COVER SHEET
NEW DEGREE PROGRAM PROPOSAL

Program Information

Program Name:	Engineering Technology
Institution Name:	Bellingham Technical College
Degree:	Bachelor of Applied Science in Engineering Technology
Level:	Bachelor
Type:	Applied Science
CIP Code:	14.0101

Contact Information

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Introduction

Bellingham Technical College (BTC) has designed a Bachelor of Applied Science in Engineering Technology (BASET) degree to:

- Meet the workforce needs of regional employers who employ engineers in manufacturing and mechanical design roles.
- Provide a pathway into these engineering jobs for students with non-conventional backgrounds.

Graduates from the BASET program will be prepared for a wide variety of engineering positions, including CAD designer, mechanical design engineer, project/product engineer, application engineer, production engineer, tooling design engineer, and quality control engineer.

When launched, the program will be the only engineering technology baccalaureate program on the state's west side, and the only public baccalaureate engineering program in the state that offers its two-year degree students the opportunity to seamlessly continue on to earn a bachelor's degree. This program will combine theoretical content with a heavy emphasis on practical application, providing current students and engineering technicians with the opportunity to complete baccalaureate degrees and advance their careers.

Program Rationale

The BASET degree is designed to help fill some of the gaps in engineering education in Washington State.

The first gap is that of sheer numbers. Engineering (including engineering technology[1]) is a high demand area with a well-documented shortage of capacity in the Washington State education system. Current completions from engineering programs (approx. 1400 students per year) are only 56% of the projected annual completions needed for 2016 – 2021 (approx. 2500 students per year)[2]. The existing 4-year engineering programs would have to nearly double in size to make up the projected shortfall.

[1] The American Society for Engineering Education notes that "The degree is Engineering Technology. The career is Engineering" http://www.asee.org/member-resources/councils-and-chapters/engineering-technology-council

[2] http://www.wsac.wa.gov/sites/default/files/2013.11.16.Skills.Report.pdf

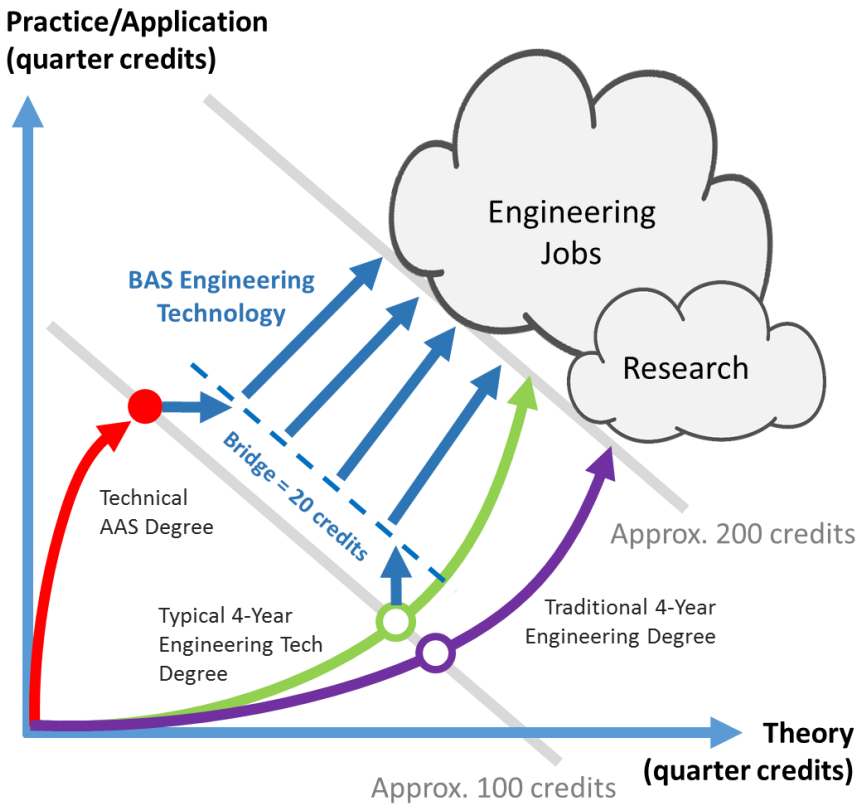

Figure 1 - BTC Bachelor of Applied Science in Engineering Technology

The second gap is that left by traditional teaching models for engineering and engineering technology programs. Traditional 4-year engineering programs are heavily-weighted towards academic study (for example, non-contextualized, non-applied physics and chemistry) during the freshman and sophomore years, adding in more theory and some practice in the junior and senior years. These programs produce engineers who are mainly intended for research (industry and university) and design jobs. A traditional 4-year engineering technology program follows a very similar trajectory with slightly less emphasis on theory, and more on the practice. However, the early emphasis on higher-level math classes in these programs is a hurdle to many students.

The third gap is that there are many engineering jobs that require more emphasis on practical skills than is provided by current degrees. Some of this evidence can be seen in classrooms within the CTC system where degree-level engineers from traditional 4-year schools can be found taking courses in topics such as machining and electronics.

The proposed program addresses these three gaps by:

1. providing additional capacity in the system
2. providing students with an alternative way to acquire the necessary math and engineering science knowledge
3. placing an emphasis on the application and integration of practical skills

The program has been designed to accept students who have a DTA, MRP, AAS-T or other Associate's degree, and those who have taken a more trades-oriented pathway. It will be a particularly good fit for students graduating from BTC's own AAS-T Engineering Technology programs, and also with graduates from nearby colleges and apprenticeship programs such as AJAC.

