personal Development: Work with teams, including those of diverse composition. Build consensus.

Projects: Observing the distribution of activities, responsibilities, and cooperation of each member of the team. This will be an element of the grading rubric.

Course Design

The course will be offered to the freshmen students in the AAS in Computer Engineering Technology Program and the Software Engineering Technology BS program in the Computer Engineering Technology Department. It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture sessions, hands-on lab sessions, and projects, following a Project-Based Learning approach. The hands-on sessions include lab exercises, experiments, and group projects.

Students will need a micro:bit v2 Go Bundle - with Batteries and USB Cable, caiman wires, speaker, and a servo motor, which cost around \$35. No additional resources are required. Adequate equipment and resources in the CET Department are available for the hands-on components (lab experiments and projects) of this course. Several existing CET full-time faculty members are qualified and available to teach this course every semester.

References

- [4] Kelly, N., & Gero, J. (2021). Design thinking and computational thinking: A dual process model for addressing design problems. *Design Science*, 7, E8. doi:10.1017/dsj.2021.7
- [5] Dym, C.L., Agogino, A.M., Eris, O., Frey, D.D. and Leifer, L.J. (2005), Engineering Design Thinking, Teaching, and Learning. *Journal of Engineering Education*, 94: 103-120. <https://doi.org/10.1002/j.2168-9830.2005.tb00832.x>
- [6] Denning, P. J. (2013). Design thinking. *Communications of the ACM*, 56(12),29-31.
- [7] Soleimani, A. (2019). Computational Design Thinking and Thinking Design Computing. In 2019 Reynolds Symposium: Education by Design. Portland, Oregon, October 18-19, 2019
- [8] Wing, J. (2008). Computational thinking and thinking about computing. *Philosophical Transactions Of The Royal Society A: Mathematical, Physical And Engineering Sciences*, 366(1881), 3717-3725

Changes in Existing Courses for CET1211 Introduction to Objected-Oriented Programming in Software Design

New York City College of Technology, CUNY

CURRICULUM MODIFICATION PROPOSAL FORM

This form is used for all curriculum modification proposals. See the [Proposal Classification Chart](#) for information about what types of modifications are major or minor. Completed proposals should be emailed to the Curriculum Committee chair.

Title of Proposal	Introduction to Objected-Oriented Programming in Software Design
Date	September 14, 2021
Major or Minor	Major
Proposer's Name	Dr. Yu Wang Dr. Lili Ma
Department	Computer Engineering Technology
Date of Departmental Meeting in which proposal was approved	9/9/2021
Department Chair Name	Dr. Sunghoon Jang
Department Chair Signature and Date	
Academic Dean Name	Dr. Gerarda Shields
Academic Dean Signature and Date	
Brief Description of Proposal (Describe the modifications contained within this proposal in a succinct summary. More detailed content will be provided in the proposal body.)	Changes in credit hours and course content. These changes will allow this course to meet the requirements of the curriculum of the new AAS program in Computer Engineering Technology. The current course is 1 credit (3-hr labs). The modified course will be 2 credits (1 class hour and 2 lab hours)
Brief Rationale for Proposal (Provide a concise summary of	Knowledge on object-oriented programming (OOP) is intensively needed by the CET BTech major. This course, together with two other courses, implements a carefully-planned streamlined

<p>why this proposed change is important to the department. More detailed content will be provided in the proposal body).</p>	<p>sequence of (three) programming courses in CET, starting from the AAS and leading into the BTech degree. The course serves as an intermediate-level programming course, introducing students to object-oriented programming concepts, widely-used data structures, and real-world embedded systems design applications. By building solid foundation in OOP, this course prepares students for more advanced programming and software usage in upper-level programming course(s).</p>
<p>Proposal History (Please provide history of this proposal: is this a resubmission? An updated version? This may most easily be expressed as a list).</p>	<p>This a modification for an existing course that will be used in a new program.</p>

Please include all appropriate documentation as indicated in the Curriculum Modification Checklist.

For each new course, please also complete the New Course Proposal and submit in this document.

Please submit this document as a single .doc or .rtf format. If some documents are unable to be converted to .doc, then please provide all documents archived into a single .zip file.

Changes to be offered in the Computer Engineering Technology Department

CUNYFirst Course ID	038726		
FROM:	EMT2480L	TO:	<u>CET1211</u>
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	Electromechanical Systems Design Laboratory	Course	Introduction to Objected-Oriented Programming in Software Design
Prerequisite	EMT 2320, PHYS 1433 or PHYS 1441, ENG 1101	Prerequisite	<u>CET 1100 and CET 1111</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	<u>MAT 1275CO or MAT1275 or higher</u>
Hours	3-cl hrs	Hours	<u>1 hr. Class, 2 hr. Labs</u>
Credits	1	Credits	<u>2</u>
Description	This course introduces the foundations of problem-solving and computer programming as it is applied to electromechanical engineering technology. It provides a basic understanding of number systems and programming techniques with practical examples implemented in a modern programming language. Concepts are developed through hands-on laboratory exercises.	Description	<u>Introduction to Object-Oriented programming (OOP) in software design and applications. Topics include modern software engineering principles, object-oriented paradigm, classes, objects, methods, attributes, encapsulation, abstraction, inheritance, polymorphism, and OOP designing applications in real-world situations.</u>
Requirement Designation	Required	Requirement Designation	Required
Liberal Arts	[] Yes [x] No	Liberal Arts	[] Yes [x] No

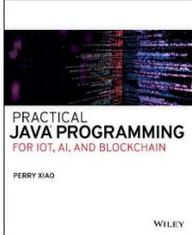
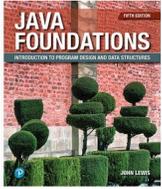
Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale:

Knowledge of object-oriented programming (OOP) is intensively needed by the CET BTech major. This course, together with CET1111 and CET2410, implements a carefully-planned, streamlined sequence of (three) programming courses in CET, starting from the AAS and leading into the BTech degree. The course serves as an intermediate-level programming course, introducing students to object-oriented programming concepts, widely-used data structures, and real-world embedded systems design applications. By building solid foundation in OOP, this course prepares students for more advanced programming and software usage in upper-level programming course(s).

Computer Engineering Technology Department
AAS in Computer Engineering Technology
Sample Course Outline

Prepared by	Yu Wang, Lili Ma	Revision Date	9/14/2021
Course No. & Title	CET 1211 Introduction to Objected-Oriented Programming in Software Design		
Course Description	Introduction to Object-Oriented programming (OOP) in software design and applications. Topics include modern software engineering principles, object-oriented paradigm, classes, objects, methods, attributes, encapsulation, abstraction, inheritance, polymorphism, and OOP designing applications in real-world situations.		
Hours / Credits	1 class hour, 2 lab hours / 2 credits		
Pre-requisite	CET 1100 and CET 1111		
Pre- / Co-requisite	MAT 1275CO or MAT1275 or higher		
Course Learning Outcomes	<p>Upon successful completion of this course, the students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate knowledge of object-oriented programming principles and implementation. • Comprehend building blocks of OOPs language, classes, objects, methods, attributes, inheritance, package, and interfaces. • Given a problem specification, demonstrate capability of designing mid-sized object-oriented programs. • Application of OOP concepts and programming skills to real-world embedded systems design applications. 		
Gen-Ed Objectives	<ul style="list-style-type: none"> • SKILLS/Inquiry/Analysis: Students will employ scientific reasoning & logical thinking. • INTEGRATION/Integrate Learning: Students will resolve difficult issues creatively by employing multiple systems and tools. • KNOWLEDGE/Lifelong Learning: Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources. 		

Textbooks	<p>Textbook 1:</p> <p>Title: Starting Out with Java: From Control Structures through Data Structures, 4th Edition</p> <p>Author: Tony Gaddis, Godfrey Muganda</p> <p>Publisher: Pearson, 2019</p> <p>ISBN-13: 978-0134787961</p>	
	<p>Textbook 2:</p> <p>Title: Practical Java Programming for IoT, AI, and Blockchain</p> <p>Author: Perry Xiao</p> <p>Publisher: Wiley; 1st edition (July 23, 2019)</p> <p>ISBN-13: 978-1119560012</p> <p>ISBN-10: 1119560012</p>	
Reference:	<p>John Lewis, Peter DePasquale, and Joe Chase, “Java Foundations: Introduction to Program Design and Data Structures, 5th Edition”, 2020 Pearson, ISBN-13: 9780135206591</p>	
	<p>Stuart Reges and Marty Stepp, “Building Java Programs: A Back-to-Basics Approach, 5th Edition”, Pearson; 4th edition (2017), ISBN-13: 978-0135471944</p>	

Weekly Lesson Plan:

Week #	Topic	Chapter
1	Course outline, classroom conduct, academic integrity, attendance, and grading policy. Intro to OOP programming in software design.	Ch 1, 2
2	Decision Structures, Class, Files class; Scanner class; String class; and Random class Lab: Writing and reading files	Ch 3, 4
3	Look at classes and objects, UML Diagram; Problem Solving with Methods Lab: Writing a Simple Class	Ch 5, 6
4	Array List Class, Array Algorithms and Operations Lab: Arrays with Search Algorithm	Ch 7
5	Focus on Object-Oriented Programming in Software Design Lab: Write a program to illustrate supper and sub classes	Ch 8
6	More about Wrapper Classes and Parse methods Lab: Write a program for text processing	Ch 9
7	Midterm exam	
8	Inheritance, Polymorphism, Abstract Classes Lab: Implement an inheritance	Ch 10
9	Encapsulation, Interface, and Polymorphism with Interfaces Lab: multiple interface implementation	Ch 10
10	Exceptions and Handling Exceptions Lab: Input/Output Streams and advanced File I/O	Ch 11
11	GUI Programming and basic Controls Lab: GUI design	Ch 12
12	Deploy of JAVA programing in real-world applications. Candidates include Image Processing, Artificial Intelligence (AI), or Internet of Things (IoT), and etc.	Ch 6,7,8 (Textbook 2)
13		
14		

15	Final Project Demonstration	
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COURSE POLICIES:

Grading:

•Midterm Exam:	20 %
•Quizzes:	20 %
•Labs and Assignments:	40 %
•Final Project	20 %
•Total:	100 %

Score %	< 60	60-69.9	70-76.9	77-79.9	80-82.9	83-86.9	87-89.9	90-92.9	93-100
Grade	F	D	C	C+	B-	B	B+	A-	A

Blackboard:

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their Blackboard login works in the beginning of the course.

Hardware and Software for Lab/Project:

- Desktop/laptop can be used for the lab and course project.
- Open-source or free software/library will be used in the labs and course project. Links to download the software/library will be posted on Blackboard.

Labs and Assignments:

- Weekly assignments will be posted. Each assignment equally contributes to the final grade.
- Labs and assignments will be done individually. See Blackboard for detailed instructions.
- All weekly assignments must be submitted through Blackboard.
- No late submission will be accepted.

Mid Term and Final Exam:

- The Mid-Term exam will cover content from weeks 1 to 7.
- The Final Exam will be cumulative.

Classroom Conduct Policy:

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity Policy:

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instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

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Assessment Methods

Course Learning Outcomes	Assessment Methods
Demonstrate knowledge of object-oriented programming principles and implementation.	Quizzes, Exams, and Labs
Comprehend building blocks of OOPs language, classes, objects, methods, attributes, inheritance, package, and interfaces.	Quizzes, Exams, and Labs
Given a problem specification, demonstrate capability of designing mid-sized object-oriented programs.	Labs
Application of OOP concepts and programming skills to real-world embedded systems design applications.	Projects

General Education Learning Outcomes	Assessment Methods
SKILLS/Inquiry/Analysis: Students will employ scientific reasoning and logical thinking.	Students will write solutions to complex problems and demonstrate efficiency of their solutions. This will be demonstrated by the lab work, quizzes, and exams.

<p>INTEGRATION/Integrate Learning: Students will resolve difficult issues creatively by employing multiple systems and tools.</p>	<p>Students will use creative, scientific, and logical thinking for selecting the building blocks of OOPs language to solve complex problems. This will be demonstrated by the lab work and project.</p>
<p>KNOWLEDGE/Lifelong Learning: Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources.</p>	<p>Students will learn and acquire new knowledge & skills demanded by the Tech industry. This will be demonstrated by the project.</p>

Course Design

This course will be offered to freshmen students of the AAS in Computer Engineering Technology Program in the Computer Engineering Technology Department (CET). It is expected that a section (22 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

Many modern engineering systems incorporate computational elements, while other engineering systems need to be validated through computational tools or computer-aided data collection. This course is designed to provide a foundation in objected-oriented programming, software engineering, debugging, and using existing computational codes in the context of controlling physical devices and gathering experimental data.

There is no similar course content with 2 credits available within City Tech. Currently, CST offers CST3513 – Object-Oriented Programming with 3 credits, introducing the fundamentals of object-oriented programming. We design the course based on our computer engineering program needs, focusing more on activities to prepare students to apply OOP principles to software and embedded system designs. Starting with the fundamentals of Java programming to algorithms, continuing to mid-sized object-oriented programming and design, the course also provides samples of real-world applications, such as Image Processing, Artificial Intelligence (AI), and Internet of Things (IoT). In this course, Java will be used as the tool for helping students to learn these OOP concepts and digital technologies.

Each session includes one hour of lecture and two hours of assisted lab work. Labs are assigned with each lecture by emphasizing understanding of the principles behind OOP and providing opportunities to practice OOP skills demanded by the software and embedded system design industry. This course is designed to serve the current CET majors (AAS and BTech) and a future Software Engineering Technology BS curriculum.