ABET Quality Standards and the BAS Engineering Technology

The primary accreditation body for engineering and engineering technology programs in the USA is the Accreditation Board for Engineering and Technology (ABET)[3] – a nonprofit, non-governmental organization recognized by the Council for Higher Education Accreditation (CHEA).

ABET accredits college and university programs in applied science, computing, engineering, and engineering technology at the associate, bachelor, and master degree levels through its four commissions:

- Applied Science Accreditation Commission (ASAC)
- Computing Accreditation Commission (CAC)
- Engineering Accreditation Commission (EAC)
- Engineering Technology Accreditation Commission (ETAC)

Each commission publishes a set of standards which are designed to assure students, employers, and the broader society that the programs are of high quality and will produce graduates prepared to enter a global workforce.

The ETAC standards do not appear to preclude the accreditation of applied baccalaureate programs (all references in the standards are to "baccalaureate degree programs") but we have been unable to identify any applied baccalaureate programs that are accredited by ABET at this time. Furthermore, a program cannot apply for accreditation until it has started to graduate students.

Applying for ABET accreditation is not possible at this time. However, we still plan to design and operate the BASET program in a way that is consistent with the guidelines and standards established by ABET ETAC in order to create a high quality and sustainable engineering technology program. Should ABET accreditation for BAS degrees become possible in the future, we would then be well-placed to apply.

[3] http://www.abet.org

1. Curriculum

Advisory Committee Input

A robust advisory committee already exists for BTC's two-year degrees in Engineering Technology. Over the past year, committee members have been actively engaged in helping to design the BASET curriculum, responding to employer surveys regarding the proposed BAS, and reaching out to other employers to gauge interest levels. A list of advisory committee members is included in this document as Appendix C.

CIP Code

The curriculum for the BASET degree is aligned with CIP Code 14.0101 – Engineering, General:

> *A program that generally prepares individuals to apply mathematical and scientific principles to solve a wide variety of practical problems in industry, social organization, public works, and commerce. Includes instruction in undifferentiated and individualized programs in engineering.*[4]

Program Learning Outcomes

The program learning outcomes are divided into two parts and follow the pattern established by the requirements of the ABET ETAC "Criteria for Accrediting Engineering Technology Programs."[5] They are also consistent with existing ABET ETAC-accredited baccalaureate-level engineering technology degrees.

Program Educational Objectives

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. The program educational objectives of BTC's BASET program are to produce graduates who are able to:

- analyze and design practical mechanical and manufacturing systems.
- communicate effectively and work well on team-based engineering projects.
- succeed in mechanical and manufacturing engineering positions.
- pursue continued professional development.

Expected Student Learning Outcomes

The BASET program outcomes have been mapped to the ABET ETAC outcomes (a-k) as listed below.

a) an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;

b) an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;

c) an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;

[4] http://nces.ed.gov/ipeds/cipcode/

[5] http://www.abet.org/wp-content/uploads/2015/05/T001-15-16-ETAC-Criteria-05-04-15.pdf

d) an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
e) an ability to function effectively as a member or leader on a technical team;
f) an ability to identify, analyze, and solve broadly-defined engineering technology problems;
g) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
h) an understanding of the need for and an ability to engage in self-directed continuing professional development;
i) an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
j) a knowledge of the impact of engineering technology solutions in a societal and global context;
k) a commitment to quality, timeliness, and continuous improvement.

Curriculum Structure

The curriculum has been designed around four key elements:

A. **Bridge** – allows access to a broad spectrum of prospective students while maintaining a verifiable level of academic knowledge and practical skills at the entry to the Junior year.
B. **Engineering Technology Core** – provides a solid grounding in the engineering science and applied math that is essential to working as an engineer.
C. **Business Skills** – provides students with the opportunity to develop communication skills, develop leadership and financial management skills, and explore the ethical responsibilities that engineers have to society.
D. **Projects and Electives** – give students the opportunity to apply the knowledge and skills that they have gained, integrate various aspects of their learning, and apply the business skills that they have learned.