The course is structured as a combination of lecture sessions and hands-on lab sessions. The course is designed to be taught both in-person and online, via the following three types of activities:

- Lectures
- Lab Assignments
- Tutorials/Project

No additional physical resources are required. The required software and development tools, together with the textbook, are Open Source/free. For in-person teaching, this course will take place in one of the computer labs in the CET department. Under e-learning, students will use their own computers.

Several existing faculty members in the CET department are qualified and available to teach this course. Adequate equipment and lab resources are also available for the hands-on component of the course.

Changes in Existing Courses for CET1120 Technical Graphics

Changes to be offered in the Computer Engineering Technology Department

CUNYFirst Course ID	038709		
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	EMT 1120 Technical Graphics	Course	<u>CET 1120</u> Technical Graphics_
Prerequisite	None	Prerequisite	
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	3 lab hrs	Hours	
Credits	1	Credits	
Description	<p>Training in basic orthographic projection and isometric drawing using sketching as a tool. Included are standard symbols and representations used in the electromechanical field, assembly drawings, charts, graphs, electrical and electronic schematics and timing charts. Extensive use of electrical, electronic, mechanical and electromechanical visual aids.</p>	Description	<p><u>This course will provide theory and training on basic 2D mechanical drawings along with electrical / electronics drawings. Student is introduced to graphic communication through the use of drafting instruments and AutoCad software.</u></p>
Requirement Designation	Required	Requirement Designation	Required
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No
Course		Course	

Attribute (e.g. Writing Intensive, Honors, etc		Attribute (e.g. Writing Intensive, Honors, etc	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: EMT 1120 is an existing course in CET Department. It is streamlined and tailored to be CET 1120 with updated course description, which is to be shared by the proposed SET BS program and CET program.

Changes in Existing Courses for CET1150

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID	038711		
FROM:	EMT1150	TO:	CET1150
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	EMT-1150-Electrical-Circuits	Course	CET 1150 Fundamentals of Electrical Circuits
Prerequisite		Prerequisite	
Corequisite		Corequisite	
Pre- or corequisite	MAT 1275 or MAT 1275CO or higher, EMT 1120, EMT 1130	Pre- or corequisite	CET 1100, MAT 1275 or MAT 1275CO or higher
Hours	4 hr. Lecture, 3 hr Lab	Hours	2 hr. Lecture, 3 hr. Lab
Credits	5	Credits	3
Description	Introduction to the basic principles of direct current circuits. Topics include the basic techniques to analyze DC linear circuit network, such as series, parallel and series-parallel circuits, network theorems, equivalent circuits. Laboratory experiments include circuit simulation, breadboarding, measurement techniques and troubleshooting.	Description	Introduction to the basic principles of direct current circuits. Topics include the basic techniques to analyze DC linear circuit network, such as series, parallel and series-parallel circuits, network theorems, equivalent circuits. Laboratory experiments include circuit simulation, breadboarding, measurement techniques and troubleshooting.
Requirement Designation	Required	Requirement Designation	Required
Liberal Arts	[] Yes [x] No	Liberal Arts	[] Yes [x] No
Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	

Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale:

EMT1150 was a 5-credit course with 4 lecture hours and 3 lab hours. It was a heavy course for freshman students and usually had only 60% to 70% passing rate. This course is one of the most important reasons for low retention rate in CET department. In this proposal, EMT1150 is modified to suit for freshman students. Alternating current (AC) circuit is removed and only direct current (DC) circuit is introduced in CET1150. Two lecture hours and three lab hours can balance the needs between theory and experiments. Ultimately, this change is part of a redistribution of credits in the curriculum of the new AAS program in Computer Engineering Technology. This course will be a common core course shared by the new SET BS program.

Sample Course outline

New York City College of Technology

Computer Engineering Technology Department

BTech Program in Computer Engineering Technology

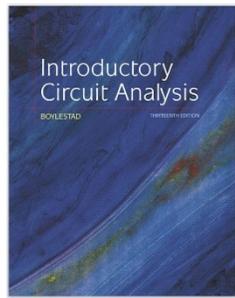
CET1150: Electrical Circuits

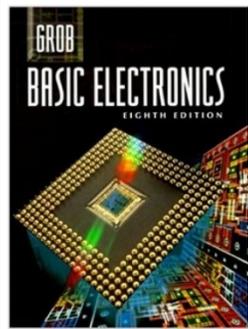
Prepared by	Chen Xu, Ohbong Kwon, Robert Armstrong	Revision date	9/8/2022
Course No. & Title	CET1150: Fundamentals of Electrical Circuits		
Course Description	Introduction to the basic principles of direct current circuits. Topics include the basic techniques to analyze DC linear circuit network, such as series, parallel and series-parallel circuits, network theorems, equivalent circuits. Laboratory experiments include circuit simulation, breadboarding, measurement techniques and troubleshooting.		
Hours / Credits	2 lecture hours, 3 lab hours, 3 credits		
Pre-requisite			
Pre- / Co-requisite	CET1100, MAT 1275 or MAT 1275CO or higher		
Gen-Ed Objectives	<ul style="list-style-type: none"> • SKILLS/Inquiry/Analysis: Employ scientific reasoning and logical thinking. • SKILLS/Inquiry/Analysis: Use critical thinking to solve problems • SKILLS/Communication: Students will communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means • VALUES, ETHICS, AND RELATIONSHIPS/Professional/Personal Development/Demonstrate Intellectual honesty and personal responsibility. • KNOWLEDGE/Lifelong learning/Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources 		
Course Objectives/ Student Learning Outcomes	<p>Upon successful completion of this course, students shall be able to</p> <ul style="list-style-type: none"> ○ Demonstrate a basic understanding of engineering expressions and basic concepts, such as current, voltage, resistance, and power ○ Understand Ohm's law and use it to analyze basic series, parallel, and series-parallel circuits ○ Understand basic network theorems, especially using Thevenin's Theorem to find an equivalent circuit ○ Connect basic circuits on breadboard, and measure voltage, current, and 		

	<p>resistance using Multimeter</p> <ul style="list-style-type: none"> ○ Perform simple troubleshoots and fix problems in electrical circuits ○ Perform circuit computer simulations to assist problem solving. ○ Demonstrate proficiency in oral and written communication skills using appropriate technology ○ Demonstrate the ability to function effectively as a member of a team.
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Recommended Instructional Materials

Textbooks and Reference Books

Text book (required)	Introductory Circuit Analysis, Thirteenth Edition	
Author	Robert L. Boylestad	
Publisher	Pearson Education Inc. 2016	
ISBN	ISBN: 978-0-13-392360-5	

Reference book (optional)	Grob's Basic Electronics	
Author	Mitchel E Schultz	
Publisher	McGraw-Hill Education, 2015	
ISBN	ISBN:978-0-07-337387-4	

Lab material:

- Lab Manual provided by the CET Department

Reading and Reference Materials:

- Openlab course website
- DC Circuit, Chad Davis, University of Oklahoma
- Additional reading and reference materials will be provided on Blackboard as needed

Wk	Weekly Topics	
	Lecture	Lab
1	Course outline, classroom conduct, academic integrity, attendance, and grading policy. Introduction (Ch. 1), Systems of Units and conversion, Scientific and Engineering Notation	Math review
2	Voltage and Current (Ch. 2), Voltage, Current, Voltage Sources, Ampere Hour Rating, Battery Life Factors, Conductors and Insulators, Semiconductors	Multisim simulation
3	Resistance (Ch. 3), Resistance: Circular Wires, Wire Tables, Temperature Effects, Types of Resistor, Color Coding and Standard Resistor Values, Conductance, Ohmmeters, Metric Units.	Multimeter and resistance
4	Ohm's Law, Power and Energy (Ch. 4), Ohm's Law, Plotting Ohm's Law, Power, Energy.	Breadboard introduction and voltage current measurements with Multimeter
5	Series DC Circuits (Ch. 5), Series Resistors, Series Circuits, Kirchhoff's Voltage Law, Voltage Division in a Series Circuit.	Ohm's Law
6	Parallel DC Circuits (Ch. 6), Parallel Resistors, Parallel Circuits, Kirchhoff's Current Law, Current Divider Rule, Open and Short Circuits.	Measurement in series circuits
7	Mid-Semester Exam	Measurement in parallel circuits
8	Series-Parallel Circuits (Ch. 7), Series-Parallel Networks, Reduce and Return Approach, Block Diagram Approach, Descriptive Examples.	Measurements in series and parallel circuits
9	Series-Parallel Circuits (Ch. 7), Ladder Networks, Voltage Divider Supply (Unloaded and Loaded), Potentiometer Loading, Applications, Computer Analysis.	bridge circuit
10	Method of Analysis (Ch. 8) Current source, mesh analysis	Trouble shooting (I)
11	Network Theorem (Ch. 9), Source conversion	Trouble shooting (II)
12	Network Theorem (Ch. 9), Thevenin's Theorem.	Thevenin theorems (I)
13	Network Theorem (Ch. 9), Application of Thevenin's Theorem.	Thevenin theorems (II)

14	Review For Final Exam	Lab makeup
15	Final exam	Final exam

Course Policies

Grading Policy:

Quizzes, homework	20%
Class Midterm Exam	20%
Lab session	25%
Final Examination	25%
Attendance and Class Participation	10%

If students failed the lab session, the course is automatically failed.

Letter Grade	Numerical Grade	Ranges Quality
A	93-100	4.0
A-	90-92.9	3.7
B+	87-89.9	3.3
B	83-86.9	3.0
B-	80 -82.9	2.7
C+	77-79.9	2.3
C	70-76.9	2.0
D	60-69.9	1.0
F	59.9 and below	0.0

Blackboard

- Blackboard will be used extensively to provide course material, collect assignments and reports and provide detailed grading information. Students must make sure their blackboard login is working in the beginning of the course. Students are suggested to access the class webpage on blackboard for new materials every school day during the semester.

Library Resources

- Students are encouraged to use the library for supplementary resources in support of the lectures and labs.

Software for Lab

- Software applications will be used in the labs and course project. The links to download the software will be posted in Blackboard.

Lab Reports

- Lab reports must be submitted on time.
- Lab reports must be in Doc or PDF file format.
- All lab reports must be submitted through Blackboard – Assignments section.
- Each lab report is due one week after the lab work is performed.
- Any late-due lab report will have late penalty one week after due date.
- Additional requirements on lab report's content and format will be posted on Blackboard. Please read them carefully.

Attendance & Class Participation

Attendance and class participation are essential and excessive absences will affect the final grade. Missed class time includes not only absences but also lateness and early departures, which will impact the portion of the final grade allocated to attendance and class participation.

Classroom Conduct Policy

- Cell phone ringing and any other distracting and disruptive behavior such as talking loudly without permission are absolutely prohibited and may cause the student to be expelled from class.
- Any activity that threatens the college academic integrity will result in a disciplinary action.
- Please refer to the Student Handbook and the Catalog of New York City College of Technology for a full listing of Student Code of Conduct, Classroom Behavior Guidelines and Academic Integrity Rules.

Academic Integrity

- Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity.
- Academic dishonesty is prohibited in The City University of New York. Penalties for academic dishonesty include academic sanctions, such as failing or otherwise reduced grades, and/or disciplinary sanctions, including suspension, or expulsion.
- The CUNY Academic Integrity Policy is clearly published and distributed to students via the following methods: the NYCCT web site, the Instructional Staff Handbook, the Student Handbook, and via the College email system.

Disabilities Statement

If you have special needs addressed by the Americans with Disabilities Act (ADA) and need course materials in an alternative format, please notify me immediately. Reasonable efforts will be made to accommodate your special needs.

Course Assessment Criteria

Upon successful completion of this course, students shall be able to	Evaluation methods and criteria
Demonstrate a basic understanding of engineering expressions and basic concepts, such as current, voltage, resistance, and power	Analysis of student performance on quiz, lab reports, homework, and exams.
Understand Ohm's law and use it to analyze basic series, parallel, and series-parallel circuits	Analysis of student performance on homework, quiz and class participation, exams.
Understand basic network theorems, especially using Thevenin's Theorem to find an equivalent circuit	Analysis of student performance in quiz, hand-on lab experiments, lab reports, and exams.
Connect basic circuits on breadboard, and measure voltage, current, and resistance using Multimeter	Analysis of student performance in hand-on lab experiments and lab reports.
Perform simple troubleshoots and fix problems in electrical circuits	Analysis of student performance in hand-on lab experiments and lab reports.
Perform circuit computer simulations to assist problem solving	Analysis of student performance in lab reports, homeworks and discussions.

General Education Outcomes and Assessment:

Learning Outcomes	Assessment Method
SKILLS/Inquiry/Analysis: Employ scientific reasoning and logical thinking	This will be demonstrated by class discussion, homework, exams and lab reports.
KILLS/Inquiry/Analysis: Use critical thinking to solve problems	This will be demonstrated by class discussion, homework, exams and lab reports.
SKILLS/Communication: Students will communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means.	Effective reading will be demonstrated by accurate interpretation of reading/reference materials and weekly lab procedures. Effective writing will be demonstrated in lab reports.
VALUES, ETHICS, AND RELATIONSHIPS/Professional/Personal Development/Demonstrate Intellectual honesty and personal responsibility	Students will work together in groups to do lab works and complete lab report individually. They will demonstrate personal responsibility and intellectual honesty in their lab works, homework, and exams.
KNOWLEDGE/Lifelong learning/Acquire tools for lifelong learning—how to learn, how they learn, knowledge of resources	Students will learn the knowledge accumulation and development in the field. They will learn the concept of metacognition through the semester and use it in their learning process.