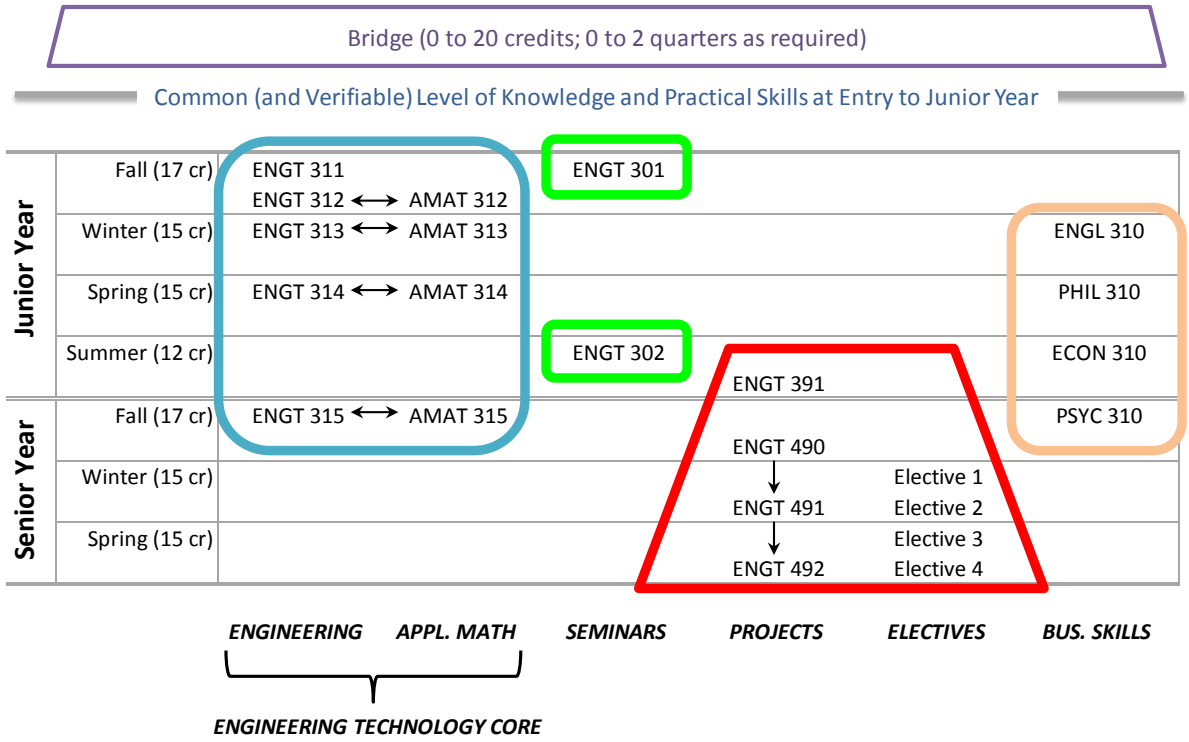

Figure 2 - Structure of the BASET Curriculum

A. Bridge

In keeping with SBCTC's aims for applied baccalaureate degrees[6], the BASET program has been designed to accept students with a broad range of educational backgrounds, and to facilitate students re-entering the educational system after time in the workforce. At the same time, it is critical that academic standards are not compromised, and that students are well-prepared for their upper division studies, including both academic knowledge and practical skills.

In order to achieve these dual aims, students will be admitted to the program and to the Bridge with relatively few credits of transferrable, college-level work. However, before beginning Junior year coursework, students will have to demonstrate that they are competent in the following areas which are critical to success in Engineering Technology through course completion or demonstration of their skills to faculty.

[6] "Increase educational pathways for professional and technical associate graduates who have been limited in their ability to apply credits toward a bachelor degree."
Ref: http://www.sbctc.ctc.edu/college/e_appliedbaccalaureates.aspx

Table 1 – Requirements for Admission to the Program and Entry to the Junior Year

Area	Admission to the Program	Entry to the Junior Year
1. Communications	ENGL& 101 – English Comp. I	ENGL& 101 – English Comp. I
2. Humanities	Any 5 credits	Any 5 credits
3. Mathematics	MATH& 141 – Precalculus I	MATH& 141 – Precalculus I MATH& 142 – Precalculus II
4. Natural Science	---	PHYS& 114 – Physics I CHEM& 161 – Chemistry I
5. Engineering Science	---	ENGR& 214 – Engineering Statics
6. CAD & Design	---	5 credits of CAD – preferably SolidWorks – or equivalent industry experience
7. Workshop Skills	---	Demonstrated workshop skills equivalent to the FSME Competencies (see below)

Note: Courses can be replaced by equivalent or higher-level courses if approved by faculty.

The FSME (Fundamental Skills for Manufacturing and Engineering) competencies are a set of more than 100 competencies that demonstrate that a student can work safely and productively in a manufacturing or engineering fabrication environment. They are equivalent to about 15 credits of workshop training, and are broadly equivalent to the technical content of a manufacturing pre-apprenticeship program. Because of space restrictions for this proposal, the list of competencies is not included here, but a copy is available on request.

Students will be allowed to take up to 20 credits of coursework during the Bridge as part of their BASET studies. All of the courses in the Bridge are lower division (100 and 200) level courses. On entry to the Junior year, students will have 30 credits that count towards the General Education requirements for the degree (ENGL& 101, MATH& 141, MATH& 142, PHYS& 114, CHEM& 161, and 5 credits of humanities).

B. Engineering Technology Core

The engineering technology core is a set of 9 courses (5 engineering, and 4 applied math) that provides the foundational technical knowledge that students will use in their project work and electives in the later part of the program.