Course Design

The course will be offered as a common core to the freshmen students in the new SET BS program and a new CET AAS program in the Computer Engineering Technology Department. It is expected that a section (20 students as maximum) will take this course when it is offered in both Spring and Fall semesters every year.

The course is structured as a combination of lecture sessions and hands-on lab sessions. Students need to purchase a lab kit for the lab session. The hands-on sessions include lab exercises, and experiments. Adequate equipment and resources in the CET Department are available for the hands-on components of this course. Several existing CET full-time faculty members are qualified and available to teach this course every semester.

Changes in Existing Courses for CET1250

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID	038715		
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	EMT 1250 Fundamentals of Digital Systems	Course	<u>CET 1250 Fundamentals of Digital Systems</u>
Prerequisite	EMT 1111, EMT 1130, EMT 1150	Prerequisite	<u>CET 1150</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	3 cl hrs, 3 lab hrs	Hours	
Credits	4	Credits	
Description	An introduction to digital logic and the basic building blocks used in digital systems. Students learn Boolean algebra and switching functions, logic gates and flip-flops, combinational and sequential logic circuits, memory elements, programmable logic devices, and computer-aided design tools for digital systems design, simulation, and testing. The laboratory provides hands-on experiences through Prototyping Circuit Boards, Programmable Logic (such as FPGAs) Prototyping Boards, and Hardware Description Language (HDL).	Description	
Requirement Designation	Required	Requirement Designation	Required
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No

Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	<u>Writing Intensive</u>
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: EMT 1250 is an existing course in CET Department, and its prefix code is changed to CET. This course will be shared by the proposed SET BS program and CET program.

Changes in Existing Tech Electives

- **Changes in Existing Courses for CET4910**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4910 Digital Image Processing	Course	CET 4910 Digital Image Processing
Prerequisite	CET 3625 or departmental approval	Prerequisite	<u>CET 3625 or SET 3510 or departmental approval</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	2 cl hrs, 2 lab hrs	Hours	
Credits	3	Credits	
Description	Introduction to the fundamental concepts and techniques of digital image processing. Topics include image display and image acquisition, sampling and quantization, two-dimensional discrete Fourier transform, spatial and frequency domain linear image filtering, noise model, image restoration, and image compression and segmentation.	Description	
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No
Course Attribute (e.g.		Course Attribute (e.g.	

Writing Intensive, Honors, etc		Writing Intensive, Honors, etc	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4910 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4915**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4915 Agile Testing of Embedded Software	Course	CET 4915 Agile Testing of Embedded Software
Prerequisite	CET 3510	Prerequisite	CET 3510
Corequisite		Corequisite	
Pre- or corequisite	CET 3640	Pre- or corequisite	CET 3640; For SET students: SET3610 only
Hours	3 cl hrs, 3 lab hrs	Hours	
Credits	4	Credits	
Description	Introduction to the theory and principles of testing embedded software. Topics cover the basics of test design, test automation, testdriven development, Agile principles, values, techniques, practices, procedures and tools. The lab and cases provide the opportunity to apply theory in practical ways in designing tests during the phases of embedded software development.	Description	
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No
Course Attribute (e.g.		Course Attribute (e.g.	

Writing Intensive, Honors, etc		Writing Intensive, Honors, etc	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4915 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4920**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4920 Introduction to Computer Vision	Course	CET 4920 Introduction to Computer Vision
Prerequisite	CET 3640	Prerequisite	<u>CET 3640 or SET3510</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	3 cl hrs, 3 lab hrs	Hours	
Credits	4	Credits	
Description	Introduction to the fundamentals and basic application techniques of computer vision. Topics include image formation, camera model and imaging geometry, image processing, feature detection, background subtraction and visual tracking. Students use the latest hardware and software tools to design and develop a prototype computer vision application. The course requires a background in object-oriented programming and microprocessor.	Description	
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No

Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4920 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4925**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4925 Internet of Things	Course	CET 4925 Internet of Things
Prerequisite	CET 4711 or department approval	Prerequisite	<u>CET 4711 or SET 3510 or department approval</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	2 cl hrs, 2 lab hrs	Hours	
Credits	3	Credits	
Description	Introduction to the architecture of Internet of Things (IoT) and the basics of key technologies for developing an IoT system, including physical computing, communication and connectivity. A variety of IoT implementations and applications are introduced. Students use some of the technologies with experimental hardware platforms to implement a prototype IoT system.	Description	
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No
Course		Course	

Attribute (e.g. Writing Intensive, Honors, etc		Attribute (e.g. Writing Intensive, Honors, etc	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4925 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4935**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4935 Wearable Computing	Course	CET 4935 Wearable Computing
Prerequisite	For Emerging Media Technology students only MTECH 2230 and MTEC 2280	Prerequisite	<u>For SET students: SET3510; For Emerging Media Technology students only MTECH 2230 and MTEC 2280</u>
Corequisite		Corequisite	
Pre- or corequisite	CET 4711 or department approval	Pre- or corequisite	CET 4711 or department approval
Hours	2 cl hrs, 2 lab hrs	Hours	
Credits	3	Credits	
Description	Introduction to the basics of existing and emerging technologies that can be used for a wearable computing application. Compact and energy efficient computing platforms, mini/micro actuators, wearable sensors, wireless communication technologies, personal area network, body area network, and a variety of wearable computing examples are discussed. Other related topics including electronic textiles, virtual reality and augmented reality are	Description	

	also introduced. Students create prototype wearable computing projects by applying the technologies with an experiment platform.		
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Liberal Arts	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4935 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4952**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4952 Robotics Technology	Course	CET 4952 Robotics Technology
Prerequisite	CET 3510	Prerequisite	<u>CET3510 or SET3510</u>
Corequisite		Corequisite	
Pre- or corequisite	MAT 2580 Potential substitute for CET 3550 or CET 4762	Pre- or corequisite	MAT 2580 Potential substitute for CET 3550 or CET 4762
Hours	3 cl hrs, 3 lab hrs	Hours	
Credits	4	Credits	
Description	Geometric configurations and classifications of robots, work envelope, drive components (electric, hydraulic, pneumatic), computer controls and interfacing, sensors and data acquisition/handling and conversion. Lab projects using a robot/ computer system.	Description	
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No

Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4952 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4960**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4960 Applied Digital Technology	Course	CET 4960 Applied Digital Technology
Prerequisite	MAT 1575 or higher; EMT 2410 or CST 2403	Prerequisite	<u>MAT 1575 or higher; CET1211 or CST 2403</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	3 cl hrs, 3 lab hrs	Hours	
Credits	4	Credits	
Description	An introduction to the use of the digital computer for measurements of real-world signals and control of realworld devices. Students program data acquisition and control hardware in a high-level language such as C.	Description	
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No
Course Attribute (e.g. Writing Intensive,		Course Attribute (e.g. Writing Intensive,	

Honors, etc		Honors, etc	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4960 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4962**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4962 Applied Software Technology	Course	CET 4962 Applied Software Technology
Prerequisite	MAT 1575 or higher; EMT 2410 or CST 2403	Prerequisite	<u>MAT 1575 or higher; CET1211 or CST 2403</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	3 cl hrs, 3 lab hrs	Hours	
Credits	4	Credits	
Description	Development of hardware-oriented programming skills. Students write programs to access external devices via the serial port or other interfaces.	Description	
Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No
Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	
Course	[X] Major	Course	[X] Major

Applicability	<input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Applicability	<input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4962 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

- **Changes in Existing Courses for CET4973**

Changes to be offered in the Computer Engineering Technology department

CUNYFirst Course ID			
FROM:		TO:	
Department(s)	Computer Engineering Technology	Department(s)	Computer Engineering Technology
Course	CET 4973 Introduction to Artificial Intelligence	Course	CET 4973 Introduction to Artificial Intelligence
Prerequisite	CET 4711 (or department approval)	Prerequisite	<u>CET 4711 or SET 3510 or department approval</u>
Corequisite		Corequisite	
Pre- or corequisite		Pre- or corequisite	
Hours	3 cl hrs, 3 lab hrs	Hours	
Credits	3	Credits	
Description	Introduction to basic methods of Artificial Intelligence (AI) such as searching, knowledge representation, problem solving and learning. Through discussions, small projects and examples, students learn what AI is, some of the major developments in the field, promising directions and the techniques for making computers exhibit intelligent behavior. Students make use of available development tools and explore some areas of application such as recommender systems, natural language processing, robotics and machine learning.	Description	

Requirement Designation	Tech Elective	Requirement Designation	Tech Elective
Liberal Arts	[] Yes [X] No	Liberal Arts	[] Yes [X] No
Course Attribute (e.g. Writing Intensive, Honors, etc)		Course Attribute (e.g. Writing Intensive, Honors, etc)	
Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts	Course Applicability	<input checked="" type="checkbox"/> Major <input type="checkbox"/> Gen Ed Required <input type="checkbox"/> English Composition <input type="checkbox"/> Mathematics <input type="checkbox"/> Science <input type="checkbox"/> Gen Ed - Flexible <input type="checkbox"/> World Cultures <input type="checkbox"/> US Experience in its Diversity <input type="checkbox"/> Creative Expression <input type="checkbox"/> Individual and Society <input type="checkbox"/> Scientific World <input type="checkbox"/> Gen Ed - College Option <input type="checkbox"/> Speech <input type="checkbox"/> Interdisciplinary <input type="checkbox"/> Advanced Liberal Arts
Effective Term			Fall 2023

Rationale: CET4973 is an existing tech elective in CET Department. Its requisites are revised to allow SET BS students to take as tech elective.

Appendix A: Letters of Support

1. From Amazon



Xiaohai Li, Ph. D.
Assistant Professor
Department of Computer Engineering Technology
New York City College of Technology
City University of New York
186 Jay Street, V633
Brooklyn, NY 11201

Dear Professor Li,

On behalf of AWS Academy, I am pleased to express our support for New York City College of Technology's new Bachelors of Science in Software Engineering Technology. If the program is approved, it is our intent to support it through the institution's membership in the AWS Academy Program. AWS Academy provides higher education institutions with a free, ready-to-teach cloud-computing curriculum that prepares students to pursue industry-recognized certifications and in-demand cloud jobs. Our curriculum helps educators stay at the forefront of AWS Cloud innovation so that they can equip students with the skills they need to work in one of the fastest-growing industries.

As described in the AWS Academy Terms and Conditions, New York City College of Technology is eligible to receive program benefits that include support from a Program Manager and Technical Program Manager assigned to guide the institution's educators through the AWS Academy instructor accreditation process. Program benefits also include access to AWS Academy curriculum designed to help educators easily integrate AWS into educational programs, and discounts on a wide variety of AWS training and certifications.

AWS values and appreciates the opportunity to support New York City College of Technology, and look forward to a long and productive collaboration. If you have any questions, or require additional information, please contact Ariella Belopolsky at 617-577-4930 or ariella@amazon.com the AWS Academy Program Manager for New York City College of Technology.

Sincerely,

Tracy Applegate

Global Sales Leader,
AWS Academy Program

Amazon Web Services, Inc. 400 Terry Avenue North Seattle, WA 98109-5210



2. From Broadridge



51 Mercedes way
Edgewood, NY 11717

February 28, 2022

Xiaohai Li, PhD

Department of Computer Engineering Technology
New York City College of Technology
City University of New York
300 Jay Street
Brooklyn, NY 11201

Dear Dr. Li,

I'm writing to express support for your department's plans to establish a Bachelor of Science in Software Engineering Technology program at the New York City College of Technology/CUNY.

As one of the leading financial service firms in the world, Broadridge continually seeks to hire qualified software engineers. According to the U.S. Department of Labor, Employment of software developers is projected to grow 22 percent from 2019 to 2029, much faster than the average for all occupations. As new technology (such as AI and cloud computing) is adopted by the financial service industry, many employers struggle to find qualified candidates to fill their open positions.

The financial service industry relies on learning institutions, such as the New York City College of Technology of CUNY, to provide a steady stream of highly trained software engineers. We look forward to learning more about this new degree program as you progress in its development, and wish you the best as you undertake this worthwhile endeavor.

Sincerely,

A handwritten signature in black ink, appearing to read "minglu".

Ming Lu

Email: Ming.lu@broadridge.com
Lead Software Engineer
Department of Investment Communication Service
Broadridge Financial Service Inc.
M: 516-736-4023
T: 631-257-4441
www.broadridge.com

3. From Queensborough Community College (QCC):



DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

February 18, 2022

Dr. Xiaohai Li
Associate Professor
Director, Robotics & Intelligent Systems Lab
Department of Computer Engineering Technology
New York City College of Technology
City University of New York

186 Jay Street, V633
Brooklyn, NY 11201
Tel: 718-260-4942
Fax: 718-260-5425

Dear Dr. Li,

I have received your proposal of a new Bachelor of Science in Software Engineering Technology (SET) degree program in your department and would like to express our full support to the program.

The demand for software engineers and software developers in the region and nation has been very high for quite some time now, and shows no sign of stopping. With the continuing growth of tech industry in NYC, it is no doubt that more software engineers and software developers will be needed in coming years. Job and career opportunities would be especially favorable for those who have a strong education background and knowledge in Software Engineering.

This proposed degree program will be a valuable alternative for the graduates of Department of Mathematics and Computer Science at QCC, who want to continue on for a bachelor degree. It would provide them with excellent opportunity to further their education and start a rewarding career in related fields. I fully support and welcome your proposed BS degree program in Software Engineering Technology.

Sincerely,

A handwritten signature in black ink that reads 'Haishen Yao'.

Dr. Haishen Yao
Chair, Department of Mathematics and Computer Sciences,
Queensborough Community College
City University of New York
Email: HYao@qcc.cuny.edu

718-631-6361
FAX 718-631-6290
Science, Room 245
222-05 56th Avenue
Bayside, NY 11364-1497

ONE COMMUNITY. INFINITE POSSIBILITIES.