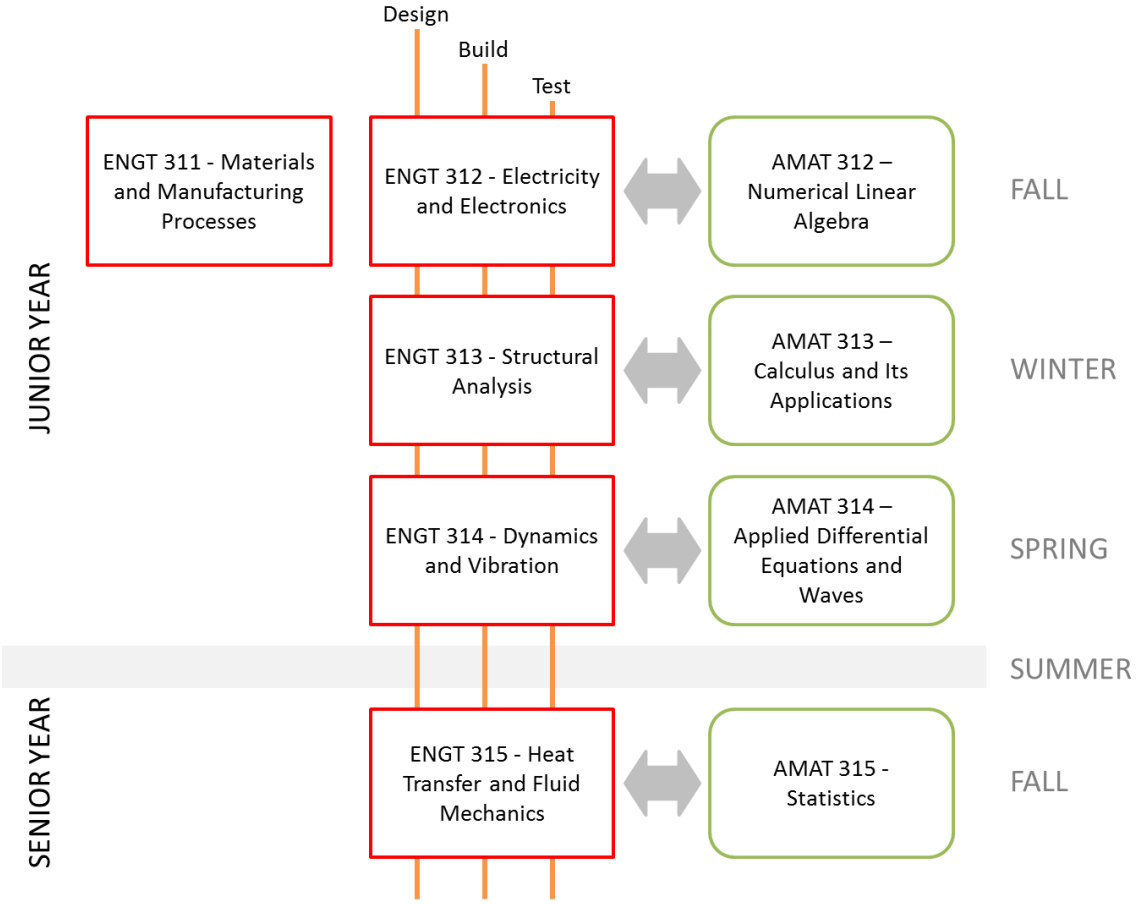

Figure 3 – Coupled Engineering and Applied Math Courses in the Engineering Technology Core

The core will be taught over four quarters, and the curriculum features the linkage of engineering classes with classes that teach the math required to address these problems. Each of the engineering courses will include learning outcomes that directly address each of the following three themes:

1) Design
2) Build/Fabrication
3) Instrument, Test and Analyze

In particular, the "instrument, test and analyze" theme will allow for the development of students' practical skills in instrument calibration, signal acquisition, and signal conditioning. The statistical skills required for data processing and interpretation of the results supports the attainment of ABET ETAC outcome c) "… an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes"; and ABET ETAC

outcome f) "… an ability to identify, analyze, and solve broadly-defined engineering technology problems;"

As an engineering technology degree with emphasis on practical work, all ENGT courses in the Engineering Technology Core will be constructed around a significant lab/workshop component. Although the detailed lesson planning has yet to be done, the intent is that these 5-credit courses will generally be designed on the basis of 22 hours of lecture and 66 hours of lab time. This also addresses employers' strong preference for graduates with hands-on skills.

AMAT (Applied Math) classes in the Engineering Technology Core will also have a significant computer lab component based around the solution of problems in support of the linked ENGT classes. Although the detailed lesson planning has yet to be done, the intent is that these 5-credit courses will generally be designed on the basis of 44 hours of lecture and 22 hours of lab time.

ENGT 311 Materials and Manufacturing Processes is an introduction to the relationship between design, manufacturing processes and materials properties with examples drawn from the aerospace, biomedical and marine industries.

ENGT 312 Electricity and Electronics is a foundational course for all students who will be working with electronic equipment with a focus on understanding concepts used in industrial electronics applications. **AMAT 312 Numerical Linear Algebra** is a co-requisite and covers the application of numerical methods and algorithms to solving problems – including electrical circuits – in engineering.

ENGT 313 Structural Analysis covers experimental techniques common to structural engineering, finite element analysis, and the comparison of measurements to numerical/analytical predictions. **AMAT 313 Calculus and Its Applications** is a co-requisite which introduces mathematical tools including derivatives, integration, and vector calculus which are needed to solve problems such as stress analysis.

ENGT 314 Dynamics and Vibrations covers the principles of motion for mechanical systems, inertia, work and energy, linear and angular momentum, vibrational analysis, and impact. **AMAT 314 Applied Differential Equations and Waves** is a co-requisite focusing on the math needed to solve problems involving waves, and vibrations.

ENGT 315 Heat Transfer and Fluid Mechanics provides students with an understanding of fluid statics and dynamics, conduction, convection, radiation, and heat exchangers. **AMAT 315 Statistics** is a co-requisite which reinforces the statistics knowledge that students will have acquired during the labs in earlier courses, and extends it to look at more advanced topics such as hypothesis testing, ANOVA, and design of experiments.

C. Business Skills

The ABET ETAC standards require the development of students' skills in non-technical areas such as communication; the ability to function effectively as a member or leader on a team; the ability to use written, oral, and graphical communication techniques; understanding of and a commitment to addressing professional and ethical responsibilities (including a respect for diversity); ability to apply

sound economic principles to engineering decisions; and a knowledge of the impact of engineering technology solutions in a societal, and global context (ABET, outcome j). The four courses in the Business Skills group are designed to address some of these requirements.

ENGL 310 Business Communication focuses on audience-oriented communication in the business environment and covers both written and oral presentation skills. **ECON 310 Managerial Economics** focuses on forecasting and estimating techniques and on tools used to analyze projects, compare alternatives, and make sound business decisions. **PHIL 310 Professional Ethics** examines ethical dilemmas that might occur at work, and shows how such issues can be resolved by management analysis and decision-making. **PSYC 310 Industrial Organizational Psychology** examines how people behave and interact with each other at work with an emphasis on the way that these interactions affect job performance.