4. From Borough of Manhattan Community College (BMCC):



Computer Information Systems

Borough of Manhattan Community College
The City University of New York

199 Chambers St., F930
New York, NY 10007
phone 212-220-1476
fax 212-220-1287

March, 29, 2022

To Whom It May Concern,

I am pleased to express my enthusiastic support for the proposal of a B.S. in Software Engineering Technology at the New York City College of Technology.

Software Engineer is a new engineering discipline concerned with all aspects pertaining to software production. It encompasses concepts, principles, theories, techniques, and tools to develop high-quality professional software. The U.S. Bureau of Labor Statistics projects 22% growth for Software Developers, Quality Assurance Analysts, and Testers from 2020 to 2030, a much faster-than-average growth rate. With the rise in the number of students who decide to pursue a degree in software development at BMCC, such a program would allow them to pursue their academic career for a B.S. in Software Engineering by transferring to Software Engineering Technology at New York City College of Technology.

Having a careful curriculum design, the proposed program that consists of 30 credits of computer essentials, 15 credits of software engineering technology core, and 15 credits of tech electives prepares the students well for the industry needs. This program will widen the variety of opportunities available to students at BMCC.

I do not doubt that this new program will advance Software Engineering Technology education and benefit CUNY students. Please feel free to contact me if you have any questions regarding this supporting letter.

Sincerely,

Don Wei, Ph.D.
Professor, Chairperson
Computer Information Systems Department
BMCC, CUNY

Appendix B: Articulation Agreement Drafts

1. With BMCC CS AS Program:

THE CITY UNIVERSITY OF NEW YORK
ARTICULATION AGREEMENT (Draft)
between
BOROUGH of MANHATTAN COMMUNITY COLLEGE
and
NEW YORK CITY COLLEGE OF TECHNOLOGY
Effective Date:

A. SENDING AND RECEIVING INSTITUTIONS

Sending Institution: Borough of Manhattan Community College (BMCC)
 Department: Computer Information Systems
 Program: Computer Science (CS)
 Degree: Associate in Science (A.S.)

Receiving Institution: New York City College of Technology (City Tech)
 Department: Computer Engineering Technology
 Program: Software Engineering Technology (SET)
 Degree: Bachelor of Science (BS)

B. REQUIREMENTS FOR SENIOR COLLEGE PROGRAM

- I. Admission requirement for students wishing to transfer to NYC College of Technology's Software Engineering Technology (SET) Bachelor of Science (BS) degree program under this agreement:
 - a. The AAS degree and a minimum GPA of 2.0
 - c. GPA of 2.5 or better in major courses
2. Total transfer credits granted toward the baccalaureate degree: 60 credits
3. Total additional credits required at the senior college to complete the baccalaureate degree: 60 credits.
4. Acceptance into this program will be under the requirements in effect at the time of admission and may be subject to such changes as shall be determined by NYC College of Technology's academic policies and curricula.
5. Certification of graduation at NYC College of Technology requires a cumulative GPA of 2.0. This 2.0 GPA is also required in the SET program.

C. COURSE EQUIVALENCIES OR/AND TRANSFER CREDIT AWARDED

Upon the admission requirements are satisfied, BMCC graduates who complete the Associate in Sciences degree (A.S.) in Computer Science will receive 60 credits transferred toward the Bachelor of Science (B.S.) degree in Software Engineering Technology at NYCCT.

BMCC Associate in Science in Computer Science Degree Requirements

Required Common Core

English Composition	6
Mathematical and Quantitative Reasoning ¹	3
Life and Physical Sciences ²	3
TOTAL REQUIRED COMMON CORE	12

Flexible Common Core

Creative Expression ³	3
Individual and Society	3
Scientific World ⁴	6
U.S. Experience in Its Diversity	3
World Cultures and Global Issues	3
TOTAL FLEXIBLE COMMON CORE	18
TOTAL COMMON CORE	30

Curriculum Requirements

CSC 111 Introduction to Programming	4
CSC 211 Advanced Programming Techniques	3
CSC 215 Fundamentals of Computer Systems	3
CSC 231 Discrete Structures and Applications to Computer Science	4
CSC 331 Data Structures	3
CSC 350 Software Development	3
MAT 302 Analytic Geometry and Calculus II	4
General Electives ⁵	6
TOTAL CURRICULUM REQUIREMENTS	30
TOTAL PROGRAM CREDITS	60

1 MAT301 is advised to be taken to satisfy the area of Mathematical & Quantitative Reasoning.

2 PHY215 is advised to be taken to satisfy the area of Life & Physical Sciences.

3 SPE100 is advised to be taken to satisfy the area of Creative Expression.

4 CSC101 is advised to be taken to satisfy the area of Scientific World.

5 Some general electives credits can be satisfied by STEM variants taken in the Common Core.

D. SENIOR COLLEGE COURSES REMAINING FOR BACCALAUREATE DEGREE

The following credits are to be earned at NYC College of Technology.

General Education:

College Option:		
Speech/Oral Communication	COM1330 or higher	3
Interdisciplinary Course	Any	3
Program-Specific Degree Requirements:		
Calculus II	MAT1575	4
Probability and Statistics I	MAT2572	4
Introduction to Linear Algebra	MAT2580	3
Subtotal		17 credits

Major Courses:

CET1150	Electrical Circuits	3
CET1250	Fundamentals of Digital Systems (current EMT1250)	4
SET2330	Cloud Database Fundamentals	3
SET2440	System Programming	3
SET3510	Software Requirements Engineering	3
SET3530	Cloud Computing & Networking	3
SET3630	Cybersecurity Fundamentals	3
SET4710	Software Testing & Quality Assurance	3
SET4810	Software Capstone Design	3
Technical Electives	Choose any five from the following: CET4925 Internet of Things CET4973 Introduction to Artificial Intelligence CET4910 Digital Image Processing CET4920 Introduction to Computer Vision SET4955 Software Engineering Technology in Robotics SET4940 Embedded Operating Systems SET4900 Internship in Software Engineering Technology	15
Subtotal		43 credits

Note: Students must complete two courses designated as Writing Intensive (WI) at New York City College of Technology for the baccalaureate degree, one in liberal arts and one in the discipline.

2. With QCC CIS AAS Program:

THE CITY UNIVERSITY OF NEW YORK
ARTICULATION AGREEMENT (Draft)
between
QUEENSBOROUGH COMMUNITY COLLEGE
and
NEW YORK CITY COLLEGE OF TECHNOLOGY
Effective Date:

A. SENDING AND RECEIVING INSTITUTIONS

Sending Institution: Queensborough Community College (QCC)

Department: Business Department

Program: Computer Information Systems (CIS) Program

Degree: Associate of Applied Science (AAS)

Receiving Institution: New York City College of Technology (City Tech)

Department: Computer Engineering Technology

Program: Software Engineering Technology (SET)

Degree: Bachelor of Science (BS)

B. REQUIREMENTS FOR SENIOR COLLEGE PROGRAM

I. Admission requirement for students wishing to transfer to NYC College of Technology's Software Engineering Technology (SET) Bachelor of Science (BS) degree program under this agreement:

- a. The AAS degree and a minimum GPA of 2.0
- c. GPA of 2.5 or better in major courses

2. Total transfer credits granted toward the baccalaureate degree: 60 credits

3. Total additional credits required at the senior college to complete the baccalaureate degree: 60 credits.

4. Acceptance into this program will be under the requirements in effect at the time of admission and may be subject to such changes as shall be determined by NYC College of Technology's academic policies and curricula.

5. Certification of graduation at NYC College of Technology requires a cumulative GPA of 2.0. This 2.0 GPA is also required in the SET program.

C. COURSE EQUIVALENCIES OR/AND TRANSFER CREDIT AWARDED

Upon the admission requirements are satisfied, the following transfer credits will be awarded to the baccalaureate degree:

General Education Requirements:

Queensborough Community College Computer Information Systems (CIS)	
Course Number & Title	Credits
ENGL-101: English Composition I	3
ENGL-102: English Composition II	3
MA-114 or MA-128 or MA-260 or MA-321	4
Life & Physical Sciences: (Select from 1C)	4
*ECON-101: Macroeconomics or ECON-102: Microeconomics	3
*Flexible Core: 2A, 2B, 2C, 2D: Humanities Elective	3
*Flexible Core 2A, 2B, 2D, or 2E: Social Science or History Elective - Recommended PSYC-101	3
Subtotal	23

Requirements for the Major:

Queensborough Community College Computer Information Systems (CIS)	
Course Number & Title	Credits
*BU-101: Principles of Accounting I	4
*BU-201: Business Organization and Management	3
BU-203: Principles of Statistics	3
CIS-101: Introduction to Computers and Applications	3
CIS-102: Computer Programming Fundamentals for Business	3
CIS-152: Computer Programming for Business I	3
CIS-153: Microcomputer Operating Systems and Utility Software	3
CIS-201: Local Area Network Management	3
CIS-208: Database Management Systems	3
CIS-251: Analysis and Design of Systems Projects	3
Subtotal	31

Electives:

Queensborough Community College Computer Information Systems (CIS)	
Course Number & Title	Credits
CIS-204: Web Design - Recommended	3
CIS-254: Data Security for Business - Recommended	3
Subtotal	6

D. SENIOR COLLEGE COURSES REMAINING FOR BACCALAUREATE DEGREE

The following credits are to be earned at NYC College of Technology.

General Education:

Flexible Core: Creative Expression, World Culture & Global Issues, Individual & Society, US Experience and Diversity, Scientific World	Any two courses from two categories that have not been taken in QCC	6
College Option: Speech/Oral Communication Interdisciplinary Course	COM1330 or higher Any	3 3
Program-Specific Degree Requirements:		
Calculus I	MAT1475	4
Calculus II	MAT1575	4
Introduction to Linear Algebra	MAT2580	3
Subtotal		23 credits

Major Courses:

CET1150	Electrical Circuits	3
CET1250	Fundamentals of Digital Systems (current EMT1250)	4
SET2320	Computer Architecture	3
SET2430	Algorithmic Design & Data Structures	3
SET3510	Software Requirements Engineering	3
SET3610	Software Architecture and Design	3
SET4710	Software Testing & Quality Assurance	3
SET4810	Software Engineering Technology Capstone Project	3
Technical Electives	Choose any four 3-credits courses from SET4900 series or CET4900 series.	12
Subtotal		37 credits

Note: Students must complete two courses designated as Writing Intensive (WI) at New York City College of Technology for the baccalaureate degree, one in liberal arts and one in the discipline.

E. SUMMARY OF CREDITS

Total Credits transferred from QCC	60
Total Credits to be earned at NYC College of Technology:	
• General Education	23
• Major courses	37
Total Credits required for the SET BS degree	120

Appendix C: Sample Job Postings

1. Software Engineer in Financial Industry

(position in *JP Morgan Chase*, retrieved at indeed.com in June 2021)

The screenshot shows a web browser window displaying a job listing on Indeed. The URL is <https://www.indeed.com/viewjob?jk=1b9e7e5c82a2fcb2&tk=1fev3ccavhirg802&fr>. The page features a search bar with the text "What Job title, keywords, or company" and "Where New York, NY". A "Find Jobs" button is visible. The job title is "Software Engineer" at "JPMorgan Chase Bank, N.A." with a rating of 4.5 stars and 8,624 reviews. The location is "New York, NY" and the job type is "Full-time". A button labeled "Apply On Company Site" is present. The "Job details" section shows "Job Type: Full-time". The "Full Job Description" section begins with: "As a member of our Software Engineering Group, we look first and foremost for people who are passionate around solving business problems through innovation and engineering practices. You'll be required to apply your depth of knowledge and expertise to all aspects of the software development lifecycle, as well as partner continuously with your many stakeholders on a daily basis to stay focused on common goals. We embrace a culture of experimentation and constantly strive for improvement and learning. You'll work in a collaborative, trusting, thought-provoking environment-one that encourages diversity of thought and creative solutions that are in the best interests of our customers globally." It lists requirements such as a BS/BA degree, advanced knowledge of application, data, and infrastructure architecture disciplines, and proficiency in programming languages. The "Company Info" section includes the JPMorgan Chase logo and a "Follow" button. A "Let employers find you" section has an "Upload your resume" button.

Software Engineer
 JPMorgan Chase Bank, N.A. ★★★★★ 8,624 reviews
 New York, NY
 Full-time
 You must create an Indeed account before continuing to the company website to apply

[Apply On Company Site](#)

Job details

Job Type
 Full-time

Full Job Description

As a member of our Software Engineering Group, we look first and foremost for people who are passionate around solving business problems through innovation and engineering practices. You'll be required to apply your depth of knowledge and expertise to all aspects of the software development lifecycle, as well as partner continuously with your many stakeholders on a daily basis to stay focused on common goals. We embrace a culture of experimentation and constantly strive for improvement and learning. You'll work in a collaborative, trusting, thought-provoking environment-one that encourages diversity of thought and creative solutions that are in the best interests of our customers globally.

This role requires a wide variety of strengths and capabilities, including:

- BS/BA degree or equivalent experience
- Advanced knowledge of application, data, and infrastructure architecture disciplines
- Understanding of architecture and design across all systems
- Working proficiency in developmental toolsets
- Knowledge of industry-wide technology trends and best practices
- Ability to work in large, collaborative teams to achieve organizational goals
- Passionate about building an innovative culture
- Proficiency in one or more modern programming languages
- Understanding of software skills such as business analysis, development, maintenance, and software improvement

JPMorgan Chase & Co., one of the oldest financial institutions, offers innovative financial solutions to millions of consumers, small businesses and many of the world's most prominent corporate, institutional and government clients under the J.P. Morgan and Chase brands. Our history spans over 200 years and today we are a leader in investment banking, consumer and small business banking, commercial banking, financial transaction processing and asset management.

We recognize that our people are our strength and the diverse talents they bring to our global workforce are directly linked to our success. We are an equal opportunity employer and place a high value on diversity and inclusion at our company. We do not discriminate on the basis of any protected attribute, including race, religion, color, national origin, gender, sexual orientation, gender identity, gender expression, age, marital or veteran status, pregnancy or disability, or any other basis protected under applicable law. In accordance with applicable law, we make reasonable accommodations for applicants' and employees' religious practices and beliefs, as well as any mental health or physical disability needs.

Equal Opportunity Employer/Disability/Veterans

JPMorgan Chase
 5 days ago
[original job](#)

Company Info



[Follow](#)

Get job updates from JPMorgan Chase Bank, N.A.

JPMorgan Chase Bank, N.A.
 ★★★★★ 8,624 reviews

One of the most respected companies in the world, Chase offers experienced professionals like you an array of opportunities to take your ...

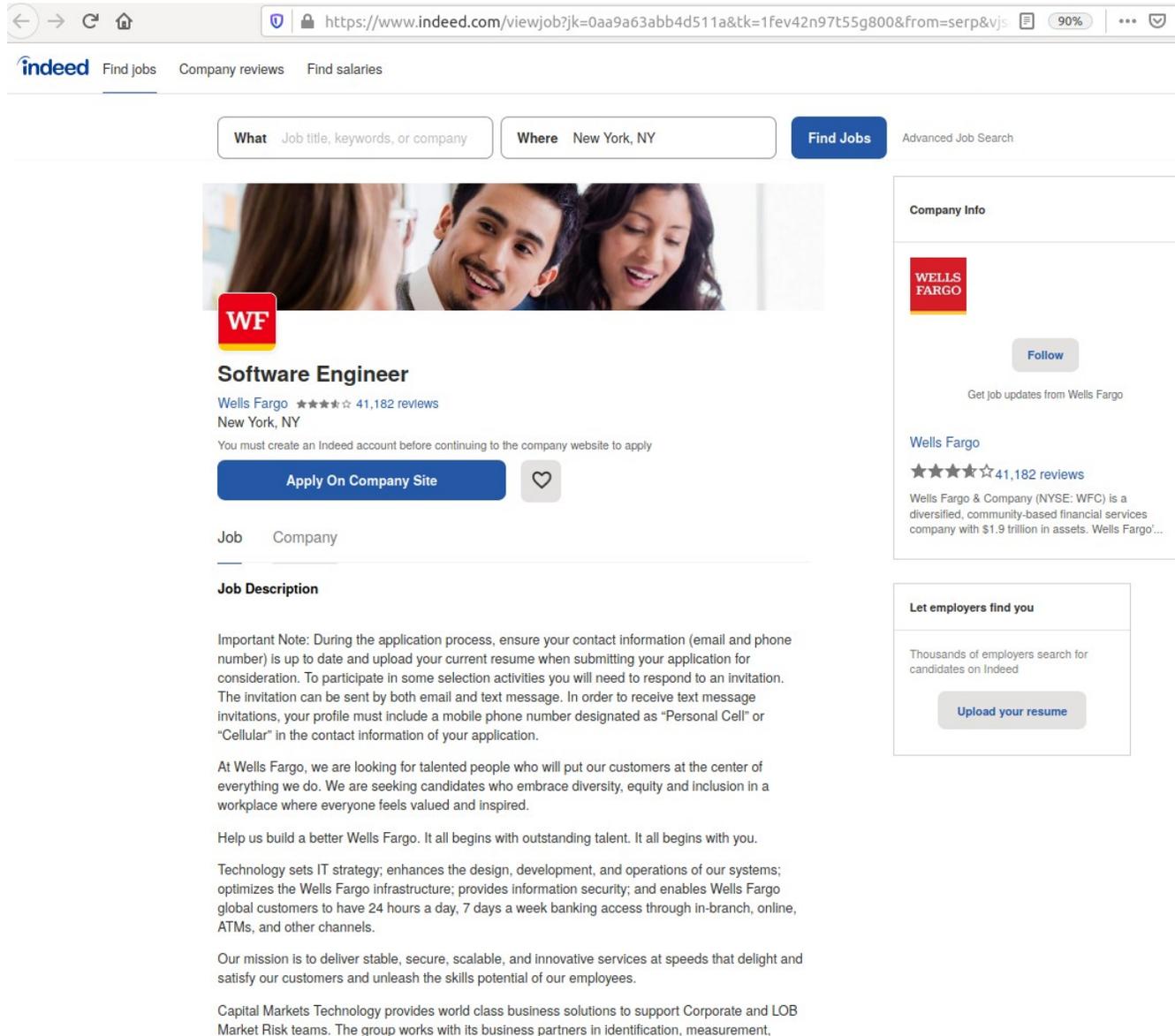
Let employers find you

Thousands of employers search for candidates on Indeed

[Upload your resume](#)

2. Software Engineer in Financial Industry – another sample

(hiring from *Wells Fargo*, retrieved at indeed.com in August 2021)



← → ↻ 🏠 <https://www.indeed.com/viewjob?jk=0aa9a63abb4d511a&tk=1fev42n97t55g800&from=serp&vjs> 90% ... 📄

indeed Find jobs Company reviews Find salaries

What Job title, keywords, or company **Where** New York, NY **Find Jobs** Advanced Job Search

 **Software Engineer**
Wells Fargo ★★★★★ 41,182 reviews
New York, NY

You must create an Indeed account before continuing to the company website to apply

[Apply On Company Site](#) 

Job Company

Job Description

Important Note: During the application process, ensure your contact information (email and phone number) is up to date and upload your current resume when submitting your application for consideration. To participate in some selection activities you will need to respond to an invitation. The invitation can be sent by both email and text message. In order to receive text message invitations, your profile must include a mobile phone number designated as "Personal Cell" or "Cellular" in the contact information of your application.

At Wells Fargo, we are looking for talented people who will put our customers at the center of everything we do. We are seeking candidates who embrace diversity, equity and inclusion in a workplace where everyone feels valued and inspired.

Help us build a better Wells Fargo. It all begins with outstanding talent. It all begins with you.

Technology sets IT strategy; enhances the design, development, and operations of our systems; optimizes the Wells Fargo infrastructure; provides information security; and enables Wells Fargo global customers to have 24 hours a day, 7 days a week banking access through in-branch, online, ATMs, and other channels.

Our mission is to deliver stable, secure, scalable, and innovative services at speeds that delight and satisfy our customers and unleash the skills potential of our employees.

Capital Markets Technology provides world class business solutions to support Corporate and LOB Market Risk teams. The group works with its business partners in identification, measurement,

Company Info

 [Follow](#)

Get job updates from Wells Fargo

Wells Fargo
★★★★★ 41,182 reviews
Wells Fargo & Company (NYSE: WFC) is a diversified, community-based financial services company with \$1.9 trillion in assets. Wells Fargo's...

Let employers find you

Thousands of employers search for candidates on Indeed

[Upload your resume](#)

The successful candidate will be expected to:

- Have advanced Object Oriented development skills in order to create Java code that can be easily maintained and extended to meet the growing demands.
- For new development, the developer will be expected to work with business partners as well as upcoming regulatory guidelines in order to understand the needs and requirements and to analyze and design the necessary software.
- Design solutions that meet the business needs encompassing the full technology stack from backend database design, java calculation frameworks and guiding the front end development teams.
- Assures quality, maintainability, and extensibility for supported systems and risk applications.
- Key technical resource on team building sophisticated and complex risk applications.

Required Qualifications

- - 5+ years of software engineering experience
 - 3+ years of Java experience
 - 3+ years of SQL experience

Desired Qualifications

- - An industry-standard technology certification
 - Strong verbal, written, and interpersonal communication skills
 - BS/BA in computer science, applied statistics, quantitative economics, operations research or a related field
 - Object Oriented Design (OOD) experience
 - Agile experience
 - Knowledge and understanding of technical documentation: impact analysis, detailed designs and unit test plans
 - 3+ years of SDLC (System Development Life Cycle) experience
 - 1 + years of JavaScript Frameworks experience (jQuery, Ext JS, Kendo UI or Angular JS)
 - Leadership experience including; coaching, training, and mentoring

Job Expectations

- - Flexibility to frequently be on call beyond normal working hours
 - Flexibility to work in a 24/7 environment, including weekends and holidays
 - Ability to travel up to 10% of the time

3. Software Engineer in Manufacturing Industry

(hiring from *Copia Automation*, retrieved at indeed.com in August 2021)

The screenshot shows a web browser window with the URL <https://www.indeed.com/viewjob?t=Software+Engineer&l=New+York%2C+NY&jk=51164a11f8ce>. The page is from indeed.com and features a search bar with the following filters: **What** Job title, keywords, or company; **Where** New York, NY; and a **Find Jobs** button. The job listing is for a **Software Engineer (Full Stack)** at **Copia Automation**, located in **New York, NY**. The job is **Remote** and **Full-time**. The employer has actively reviewed the job 4 days ago. There is an **Apply Now** button and a heart icon for saving the job. On the right side, there is a **Company Info** section with a **Follow** button and a note to get job updates from Copia Automation. Below that is a **Let employers find you** section with a note that thousands of employers search for candidates on Indeed and an **Upload your resume** button. The **Job details** section shows the **Job Type** as Full-time and the **Number of hires for this role** as 1. The **Qualifications** section lists: React 1 year (Required) and US work authorization (Required). The **Full Job Description** section includes: **Who you are**: We're hiring an engineer to support feature development at Copia. If you're interested in rethinking the hardware and software systems that make all modern industry work, then reach out. We're looking for pragmatic software engineers who understand the theory but can also execute on product. **About Us**: Copia Automation is rebuilding a 50-year old, multi-billion industrial market from the ground up by rethinking the command and control layer and developer tools that power process automation in almost every industrial vertical. Backed by some of the world's most respected investors, we're starting by creating a complete developer toolchain for industrial automation that will change how factories are built. See more at copia.io. **Why industrial automation?**: Today, manufacturing is powered by an ecosystem of computerized systems and robotics known as industrial automation. The ecosystem is programmed with a unique graphical language that can't utilize tools such as GitLab or GitHub. Controls engineers are left to work with physical storage devices, incompatible tools, and/or expensive half-baked solutions. In an industry where minutes can represent tens of thousands of dollars, full featured development tools are urgently needed. You'll be part of a team that enables engineers to realize their code through a collaborative and well-designed workflow. We're looking for passionate individuals that will transform how everything is manufactured.

What You'll be Building

You'll be building a devops platform that enables controls engineers to remotely manage, test, and deploy code in industrial environments (think GitLab for automation).

Required Qualifications

- Bachelors in Software Engineering or equivalent experience

Preferred Qualifications

- Experience in designing and implementing user interfaces (UIs).
- Experience with React, TypeScript, Golang
- Bonus: Experience/Interest in manufacturing and hardware innovation
- Bonus: Experience/Interest in industrial automation and Programmable Logic Controllers
- Bonus: Experience with compilers and building ASTs
- Bonus: Experience building developer tools

Upcoming Roadmap

Over the next few months, we are building out the core experience of the product. This will be a combination of Copia specific logic and also features that are common to almost every SaaS application. This looks like...

- CI/CD. Build the continuous integration and deployment layer for the world of operational technology. In this role, you'll gain deep technical proficiency working with CI systems, edge infrastructure, and industrial networking. If you're an infra engineer who wants to understand the edge of the cloud, we are doing it all.
- App Experience. We are rebuilding the core experience of our application. If you're a strong front-end engineer, and interested in a product-centric role, this is perfect for you.
- Vendor abstractions. The industrial automation space is split into numerous fractured vendors. We need to do everything from parsing and rendering bespoke file types to building toolchain specific integrations and determine the abstractions necessary to manage the mess.
- Growth Engineering. Want to learn how to build a product that sells itself? We are building a world-class growth engine within Copia from the sales and marketing team to the product itself.

As a result, we are looking for strong generalists who can help us scale out major features and components of our core product.

Job Type: Full-time

Schedule:

- Monday to Friday

Experience:

- React: 1 year (Required)

Work Location:

- Multiple locations

Work Remotely:

- Yes

4. Embedded Software Engineer

(hiring from *Facebook*, retrieved at indeed.com in August 2021)

 Find jobs
Company reviews
Find salaries

What Job title, keywords, or company

Where New York, NY

Find Jobs

Advanced Job Search

Embedded Software Engineer

Facebook ★★★★★ 630 reviews
New York, NY

You must create an Indeed account before continuing to the company website to apply

Apply On Company Site



Facebook Reality Labs is building products that make it easier for people to connect with the ones they love most, enjoy top notch wire-free VR, and push the future of computing platforms. We are a team of world-class experts developing and shipping products at the intersection of hardware, software and content.

Facebook Reality Labs team is seeking Embedded Software Engineers with strong design and build skills, experience with low-level systems software and device driver programming and experience with shipping hardware/software products. This person will be an integral member of the team, responsible for embedded software design and optimization. This person will also be involved in developing a solid platform while working on a variety of domains to enable new experiences for augmented reality, virtual reality and social/family products.