D. Projects and Electives

The ABET ETAC standards require that "baccalaureate degree programs must provide a capstone or integrating experience that develops student competencies in applying both technical and non-technical skills in solving problems." The projects and electives in the BASET program are designed to address this requirement, and also to give students the opportunity to further build their portfolio, which will be critical for job placement. They include:

- **ENGT 302 Project Planning and Management** teaches students some of the techniques necessary to develop realistic and comprehensive plans for technical projects.

- **ENGT 391 Junior Project**, to be carried out during the summer quarter of the first year, serves as a foundational engineering design experience that supports the Senior Project sequence.

- **ENGT 490 Senior Project: Planning**, **ENGT 491 Senior Project I** and **ENGT 492 Senior Project II**, together, constitute a 3-course, 3-quarter Senior year project sequence that builds on and integrates the knowledge gained through the extensive lab-based, hands-on curriculum in the earlier courses.

Technical Writing and Communication Skills

In addition to the development of written and oral presentation skills in ENGL 310 Business Communications, students' technical writing and communication skills will be addressed through the following measures:

- Specific outcomes relating to technical writing and communication will be included in all Engineering Technology Core ENGT courses, and in the courses associated with the Junior and Senior Projects.

- BTC's Tutoring Center staff will be provided with exemplars of documents (technical reports, PowerPoint presentations, Excel spreadsheets) so that they can more effectively help students achieve the expected standards.

General Education Requirements

As noted earlier, students will have at least 30 credits of General Education at the beginning of the Junior Year. The remaining 30 credits needed to meet the requirements for an Applied Baccalaureate degree[7] are satisfied by upper-division courses shown in Table 2.

Table 2 – General Education Requirements Satisfied by Lower and Upper Division Courses

	At Entry to the Junior Year	Upper Division Course(s)	Credits at the End of BASET Degree	Min Required Credits for a BAS Degree
Communications	ENGL& 101	ENGL 310	10	10
Quantitative/ Symbolic Reasoning	MATH& 141 MATH& 142	AMAT 312 AMAT 313 AMAT 314 AMAT 315	30	5
Humanities	Any 5 credits	PHIL 310	10	10
Social Sciences	--	PSYC 310 ECON 310	10	10
Natural Sciences	PHYS& 114 CHEM& 161	--	10	10
Any of the Above	--	--	--	15
TOTAL	**30**		**70**	**60**

Program Credits

The credit total for the BASET degree is 106 to 126 credits, depending on how many courses are required in the Bridge, and is broken down as follows.

Table 3 – Program Credits

	Lower Division	*Upper Division*
From Student's Associates Degree (or Equivalent)	90+	
BAS Engineering Technology		
Bridge	0 to 20*	
Engineering Technology Core		45
Seminars		4
Projects (including Planning)		17
Electives		20
Business Skills Courses		20
TOTAL	90+	106

[7] http://www.sbctc.edu/resources/documents/colleges-staff/programs-services/applied-baccalaureate/RecommendationforGenEdRequirementsforBASJuly2015.pdf

Teaching Model

The BASET teaching model is designed to provide as much flexibility for students as possible while recognizing that engineering technology involves a significant amount of lab and workshop time.

The ENGT (Engineering Technology) and AMAT (Applied Math) classes in the Engineering Technology Core will be developed as hybrid courses with a combination of online and classroom instruction, and on-campus labs during the week.

The Business Skills and OPM (Operations Management) courses that are taught in conjunction with the BAS Operations Management program will also be hybrid, but will be taught online with three Saturday meetings per quarter. A fully online option for these courses will also be available to students should it be needed. This is not the preferred teaching model, but it will allow for students to continue their studies should they not be able to attend the face-to-face Saturday sessions.

Program Evaluation Criteria and Process

BTC's Policy and Procedures Manual requires that formal review of programs be conducted on a four-year basis. BTC employs a variety of additional methods in order to gather feedback and recommendations from a diversity of stakeholders, including regional employers and students.

Because the BASET degree is new to the college, additional reviews and assessments will be implemented during the early stages of the program to ensure quality, and to help make any changes necessary for program and student success.

Formal Program Reviews

During the first three years of its operation, the BASET program will undergo formal reviews annually. These reviews will provide early feedback on the success of the program and/or indications of problems that might need to be fixed. In addition to looking at the instructional process, these reviews will also examine the wrap-around services provided by Students Services to potential students, students, and alumni in order to ensure that they are successfully supporting students during the entire process from initial inquiry to job placement and beyond.

After 3 years of successful operation, the program will move to BTC's regular 4-year program review cycle.

Other Reviews and Assessments

The BASET program will also benefit from the following reviews and assessments, which will provide information for the program reviews as well as operational data for the Program Director and faculty.

- *Program Advisory Committee:* A committee comprised of industry experts and educators will provide perspective, evaluation, and feedback on the program.
- *Administrative Review:* The Program Director will develop assessment criteria, including qualitative and quantitative measurements. Administrative review will be done no less often than annually, and on a quarterly basis during the first two years.

- *Student Surveys:* Upon graduating from or leaving the program, students will be surveyed as to what they perceived to be the strengths and weaknesses of all aspects of their experience, including classroom activities, pedagogical techniques, the relevance of specific courses, and other criteria, as appropriate.
- *Employer Survey*: Students will be tracked after graduation, and the employers of those hired will be surveyed as to their impressions of how well the program prepared these students for the real-life workplace.
- *Faculty Evaluations:* On a regular basis, the program faculty will meet as a team to discuss the program and its current curricula, and how they might be improved. The faculty will also meet with the Advisory Committee at least annually to ensure that the curriculum meets current industry needs.
- *Course Evaluations:* To provide specific feedback from the students' perspective, surveys of student assessments on course and instructor effectiveness will be distributed at the end of each quarter and monitored by the Program Director.
- *Internship and Capstone Projects:* Reviews of internship and capstone projects will be coordinated by the Program Director. These reviews will incorporate feedback from students, instructors, staff and (where appropriate) employers.
- *Wage Progression and Employment Status:* The Program Director, working with BTC's Institutional Research staff, will develop reporting processes for graduates of the BASET program that are consistent with BTC practices.

2. Faculty and Staff

Projected Teaching Faculty Numbers

The number of teaching faculty needed for the BASET program is based on the number of credits to be taught, and a target teaching load of 45 credits per year for a full-time faculty member.

Table 4 - Projected Teaching Faculty Numbers

	AY 16/17*	AY 17/18	AY 18/19	AY 19/20	AY 20/21	AY 21/22
CREDITS						
ENGT, AMAT & Elective Courses	0	37	86	86	86	86
Other Upper Division Courses	0	10	20	20	20	20
TOTAL CREDITS	0	47	106	106	106	106
TEACHING FACULTY FTE						
ENGT, AMAT & Elective Courses	1.0	1.0	2.0	2.0	2.0	2.0
Other Upper Division Courses	0	0.2	0.5	0.5	0.5	0.5
TOTAL FTE	1.0	1.2	2.5	2.5	2.5	2.5

* Winter and summer quarter – preparation only. No upper division classes taught.

Qualifications for Teaching Faculty

All full-time faculty teaching core courses in the BASET program, including the Program Director, will have a minimum of a Master's degree (Doctorate preferred) in a relevant field with significant teaching and/or industry experience. Teaching experience at the bachelor's degree level or higher and experience in advising students will be preferred.

All full- and part-time faculty members hired to teach technical courses will meet the certification requirements for professional and technical instructors in the Washington Administrative Code.

Anticipated faculty assignments for upper division courses, including academic qualifications for identified teaching faculty members, are shown in Appendix C. Lower division courses required by students during the Bridge will be taught by existing faculty at BTC.

The Program Director

The Program Director will share teaching duties with administrative responsibilities which include:

- Development, implementation, and quality control of the curriculum.
- Class scheduling and staffing.
- Supervision of program faculty and program support staff.
- Development of the program budget, and financial management.
- Maintenance of accreditation and industry standards for the program.
- Recruitment and admissions.
- Oversight of projects.

Once the program is in full operation (AY 18/19), it is planned that the Program Director's time be split 50:50 between teaching and program-related administrative responsibilities.

The Program Director will be required to have:

1) A minimum of a Master's degree (preferably a PhD) in Engineering or Engineering Technology.
2) Teaching experience at the baccalaureate level or higher.
3) Considerable (at least five years) industry experience in an engineering role.
4) Contacts within local industries and businesses able to help with curriculum design, student recruitment, and student placement.

Laboratory Support

Provision is made in the budget for a Lab Technician to support the program at the 0.5 FTE level during AY 17/18 and then at the 1.0 FTE level thereafter.

Student Services

The need to provide specialized support to BASET students, particularly through the selective admission process which may be new to many applicants, is recognized by the plan to provide 1 FTE of additional resources within BTC's Student Services departments throughout the program.

Library and Information Commons

The BTC Library provides a variety of print, media, and online digital resources to students, faculty, and staff. The collection of books, reference materials, journals, and multi-media resources focuses on supporting BTC's instructional programs. All of the digital resources including specialized online reference databases, a large collection of eBooks, and digital journals are available from any computer on campus or through remote access. A professional library staff is ready to provide research and reference assistance either in the library or online.

The Information Commons, the open computer lab on campus, includes over 40 different computer applications, Internet access, and a variety of assistive technologies. The library staff provides all of the student technical support. There is an Information and Digital Literacy classroom and eight media-enhanced small group study rooms.

In order to support the specialized research needs of BASET students, the plan provides for 0.3 FTE of additional librarian support throughout the program together with additional funding to allow the library to add specialized data resources and subscriptions.

3. Admissions Process

BTC adheres to the open access mission and values of the State Board of Community and Technical Colleges, documented in Chapter Three of the SBCTC Policy Manual. Admission requirements are flexible to allow for broad participation, but selective enough to recruit students with the greatest likelihood of success.

Program Admission Requirements

Admission to the BASET program is open to students who meet the following requirements:

1. An earned associate degree (or equivalent) from a regionally-accredited institution with a minimum of 90 quarter credits, and minimum cumulative GPA for all college coursework of 2.5.

2. Completion of at least 15 credits of college-level General Education with a minimum of a 2.5 GPA in each class as follows:
    - English Composition (ENGL& 101 or equivalent) – 5 credits
    - Humanities – 5 credits
    - Precalculus I (MATH& 141 or equivalent) – 5 credits

Admission to the program does not guarantee entry to the Junior year.

Credit may be awarded for military experience, as demonstrated through a student's military transcript, based upon guidelines from the American Council of Education. Credit for prior learning and experiential competencies gained through work will be assessed on an individual basis, according to institutional guidelines described in BTC's Policies and Procedures Manual.

Applicants must also submit:

a) A formal resume.

b) A one-to-two page admission essay describing the candidate's interest in the degree, his or her background and experience, how completion of this degree meets his or her personal education and employment goals, his or her understanding of the commitment that will be required to complete the program, and any other information that may support entry to the program.

c) Two sealed letters of recommendation attesting to the student's ability to succeed at the baccalaureate level, preferably one from an instructor and one from an employer or supervisor.

d) $50 non-refundable application fee.