- Design and implement components at all layers of the system, e.g. kernel, synchronization primitives, resource allocators, memory management, security, I/O systems, persistence, etc.
- Design and implement drivers and services that operate efficiently in a constrained environment yet when pressed can efficiently deliver large volumes of data with low-latency and high-bandwidth.
- Debug complex, system-level, multi-component issues that typically span across multiple layers from kernel to application.
- Profile performance problems and drive optimizations that span the entire software stack.
- Bring up new devices and lead debugging and performance tuning exercises that span multiple hardware/firmware/software teams.
- Understand software components from multiple partner teams, lead the integration of those components into the unified product code base, and drive their continued development.
- 2+ years' Software Engineering experience in the following: device driver development, embedded systems, or operating systems.
- 2+ years' experience working on systems software in a large-scale C/C++ code base.
- Experience in one or more of the following areas: BSP/Board Support Package, Operating Systems, Android OS, RTOS, Bootloader, Power Management, Linux, Graphics and Display Drivers, MCU (Microcontroller).
- Experience in hardware bringup using interfaces like ADC, GPIO, SPI, I2C, etc.
- Experience developing, debugging, and shipping software products on large code bases that span platforms and tools.
- Experience with Software Development processes including: source control, bug tracking, and design documentation.
- Bachelor or Master in Computer Engineering, Computer Science, Electrical Engineering, or related field.
- Deep specialized experience in two or more of the following areas: BSP/Board Support Package, Operating Systems, CoreOS, Kernel, Android Kernel, Bootloader, Power Management, RTOS, Linux, Graphics and Display Drivers, MCU (Microcontroller).
- Demonstrated experience working collaboratively in cross-functional teams.

Facebook's mission is to give people the power to build community and bring the world closer together. Through our family of apps and services, we're building a different kind of company that connects billions of people around the world, gives them ways to share what matters most to them, and helps bring people closer together. Whether we're creating new products or helping a small business expand its reach, people at Facebook are builders at heart. Our global teams are constantly iterating, solving problems, and working together to empower people around the world to build community and connect in meaningful ways. Together, we can help people build stronger communities - we're just getting started.

Company Info

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Founded In 2004, Facebook's mission is to give people the power to build community and bring the world closer together. People use Facebo...

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5. Software Engineer for Medical Devices

(hiring from *Sterling Medical Devices*, retrieved at indeed.com in August 2021)

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Entry-Level C# Software Engineer | Medical Device Engineering Services | NJ

[Sterling Medical Devices](#) ★★★★★ 8 reviews
 Moonachie, NJ 07074
 From \$65,000 a year - Full-time
 Employer actively reviewed job 4 days ago

 Responded to 75% or more applications in the past 30 days, typically within 6 days.

Apply Now



Job details

Salary
From \$65,000 a year

Job Type
Full-time

Number of hires for this role
On-going need to fill this role

Qualifications

- Bachelor's (Preferred)
- C#: 1 year (Preferred)
- Java: 1 year (Preferred)
- C/C++: 1 year (Preferred)

Full Job Description

TO BE CONSIDERED FOR THIS POSITION, YOU MUST APPLY USING THIS LINK:
<https://sterlingmedicaldevices.applytojob.com/apply/5LeA0KTz9R/EntryLevel-C-Software-Engineer-Medical-Device-Engineering-Services-New-Jersey-Location?source=INDES>

About Sterling Medical Devices:

Sterling Medical Devices, a provider of custom electro-mechanical and software solutions for the medical device industry, has been dedicated to helping our clients resolve medical device development challenges. Our engineering teams address the whole development process: systems, software, electronics, mechanical, quality, and compliance. Our headquarters, located in Moonachie, NJ, is a casual work environment that engages our team in cutting edge technologies and projects.

Sterling has over 20 years of experience working with doctors, startups, medical device companies and providing solutions for healthcare companies that need to scale up quickly to bring medical device software, hardware, mechanical, and mobile medical device apps to market by successfully navigating the FDA and CE approval process. We design our client's products with a focus on the user needs and requirements, while making smart design choices based on our extensive and diverse product development experience.

The Opportunity:

We are currently searching for an Entry-Level Software Engineer with expertise in C#. In this role, you will be responsible for the design, development and testing of Medical Device software products and/or related tools in the Microsoft stack. You will define software requirements for complex systems, evaluate new frameworks and collaborate with the team to help lead the project's technical vision. The ideal candidate is a self-starter with strong C# skills and a passion for being part of a team developing medical technologies that improve people's lives.

Company Info



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Essential Duties and Responsibilities:

- Apply systems analysts techniques and procedures, including consulting with clients, to determine hardware, software or system functional specifications for the medical device project at hand
- Design, develop, document, analyze, create and test computer systems or programs, including prototypes, based on client feedback and system design specifications and user requirements
- Design, document, test create or modify computer programs related to machine operating systems
- Code and test software based upon software specifications and designs
- Design, develop and implement software tools and subsystems to support software reuse and domain software development
- Design, develop, document, analyze, test and implement design specifications, software architecture solutions and/ or programs that impact the design success of products or addresses broad design issues of future products or technologies related to user or system design specifications
- Participate in technical design and design review meetings to discuss and provide recommendations to problems related to software systems architecture
- Use sound software engineering principles to ensure that developed code is modifiable, efficient, reliable, understandable, and fault tolerant
- Analyze, layout and change multi-layered applications in C#, using Win Forms for the UI layer and SOAP-based/REST full web benefits for the back-end
- Design, build and keep up capable, reusable, and strong C# code
- Provide software process management and control throughout the coding portion of the software development process
- Apply system analysis techniques and procedures and co consult with clients to determine and finalize software and medical device's system functional application

Education and Experience:

- Bachelor's Degree in Computer Engineering or similar discipline
- 0-3 years of C# programming experience
- 0-3 years' technical writing experience for system requirements, design documents, test reports
- Knowledge of and ability to work in a safety-related quality process. Experience with ISO, FDA, etc. would be a plus
- Experience with the DICOM Standard including a working understanding of Information Model and Network Communications is preferred.
- Experience with user interfaces, MVVM, and WPF (XAML) is preferred.
- Experience with unit testing and automated testing is preferred.
- Experience with Git, Github, JIRA, and Confluence is preferred.

Knowledge and Skills:

- Object Oriented development experience, preferably C#
- Development experience in C, C#, and Assembly
- Proficient in debugging using emulators and electronic test equipment
- Understanding of testing methodologies including white and black box
- Knowledge of and ability to work in a safety related quality process. A plus would be: experience with ISO, FDA, FAA (DO-178B), DOD, etc.
- Ability to effectively and efficiently analyze information
- Knowledge of software documentation and testing
- Strong problem solving skills
- Understanding of system design concepts
- Understanding of modeling languages like UML/Booch/OMT
- Experience with hardware and electronics used in embedded systems
- Ability to interact well with clients
- Demonstrated ability to work collaboratively on cross-functional teams in a fast moving environment
- Strong analytical skills
- High level of initiative with ability to self-manage
- Strong interpersonal skills with ability to work both independently and as part of a team
- Strong written and verbal communication skills

Sterling Medical Devices (SMD) is an Equal Opportunity Employer. SMD does not discriminate on the basis of race, religion, color, sex, gender identity, sexual orientation, age, non-disqualifying physical or mental disability, national origin, veteran status or any other basis covered by appropriate law. All employment is decided on the basis of qualifications, merit, and business need."

Local candidates only at this time, please. We do not offer relocation assistance.

No third-party candidates please.

Job Type: Full-time

Pay: From \$65,000.00 per year

Benefits:

- 401(k)
- 401(k) matching
- Dental Insurance
- Health Insurance

6. Software Test Engineer

(hiring from *Real-Time Technology Solutions*, retrieved at indeed.com in August 2021)

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Entry-Level Developer / Software Test Engineer

Real-Time Technology Solutions
Manhattan, NY

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Who We Are

RTTS is the premier pure-play Quality Assurance and Testing organization that specializes in test automation. Based in midtown Manhattan (NY) and serving Fortune 500 companies throughout the world since 1996, RTTS has helped over 700 companies reach their continuous deployment and automation goals.

RTTS' software division also develops QuerySurge, the smart data testing & validation software for Big Data, Data Warehouses, and Business Intelligence Reports. In forging strategic partnerships with leading software vendors IBM, Microsoft, Oracle, SAP, Micro Focus, Teradata, Cloudera, Hortonworks and MongoDB, RTTS offers the most complete automated testing solution that validates both data stores and complex applications & architecture.

What You'll Be Doing

Using your strong programming and analytical skills, you'll be responsible for coding custom solutions using cutting edge automated functional and performance software solutions to support complex software applications and architectures. Other responsibilities include:

- Work alongside development teams to verify application functionality, usability, scalability and data validity.
- Assist application owners with regression testing, script testing, user acceptance testing and test architecture support.
- Develop and maintain reusable code libraries to help build streamlined and efficient development/testing processes.
- Evaluate and analyze automation metrics, providing feedback to developers, system architects and subject matter experts.
- Assignments vary in length depending on our clients' needs, providing you with the opportunity to learn new technologies and gain valuable exposure to many areas of business while working with client teams and experienced RTTS mentors.

What You Need

Must possess an undergraduate or graduate degree with a concentration in Computer Science, Information Technology or a related field. Other qualifications include:

- Proficiency in a mainstream programming language such as Java, C++, C#, C, PHP, .NET, or other.
- Desire to learn and utilize emerging technologies while working in a stimulating team environment.
- Professional appearance and the ability to communicate clearly

What We Offer

Competitive starting salary, career advancement opportunities, generous increases and numerous bonus programs. Excellent benefits package including medical, dental, 401K, tuition reimbursement, paid vacation and holidays, continuous learning and more.

You can expect:

- The most comprehensive training program in the industry. One-on-one mentoring is provided, an ideal fit for recent graduates and career changers.
- Ongoing development of your skills working with web technologies, server-side software and database platforms.
- A challenging, supportive, educational and fun work environment. Our office culture encourages innovation and professional growth.

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6. Cloud Software Engineer

(hiring from *Flipped.ai*, retrieved at indeed.com in August 2021)

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Cloud Software Engineer

Flipped.ai
New York, NY
Full-time, Part-time

Job details

Job Type
Full-time
Part-time

Full Job Description

Cloud Software Engineer

USA Based Applicants Only.

We are looking for top-quality college and graduate cloud software engineers. If you are interested and have the majority of the relevant experiences/skills below, please apply.

Qualifications

- 1-3+ years experience.
- Bachelor's or higher degree in Computer Science or a related discipline.

Core Skills:

Technologies

- Highly proficient in one or more programming languages: Python, C++, Java, etc.
- Experience using cloud native products.
- Strong experience working with one or more cloud-based platforms: AWS, Azure and/or GCP environments.
- Experience using data engineering platforms.
- Strong systems experience in distributed systems, networking or security projects is a plus.
- Deliver high-quality code and technical documentation.

Personal Attributes

- Solid verbal, written, presentation and interpersonal communication skills.
- Data project management skills.
- Strong analytical problem solving skills

Job Types: Full-time, Part-time

Schedule:

- 8 hour shift

Work Location:

- One location

Work Remotely:

- No

Company Info

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Appendix D: CET Department Industry Advisory Board Meeting

The proposed Software Engineering Technology BS degree program has been presented to CET Department's Industry Advisory Committee (IAC), from the beginning of its initiation to the middle of development. It was discussed in two IAC meetings hold in 2019 and 2020. Suggestions and comments were provided by the IAC members for better developing the program and its curriculum.

1. CET Department IAC Meeting on May 16, 2019, Thursday, 12:30~2PM

Location: CET Department conference room, V733

2019-05-16 IAC Meeting Minutes

Attendance (excused are in bold): Sunghoon Jang, **Robert Armstrong**, Seymour Blank, Aparicio Carranza, Ohbong Kwon, Xiaohai Li, Lili Ma, Benito Mendoza, Edward Morton, John Razukas, José M. Reyes Álamo, Yu Wang, Chen Xu, Farrukh Zia, Alberto Aponte.

IAC members present: See attendance list.