Selection Criteria

Complete applications will be reviewed by an Admissions Committee chaired by the Program Director. Applicants will be ranked based on the criteria listed above. GPA is the most heavily-weighted criteria followed by resume, admission essay and recommendation letters. Prior to reviewing applicants, the Admissions Committee will design comprehensive rubrics for evaluating the resume, admission essay

and references. These rubrics will ensure that a consistent and rigorous method is applied to each application equally.

Qualified applicants will be admitted on the basis of first-received, first-admitted. If there are more applications than available slots, qualified students will be placed on a waiting list, again in the order of the dates on which their applications were received.

It is anticipated that the college will use a weighted method for selection criteria for the BASET program similar to that used in other SBCTC colleges awarding applied baccalaureate degrees. An example is shown in Table 7. The final decision on admission to the BASET program will be made by the Program Director.

Table 5 – Example of Weighted Criteria for Selective Program Admission

Application Requirements	Max. Pts	Notes
Cumulative College Level Associate Degree GPA	**60**	Multiply cumulative GPA by 15 to determine total points
Resume	**10**	Based on evaluation rubric
Essay	**10**	Based on evaluation rubric
Recommendations	**20**	10 points for each recommendation, based on evaluation rubric
TOTAL	**100**	

Encouraging Diversity

The issue of diversity in the admission plan has short and long-term timeframes:

Short Term

The BASET program is non-traditional – at least from an engineering point of view – because the Bridge allows those who start down a "trades" path to enter the engineering field.

As a result, we will be able to approach students currently enrolled in trades programs at BTC and partner colleges, and offer them an opportunity to see if an engineering technology pathway is right for them – either immediately, or later in their career. Since non-traditional programs tend to have a more diverse enrollment than traditional engineering programs, we hope to see a more diverse group of students interested in, and applying for admission to the BASET program. We will, therefore, be developing materials (papers, online presentations) describing how these students could take advantage of the opportunity.

Working with partner colleges (see below) we also hope to tap into programs in other regions which serve a more diverse population than in BTC's immediate service area.

Finally, the Bridge also allows us to admit older workers who have already amassed considerable practical experience, but who did not take a traditional calculus track in high school or college. This

opens the door to another student population not well served by existing programs in the region. It may be of particular value to older workers in physically challenging occupations such as machining and welding, who may be looking to use their extensive knowledge and abilities in a less physically-demanding field.

Long Term

We plan to address the long-term diversity of the program by making local high school students and their parents aware of this program since a traditional engineering pathway may not be a good fit with talented students who have strayed from the rigid calculus-based math sequence due to factors such as peer pressure, language difficulties, or legal problems; or who may simply want a more practically-oriented approach. In this way, we can begin to build a long term pipeline with a diverse group of individuals. The primary channel for doing this will be through our ongoing work with Bellingham Public Schools – notably our active presence on the CTE Advisory Council, and regular meetings with the Middle School and High School Counselors.

Specific Measures

In addition to the work above, the following measures will be adopted in the BASET program to encourage diversity:

- Recruitment materials for the BASET program will be designed to appeal to all ages and genders, as well as to students of color. This will involve the intentional development of marketing collateral which models an appropriate diversity of racial, gender and age groups.
- Efforts will be made to ensure representatives from industry partners represent a variety of backgrounds, and speakers invited to campus will be carefully selected to emphasize diversity.
- We plan to reach out to Whatcom Community College and Skagit Valley College (SVC) once the BASET program is approved in order to start developing formalized pathways. The programs at SVC, in particular, are likely to be good feeder programs for the BASET program. The workforce and academic deans at SVC have been both aware of, and involved in, BTC's development of this degree and both are strongly in favor of building pathways from their programs to BTC's BASET program. Since SVC programs tend to be more diverse than BTC's programs due to the demographics of the Skagit Valley, we anticipate that this will have a positive effect on enrollment of diverse students in the BASET program.
- Because the BASET program will use selective admission, the Program Director will carefully monitor diversity in student enrollment in the program to determine the extent to which it represents the local community and to determine if action needs to be taken to change the recruitment processes. BTC's Institutional Effectiveness area will provide the data necessary for this, and the criteria that we will use to assess diversity will be developed after discussions with faculty and staff, including BTC's Director of Multicultural and Student Support Services.

4. Student Services Plan

Generally Available Services

BTC's Student Services organization is aware and supportive of the BASET program, and is preparing to provide full wrap-around services to potential students, students, and alumni.

Students in the BASET program will have access to all of the support, advising, and counseling services generally available to students at BTC. These services include:

- Admissions & Recruitment
- Advising & Career Services
- Accessibility Resources
- Assessment Center
- Counseling & Multicultural Services
- Financial Aid
- Registration & Enrollment
- Workforce Funding & Student Support

In particular:

- BTC has a Veterans Coordinator and Veterans Club as well as a dedicated Veterans Center space.
- Students in the BASET program will pay the services and activities fee, and will benefit from the leadership and the services provided by Associated Student Body (ASBTC).

The majority of the BASET courses are on campus. Only a few of the courses (the Business Skills and OPM courses) will use the hybrid/weekend model. Consequently, students will be on-campus for at least some of the time during every one of their 7 quarters and will have the same access to services as other BTC students.

It is BTC's policy that all support services are available online as well as face-to-face. More information can be found at http://www.btc.edu/CurrentStudents/StudentResources/indexStudentResources.aspx

Program-Specific Services

Additional Resources

The financial plan shown in Section 5 below provides for 1 FTE of additional resources within BTC's Student Services department throughout the program to provide specialized support to BASET students – particularly through the admission process. It is planned to hire this person in winter 2017 to provide sufficient time to establish formal admissions processes before recruitment to the program begins, and before students start taking Bridge courses in spring and summer 2017. We will be looking for someone with a minimum of:

- a Master's degree in an appropriate field,
- recruitment, admissions and (ideally) transcript evaluation experience in a 2-year college

Preferred experience will include recruitment, admissions and/or transcript evaluation experience in a 4-year institution.