Started at 12:34 PM

1. Welcome address and introduction of the attendees by the chairman of the department and IAC coordinator.
 1. Introduction of the chairman
 1. Statistics about the department were mentioned as well as the need for space.
 2. Introduction and greetings from Dean Hom
 1. Questions about places/sites to post job openings.
 3. Introductions by the members of the IAC committee. Interesting discussion about security, systems vulnerabilities and the different mechanism to handle these.
 1. Questions about the different tracks available at the College and within the Department, especially with respect of security.
 2. A member of the IAC is interested in giving a talk about superintelligence.
 3. Discussion about how technology is changing so quickly and how engineers need to be more versatile and handle multiple languages and platforms.
 4. Suggestions of a course in history of computing.
 5. Discussion about the fact that faculty needs to teach students how to solve problems, vs their expectation of some students that instructors need to teach them every step.
 6. Teaching C++ is very valuable as it teaches the students the basics. It offers a competitive advantage due to the large number of developer without in-depth skills.
 7. Prof. Blank suggested the IAC members to provide a list of courses skills that would shape a potential BS in Software Engineering.
 8. IBM is moving towards growth technology due to the cloud. They do a lot of research on hardware and related topics.
 9. Some recent graduates have unrealistic expectations about their first year on the job. It takes times, about a year, to learn the job, skills, language to perform.
 10. Students should be self-learners in order to maximize their chance of success.
 11. Areas in which the department should be focusing: software engineering was suggested.
2. Approval of the minutes of the previous IAC meeting.
3. BS in Software Engineering Program by Professor Li.
 1. Presentation by Prof. Li about the motivation and the plans for the BS in Software Engineering program.
 2. Software engineers earn more than other positions that our students traditionally obtain.
 3. There are many jobs in SE, the data should also be divided by category and the type of engineering.
 4. Few of our alumni are software engineers about 4.2%, while 46.3% work as IT/Specialist/Technician
 5. Include CET 3510 in the list of programming courses
 6. There are no CUNY college offering software engineering, and only a few in the area.
 7. List of courses and suggestions of areas of study and components of the program.
 8. Comments about the BS in SE:
 1. Create a course that teaches students how to interview for certain big tech companies such as Amazon, Google, etc.
 2. Identify the main objectives for the SE program.
 3. Include data analytics and hands-on experience as part of the program.
 4. IEEE/ACM standards are fine, but also feedback from industry leaders is needed and to name specific technology.
 5. Need to pay attention to what the professional organization says about the program, the body of knowledge (BOK).
 6. Get an outside evaluator when graduating the first class.
 7. Need to define a goal and the approach should be top-down.
 9. IAC members supported and approved our plan of developing the SWE BS program.
4. ABET/Middle States Report of the CET department by Prof. Zia and Mendoza
 1. Prof. Mendoza introduced to the AIC members the New College Mission Statement
 2. Prof. Mendoza introduced the mapping between the Program Educational Objectives of the AAS in EMT program and the New College Mission Statement for AIC members validation

3. Prof. Zia introduced the mapping between the Program Educational Objectives of the BTech in CET program and the New College Mission Statement for AIC members validation
4. ABET Accreditation and Current Assessment Cycle
 1. Prof. Mendoza introduced the Assessment Cycle 2014-2020 for the EMT Program and informed that it has been followed as planned.
 2. Prof. Zia introduced the Assessment Cycle 2015-2018 for the CET Program and informed that it has been followed as planned.
5. ABET/ETAC Newly Introduced Requirements in 2019
 1. Prof. Mendoza introduced the recent requirements on Criterion 3. Student Outcomes (a~k to 1~5). New Student Outcomes (SOs) were introduced. A mapping from current SO to the new SO, for both programs CET and EMT, was presented for validation.
 2. Prof. Mendoza introduced a minor curriculum change in the EMT2480L course (submitted by Profs. Ma (course coordinator) and Wang) to satisfy the new Student Outcome for AAS programs (Engineering Design)
 - Title: EMT2480L: Electromechanical Systems Laboratory
 - New Title: EMT2480L: Electromechanical Systems Design Laboratory
 - New content includes Engineering Design principles and a final project about engineering design.
 3. Prof. Zia introduced the changed in Criterion 5. Curriculum. He indicated that the soft-skills that were assessed as Student Outcomes under the previous ABET/ETAC model, are no longer required to be assessed. However, these skills have to be part of the curriculum of the programs, they have to incorporate directly in some courses.
 4. Prof. Zia introduced Criterion 6. Faculty. He indicated that a revision and update of faculty CVs (including adjuncts) and assignments are planned.

Meeting Adjourned at 2:00 PM

Scribe: José M. Reyes Álamo

2. CET Department IAC Meeting on February 13, 2020, Thursday, 12:30~2:20PM

Location: CET Department conference room, V733

Meeting minutes:

2020-02-13 IAC Meeting Minutes

Faculty Attendance (excused are in **bold**): Sunghoon Jang, Robert Armstrong, Seymour Blank, Aparicio Carranza, Ohbong Kwon, Xiaohai Li, Lili Ma, Benito Mendoza, Edward Morton, John Razukas, José M. Reyes Álamo, Yu Wang, Chen Xu, Farukh Zia

IAC Members Present: See attendance list

Started at 12:37PM

1. Welcome address and introduction of the attendees by the chairman of the department and IAC coordinator.
 1. Each faculty and IAC member made a brief introduction of themselves.
2. Approval of the minutes of the previous IAC meeting.
 1. Minutes approved unanimously.
3. ABET/Middle States Reports of the CET department by Professors Zia and Mendoza.
 1. Prof. Mendoza gave a presentation about the ABET PEOs, including the new modifications, and how our department aligns with these.
 2. A copy of the presentation was provided showing the alignments/mappings. Feedback from the IAC was requested.
 3. Motion to accept these changes and mapping/alignment for EMT AAS was approved unanimously.
 4. Motion to accept these changes and mapping/alignment for CET B Tech was approved unanimously.
 5. The new student outcomes for EMT includes assessing engineering design. The department updated the EMT 2480L course, designed rubrics, and created projects to assess this new outcome successfully.
 1. A summary of the project, some samples as well as the preliminary assessment results were shown.
 2. Question about the content of the syllabi and whether these will include these outcomes specifically.
 3. IAC member question about the target percentage (currently at 70%) and how that number was determined. It seems the School of Tech & Design this is the historical target.
 4. Another question was about how the assessment is made and by whom, usually faculty perform these evaluations. After assessment, feedback is given to the faculty.
 5. Another question/issue was raised about the amount of time it takes to perform these evaluation and how it is acknowledged by the College. As this is a time consuming activity, requesting exclusive time for it was suggested, and making ABET evaluators aware of how these activities are performed.
 6. Prof Wang read a statement by an IAC member who could not attend. Some suggestions are how software is a major component of today's computer engineering programs as well as embedded software and cyber security.
 7. BS in Software Engineering by Prof. Li
 1. Review of the guidelines being used for this initiative including IEEE/ACM, highlighting the most relevant ones.
 2. Review of the areas usually covered in software engineering curricula
 3. A list of major components was presented with the preliminary number of credits and some of the courses that may be used to fulfill these.
 4. The Dean of the SoTD stopped and say a few remarks especially about ABET and the importance of the IAC meetings.
 5. IAC member questions why the proposed curriculum specifically includes multiple programming languages (Python, C++, Java) however he points how the programming languages have a basic structure and the focus should be on the techniques. Also some of the electives should be part of the core such as digital image processing and cloud computing.
 6. Dean Shield asked a question about the programming languages and how it is a side note. Suggestion is to be more generic to adapt to the changing nature of programming languages and their relative popularity. The focus should be teaching the subjects, skills, and the techniques, not necessarily the language.
 7. About feedback control system, a lot of automation is happening in companies like Con Edison and many systems are moving in that direction.

8. Summary of the goals of the department and the motivation from the achievements of other departments such as architecture, and CST with data science.
9. There is a concern about the BS due to the fact that its a 120-credit only.
10. Prof. Jang mentioned about the proposed change from EMT to CET for the AAS to better suit the department and students need.
 1. IAC members were asked if there were any objections to this change and they answered that there are no objections, also requested more details about the changes.
11. Suggestion about approaching the high schools to get their feedback and perhaps bring a demo to get students interested. Also get the administration on-board due to the importance and interest in the field
8. Good and welfare.

Meeting adjourned at 2:21 PM

Scribe: José M. Reyes Álamo

Appendix E: Evidence of Consultation with Other Departments

1. Department of Computer System Technology

Re: SWE BS Program Proposal

Ashwin Satyanarayana

Tue 2/22/2022 9:23 AM

To: Xiaohai Li <XHLi@citytech.cuny.edu>;

Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>;

Dear Prof. Li and Prof. Jang,

I must congratulate you on a proposal very well done. I did find some overlap with 2 courses: Cloud Database Fundamentals and Cloud Computing and Networking with our CST 1204 (Database Fundamentals), CST 3624 (Intro to NoSQL Technologies) and CST 2307 (Networking Fundamentals). On careful review we found that the overlap is about 30% or less.

So you have the complete support from the CST department for this proposal.

Best,
Ashwin

Ashwin Satyanarayana, Ph.D.
Associate Professor / Department Chair
Department of Computer Systems Technology,
New York City College of Technology
[300 Jay Street - Namm 913, Brooklyn, NY 11201](#)
Ph: (718) 260-5161

From: Xiaohai Li
Sent: Monday, February 21, 2022 4:08:35 PM
To: Ashwin Satyanarayana
Cc: Sunghoon Jang; Gerarda Shields
Subject: Re: SWE BS Program Proposal

Dear Prof. Satyanarayana,

I believe you have already known, our Software Engineering proposal is now under CCCC subcommittee's reviewing. We will love to have your support as well as your comments. For your convenience, I attach here the updated proposal that CCCC submitted is reviewing. Please be noted that our proposal title has been changed to *Software Engineering Technology*. because City Tech's charter does not allow us to have an engineering program.

Please let Prof. Jang and me know any comments and suggestions you have. Thank you so much for your time!

Best regards,

Xiaohai Li, Ph. D.
Associate Professor
Director, Robotics & Intelligent Systems Lab
Department of Computer Engineering Technology
New York City College of Technology
City University of New York

[186 Jay Street, V633](#)
[Brooklyn, NY 11201](#)
Tel: 718-260-4942
Fax: 718-260-5425
Email: xhli@citytech.cuny.edu
URL: www.citytechrobotics.org

Re: SWE BS Program Proposal

Ashwin Satyanarayana

Wed 9/8/2021 11:01 AM

To: Xiaohai Li <XHLi@citytech.cuny.edu>;

Cc: Pamela Brown <PBrown@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>; Sunghoon Jang <SJang@citytech.cuny.edu>; Kim Cardascia <KCardascia@citytech.cuny.edu>;

Thank you, Prof. Li. I have sent the proposal to my colleagues at CST. Once i hear back from them, will compile any comments and send it to you.

Best,
Ashwin

Ashwin Satyanarayana, Ph.D.
Associate Professor / Department Chair
Department of Computer Systems Technology,
New York City College of Technology
[300 Jay Street - Namm 913, Brooklyn, NY 11201](#)
Ph: (718) 260-5161

From: Xiaohai Li
Sent: Wednesday, September 8, 2021 10:45:12 AM
To: Ashwin Satyanarayana
Cc: Pamela Brown; Gerarda Shields; Sunghoon Jang; Kim Cardascia
Subject: SWE BS Program Proposal

Dear Prof. Satyanarayana,

As you have already heard from Prof. Jang, our CET Department is working on a new degree program proposal -- BS in Software Engineering. We would love to have your support and discuss with you how we can work together to make this program really beneficial for our students in both departments.

Attached please find a preliminary draft of our proposal. Please let Prof. Jang and me know any of your comments and suggestions! Thank you so much for your support and time in advance!

Best regards,

2. Department of Mathematics

Re: SWE BS Program Proposal

Jonathan Natov

Tue 2/22/2022 10:52 PM

To: Xiaohai Li <XHLi@citytech.cuny.edu>;

Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>;

Dear Professor Li,

This is to express enthusiastic support for your Bachelor of Science degree in Software Engineering.

The proposal is well thought out and will surely benefit our students.

There is one small change that is recommended, if it is not too late.

MAT 4872 is not offered and has been replaced with MAT 4672. On page 23, under General Education Electives, can you please remove MAT 4872.

Please ask if you have questions,

Jonathan

Professor Jonathan Natov
Mathematics Department Chair, N711
New York City College of Technology
[300 Jay Street, Brooklyn NY 11201](https://www.citytech.cuny.edu/300-Jay-Street-Brooklyn-NY-11201)

Re: SWE BS Program Proposal

Jonathan Natov

Wed 9/8/2021 11:34 PM

To: Xiaohai Li <XHLi@citytech.cuny.edu>;

Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>; Pamela Brown <PBrown@citytech.cuny.edu>; Kim Cardascia <KCardascia@citytech.cuny.edu>;

Dear Professor Li,

Hope you (and all on this email) are well.

Thank you for sharing this exciting proposal.

The Mathematics Department faculty will be informed.

We would be happy to share any suggestions or comments if you like.

Best regards,

Jonathan

Professor Jonathan Natov
Mathematics Department Chair, N711
New York City College of Technology
[300 Jay Street, Brooklyn NY 11201](https://www.citytech.cuny.edu/300-Jay-Street-Brooklyn-NY-11201)

From: Xiaohai Li

Sent: Wednesday, September 8, 2021 2:02:29 AM

To: Jonathan Natov

Cc: Sunghoon Jang; Gerarda Shields; Pamela Brown; Kim Cardascia

Subject: SWE BS Program Proposal

Dear Prof. Natov,

Prof. Jang and I would like to let you know that our CET Department is working on a new degree program proposal – BS in Software Engineering. This new degree program will provide a great opportunity for our students to step into a highly awarding career (software engineer). We would love to have your support and discuss with you how the Computer Science Associate degree program in

your department can be bonded with this program.

Attached please find a draft of our proposal. Please let Prof. Jang and me know any of your comments and suggestions! Thank you so much in advance!

Best regards,

Xiaohai Li, Ph. D.
Associate Professor
Director, Robotics & Intelligent Systems Lab
Department of Computer Engineering Technology
New York City College of Technology
City University of New York

[186 Jay Street, V633](#)
[Brooklyn, NY 11201](#)

Tel: 718-260-4942

Fax: 718-260-5425

Email: xhli@citytech.cuny.edu

URL: www.citytechrobotics.org

3. Department of Mechanical Engineering Technology

Re: SWE BS Program Proposal

Masato Nakamura

Wed 9/8/2021 7:19 AM

To: Xiaohai Li <XHLi@citytech.cuny.edu>;

Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Pamela Brown <PBrown@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>; Kim Cardascia <KCardascia@citytech.cuny.edu>;

Hi Dr. Li,

That is exciting news! A lot of prospective students would like to join the BS in Software Engineering. Let me read the proposal and give you feedback/comments.

Masa

--

Masato R. Nakamura, Eng.Sc.D.

Associate Professor and Chair

Department of Mechanical Engineering Technology and Industrial Design Technology

New York City College of Technology (City Tech)

The City University of New York (CUNY)

[186 Jay Street, Voorhees Hall Room 532, Brooklyn, NY 11201](https://www.citytech.cuny.edu/186-Jay-Street-Voorhees-Hall-Room-532-Brooklyn-NY-11201)

Cell: 202-381-6976, Email: mnakamura@citytech.cuny.edu

MECH Web: [citytech.cuny.edu/mechanical](https://www.citytech.cuny.edu/mechanical)

MECH Community: <https://openlab.citytech.cuny.edu/mech/>

Are you City Tech alumni or current students? Join LinkedIn:

<https://www.linkedin.com/groups/8973215/>

<https://www.linkedin.com/in/masatornakamura/>

--

MECH Fall 2021 info:

MECH Reopening Plan:

<https://openlab.citytech.cuny.edu/mech/2021/04/05/mech-department-reopening-plan/>

Need advisement? Meet our faculty:

http://bit.ly/Mech_advisement

Need to talk with me? Come to the Virtual Chair's Office anytime bet 9 and 10 am from Mondays through Fridays:

<https://openlab.citytech.cuny.edu/mech/2020/09/15/virtual-chairs-office-dr-nakamura/>

Need more info? Visit MECH Department Openlab Community Site:

<https://openlab.citytech.cuny.edu/mech/>

From: Xiaohai Li
Sent: Wednesday, September 8, 2021 2:10:57 AM
To: Masato Nakamura
Cc: Sunghoon Jang; Pamela Brown; Gerarda Shields; Kim Cardascia
Subject: SWE BS Program Proposal

Dear Prof. Nakamura,

Prof. Jang and I would like to let you know that our CET Department is working on a new degree program proposal -- BS in Software Engineering. This new degree program may provide an opportunity for interested MECH students to take some courses on software engineering. We will love to have your support and discuss with you how it can benefit MECH students.

Attached please find a draft of our proposal. Please let Prof. Jang and me know any of your comments and suggestions! Thank you so much in advance!

Best regards,

Xiaohai Li, Ph. D.
Associate Professor
Director, Robotics & Intelligent Systems Lab
Department of Computer Engineering Technology
New York City College of Technology
City University of New York

186 Jay Street, V633
Brooklyn, NY 11201
Tel: 718-260-4942
Fax: 718-260-5425
Email: xhli@citytech.cuny.edu
URL: www.citytechrobotics.org

4. Department of Electrical & Telecommunications Engineering Technology

Re: SWE BS and AAS-EMT Change to AAS-CET Program

Mohammad Razani

Tue 3/8/2022 8:37 PM

To: Sunghoon Jang <SJang@citytech.cuny.edu>; Ohbong Kwon <OKwon@citytech.cuny.edu>;

Cc: Gerarda Shields <GShields@citytech.cuny.edu>; Pamela Brown <PBrown@citytech.cuny.edu>; Ashwin Satyanarayana <ASatyanarayana@citytech.cuny.edu>; Anne Marie Sowder <AMSowder@citytech.cuny.edu>; Xiaohai Li <XHLi@citytech.cuny.edu>; Benito Mendoza <BMendoza@citytech.cuny.edu>;

Thank you Prof. Jang.

Regards,

MR

From: Sunghoon Jang

Sent: Tuesday, March 8, 2022 10:30 AM

To: Mohammad Razani; Ohbong Kwon

Cc: Gerarda Shields; Pamela Brown; Ashwin Satyanarayana; Anne Marie Sowder; Xiaohai Li; Benito Mendoza

Subject: RE: SWE BS and AAS-EMT Change to AAS-CET Program

Dear Dr. Razani,

Thanks for your comment. The CET department has reviewed your comments and we feel the SET-BS and CET-AAS programs meet all requirements. Attached please find our response.

Thank you,

Sunghoon Jang, PhD
Professor & Chairman
Department of Computer Engineering Tech
NY City College of Technology of CUNY
186 Jay Street, 635 Voorhees Hall

Brooklyn, NY 11201-2983
Tel: 718-260-5886
Fax: 718-260-5425
Email: sJang@citytech.cuny.edu

From: Mohammad Razani
Sent: Thursday, March 3, 2022 4:59 PM
To: Ohbong Kwon <OKwon@citytech.cuny.edu>
Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>; Pamela Brown <PBrown@citytech.cuny.edu>; Ashwin Satyanarayana <ASatyanarayana@citytech.cuny.edu>; Anne Marie Sowder <AMSowder@citytech.cuny.edu>; Xiaohai Li <XHLi@citytech.cuny.edu>; Benito Mendoza <BMendoza@citytech.cuny.edu>
Subject: Re: SWE BS and AAS-EMT Change to AAS-CET Program

Dear Prof. Kwon,

Attached please note some of the comments made on the responses that you sent me earlier.

It is our hope that the CET department considers these comments favorably as they are made to improve the proposal and make the efficient and effective use of the College resources (Faculty, Equipment, Lab space, etc.) and adjusts the proposal accordingly as much as possible.

Regards,

MR

From: Ohbong Kwon
Sent: Friday, February 25, 2022 2:25 AM
To: Mohammad Razani
Cc: Sunghoon Jang; Gerarda Shields; Pamela Brown; Ashwin Satyanarayana; Anne Marie Sowder; Xiaohai Li; Benito Mendoza
Subject: Re: SWE BS and AAS-EMT Change to AAS-CET Program

Dear Prof. Razani,

Please see the attached for the responses to your comments for the both SWE-BS proposal and the program change from AAS- EMT to AAS- CET proposal.

Please let us know if you have any further questions or concerns.

Best,
Ohbong

Ohbong (John) Kwon, Ph. D.
Associate Professor
EMT Program Coordinator
Department of Computer Engineering Technology
NYC College of Technology/CUNY
186 Jay Street, Brooklyn, NY 11201
Tel: 718-260-5439
Email: okwon@citytech.cuny.edu

SWE BS and AAS-EMT Change to AAS-CET Program

Mohammad Razani

Tue 2/22/2022 12:31 AM

To: Xiaohai Li <XHLi@citytech.cuny.edu>; Benito Mendoza <BMendoza@citytech.cuny.edu>; Ohbong Kwon <OKwon@citytech.cuny.edu>;

Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>; Pamela Brown <PBrown@citytech.cuny.edu>;
Ashwin Satyanarayana <ASatyanarayana@citytech.cuny.edu>; Anne Marie Sowder <AMSowder@citytech.cuny.edu>;

📎 1 attachments (184 KB)

ETET Department's Comments and Concerns on CET Department's Two Proposals.pdf;

Dear All,

Attached please find the ETET department's preliminary review of both SWE-BS proposal as well as the program change from AAS- EMT to AAS- CET proposal.

If there are additional comments, I will be sending them to all very soon but for now, please consider the attached itemized issues as our comments and concerns which I hope they get resolved before they are discussed on the floor of CCCC meeting.

Best Regards,

Mohammad

Re: SWE BS Program Proposal

Mohammad Razani

Sat 2/12/2022 3:33 PM

To: Xiaohai Li <XHLi@citytech.cuny.edu>;

Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>; Pamela Brown <PBrown@citytech.cuny.edu>; Kim Cardascia <KCardascia@citytech.cuny.edu>;

Thank you Prof. Li,

I have forwarded the proposal to the ETET faculty for their reviews and possible comments. As soon as I hear from them, I will email you the results of our reviews

Best,

Prof. Razani

From: Xiaohai Li
Sent: Friday, February 11, 2022 4:12 PM
To: Mohammad Razani
Cc: Sunghoon Jang; Gerarda Shields; Pamela Brown; Kim Cardascia
Subject: Re: SWE BS Program Proposal

Dear Prof. Razani,

Hope your new semester is off to a great start! This email is a gentle reminder about commenting our proposal for the new BS in Software Engineering Technology degree program. For your convenience, I attach here the updated proposal that CCCC submitted is reviewing. We will love to have your support and discuss with you how it can benefit ETET students as well. Please let Prof. Jang and me know any of your comments and suggestions!

Thank you for your time!

Best regards,

Xiaohai Li, Ph. D.
Associate Professor
Director, Robotics & Intelligent Systems Lab
Department of Computer Engineering Technology
New York City College of Technology
City University of New York

[186 Jay Street, V633](#)
[Brooklyn, NY 11201](#)
Tel: 718-260-4942
Fax: 718-260-5425
Email: xhli@citytech.cuny.edu
URL: www.citytechrobotics.org

From: Xiaohai Li
Sent: Wednesday, September 8, 2021 1:56 AM
To: Mohammad Razani
Cc: Sunghoon Jang; Gerarda Shields; Pamela Brown; Kim Cardascia
Subject: SWE BS Program Proposal

Dear Prof. Razani,

Prof. Jang and I would like to let you know that our CET Department is working on a new degree program proposal -- BS in Software Engineering. This new degree program may provide an opportunity for interested ETET students to take some courses on software engineering. We will love to have your support and discuss with you how it can benefit ETET students.

Attached please find a draft of our proposal. Please let Prof. Jang and me know any of your comments and suggestions! Thank you so much in advance!

Best regards,

Xiaohai Li, Ph. D.
Associate Professor
Director, Robotics & Intelligent Systems Lab
Department of Computer Engineering Technology
New York City College of Technology
City University of New York

[186 Jay Street, V633](#)

[Brooklyn, NY 11201](#)

Tel: 718-260-4942

Fax: 718-260-5425

Email: xhli@citytech.cuny.edu

URL: www.citytechrobotics.org

5. Open Hearing during Club Hours on May 5, 2022

Event Announcement Email sent from Faculty Commons:

Mail - XHLi@citytech.cuny.edu

https://webmail.citytech.cuny.edu/owa/#path=/mail/sea...

Open Hearing for SET BS and CET AAS Program Proposals

FacultyCommons

Fri 4/29/2022 3:07 PM

Inbox

Announcement:

=====

CET Department invites you to join an open hearing on its new SET(Software Engineering Technology) BS and changing existing EMT AAS to CET AAS program proposals.

Date: **May 5, 2022 (Thursday)**

Time: **12:30~2:00 PM EST**

Click the following link to join Zoom Meeting:

<https://us02web.zoom.us/j/85361941258?pwd=ZXFQOWI5UWU0RzgweGpwczRyeEJ4dz09>

Zoom Meeting ID: **853 6194 1258**

Passcode: **070571**

Please go to College Council OpenLab website for the latest version of the proposals (<https://openlab.citytech.cuny.edu/collegecouncil/current-proposals/>). Please feel free to email us at compengtech@citytech.cuny.edu or Sjang_@citytech.cuny.edu for any questions you have. Thank you!

Thank you email sent to event attendees:

Re: Open Hearing -- Thank you!

Xiaohai Li

Thu 5/5/2022 4:37 PM

To: Pamela Brown <PBrown@citytech.cuny.edu>; Elizabeth Milonas <EMilonas@citytech.cuny.edu>; Kim Cardascia <KCardascia@citytech.cuny.edu>; Lin Zhou <LZhou@citytech.cuny.edu>; David H Lee <DLee@citytech.cuny.edu>; Masato Nakamura <MNakamura@citytech.cuny.edu>; Ashwin Satyanarayana <ASatyanarayana@citytech.cuny.edu>; Andy Zhang <AZhang@citytech.cuny.edu>; Zory Marantz <ZMarantz@citytech.cuny.edu>; Joseph Jeyaraj <JJeyaraj@citytech.cuny.edu>; Adam J Wilson <AWilson@citytech.cuny.edu>; Akm S Rahman <asrahman@citytech.cuny.edu>; Justin Vazquez-Poritz <JVazquez-Poritz@citytech.cuny.edu>; John McCullough <JMcCullough@citytech.cuny.edu>; Mohammad Razani <MRazani@citytech.cuny.edu>; Daniel Wong <DWong@citytech.cuny.edu>; Gerarda Shields <GShields@citytech.cuny.edu>; Anne Marie Sowder <AMSowder@citytech.cuny.edu>; Phillip Ross Anzalone <PAnzalone@citytech.cuny.edu>; Jonathan Natov <JNatov@citytech.cuny.edu>; Reginald Blake <RBlake@citytech.cuny.edu>;

Cc: Sunghoon Jang <SJang@citytech.cuny.edu>; Ohbong Kwon <OKwon@citytech.cuny.edu>; Seymour Blank <SBlank@citytech.cuny.edu>; Aparicio Carranza <ACarranza@citytech.cuny.edu>; Lili Ma <Lma@citytech.cuny.edu>; Benito Mendoza <BMendoza@citytech.cuny.edu>; Jose Reyes Alamo <JReyesAlamo@citytech.cuny.edu>; Chen Xu <CXu@citytech.cuny.edu>; Farrukh Zia <FZia@citytech.cuny.edu>;

Dear All,

Thank you so much for joining us in today's CET Department open hearing! Your time and sincere support are greatly appreciated. Your inputs and comments are highly valued. Please be assured that we are willing to do all we can to cooperate with all concerned parties. Our goal is nothing else but to build quality and strong degree programs for our students to be better prepared for the job market. Please feel free to let Prof. Jang, Kwon or me know if you have any further questions or comments. Thank you!

Best regards,

Xiaohai Li, Ph. D.
Associate Professor
Director, Robotics & Intelligent Systems Lab
Department of Computer Engineering Technology
New York City College of Technology
City University of New York

186 Jay Street, V633
Brooklyn, NY 11201
Tel: 718-260-4942
Fax: 718-260-5425
Email: xhli@citytech.cuny.edu
URL: www.citytechrobotics.org

From: Xiaohai Li
Sent: Wednesday, May 4, 2022 9:24 AM
To: Pamela Brown; Elizabeth Milonas; Anne Marie Sowder; Kim Cardascia; Lin Zhou; David H Lee; Reginald Blake
Cc: Gerarda Shields; Sunghoon Jang; Ohbong Kwon
Subject: Re: Open Hearing

Dear All,

This is a gentle reminder about our open hearing tomorrow. See the even announcement and Zoom meeting ID below. Thank you for your time and support!