Initially, the position will report to the Vice President of Student Services, with a "dotted line" reporting link to the BASET Program Director. This staff member will be the primary point of contact for all questions relating to the BASET degree. BTC Student Services has developed a "flat" organizational structure that works effectively for this institution. Currently, 7 directors report directly to the Vice President and meet together weekly. The new position will be included at this level in order to provide for strong communication and high visibility of the program within the organization, and to help with integration of BAS services into the Student Services team. As the program develops, the reporting arrangements will, of course, be reassessed periodically and this reporting structure may change.

Financial Aid

Although the specific financial aid needs of students in the BASET program may differ in some respects from the needs of students in traditional Associates' programs, it is not planned to have a separate group dealing with this. Instead, existing Financial Aid staff will be provided with training as required to understand any differences that may exist.

BTC's Director of Financial Aid has experience in the administration of financial aid for baccalaureate degrees from her time working for the NW Indian College as their Financial Aid Officer. She will be responsible for teaching the other 6 members of the BTC's Financial Aid group about the differences in processing BAS applications.

It is believed that the current Financial Aid staff does have the capacity to serve this population. However, we will monitor this carefully as student numbers increase over the first two years of the program's operation.

Program and Career Advising

Advising is the formal responsibility of Student Services staff. BTC uses a centralized case advising system, and BASET students will have the full benefit of this coordinated approach, which is based on nationally-recognized best practices.

All students with program intent are enrolled in BTC's case management system on starting a program, and assigned to an Academic and Career Advisor specializing in that program. At the request of the advisor, the BASET program director and/or faculty teaching in the BASET program will be available to advise students on course choice, discuss student progress, direct students to needed resources, and assist with other program-related issues or problems. If the Program Director is not going to be available, he/she will designate a member of faculty to act in his/her stead.

The BASET program director and faculty will also work with Student Services staff to establish links with businesses who may hire BASET program graduates.

Prior Learning Assessment

Students in the BASET program will be able to apply credit for prior learning in accordance with BTC's Non-Traditional Credit - Prior Learning Assessment policy[8]. Assessment of work submitted to gain credit for prior learning will be the responsibility of qualified program faculty.

Tutoring Center

BTC's Tutoring Center is a free service which helps students to achieve success in math, accounting, chemistry, biology, writing, English, and many other courses. Tutors are recruited to provide support for subjects as requested by BTC students.

BASET program faculty will work with the Tutoring Center staff to help them understand the requirements of the program and the standards that students are expected to achieve to be successful – particularly in the area of math. As part of this collaborative approach, program faculty will provide Tutoring Center staff with exemplars of documents (reports, PowerPoint presentations, Excel spreadsheets) so that they can more effectively help students achieve the expected standards.

Staff from the Tutoring Center will also provide technology orientations for BASET students during the initial orientation course (ENGT 301 - Introduction to Engineering Technology), and will be available on request at other times to provide academic support as needed.

[8] http://www.btc.edu/General/Publications/Policies/Non-Traditional%20Credit%20and%20Prior%20Learning%20Assessment.pdf

5. College Commitment and Financial Plan

Financial Plan

The financial plan assumes the following:

1) Student enrollment is shown in this table:

AY 17/18	AY 18/19	AY 19/20	AY 20/21	AY 21/22
27	27	28	30	30

   The numbers projected here are slightly higher than those included in the Statement of Need previously reviewed by SBCTC because of the significant interest that has been shown by potential students – especially those within BTC's existing AAS-T Engineering Technology programs.

2) The attrition rate is assumed to be 10% for each cohort.

3) In winter 2017, the Program Director will be hired and 1 FTE of Admissions/Student Services resources will be assigned to the program to recruit students into the program, develop and formalize the admissions processes, and start development of the instructional resources.

4) In spring 2017, an additional full-time faculty member will be hired to work on detailed lesson planning and further development of instructional resources.

5) Library support (0.3 FTE) for the program will be provided starting in summer 2017.

6) A Lab Technician will support the program at the 0.5 FTE level during AY 17/18 and then at the 1.0 FTE level thereafter.

7) Benefits for faculty and staff are assumed to be 35% of gross salary.

8) An annual COLA of 1% has been included in the salary + benefit numbers.

9) The per credit tuition fee is based on the proposed FY2016-17 rate, assuming that students are taking full loads (maximum discount) and have Resident status. This amounts to $119.62 per credit.

10) There will also be a student fee of $65 per credit.

11) Teaching will occur in all 4 quarters, with the summer quarter being a lighter load (12 credits) due to the reduced instruction time available. Student will take 47 credits of upper division courses over the 3 quarters of the first year, and 59 credits of upper division courses over the 4 quarters of the second year

Table 8 shows the financial plan for winter and spring 2017 and the first 5 full years of the BASET program.

Facilities, Equipment and Instructional Resources

BTC is in the fortunate position of having substantial resources and capabilities for training in the fields of machining, welding, instrumentation and control technology, electronics, mechatronics, process technology, and composites. BASET students will have access to these labs and workshops during their studies. However, the program also involves a considerable amount of project work for which a dedicated space is needed.

BTC has agreed to commit the use of space in Building B on the main campus, which totals 4100 sq. ft. (3,500 sq. ft. of workshop, and 600 sq. ft. of classroom). Any necessary refurbishment of the space will be covered in the college's facilities plan. Since the space that has been allocated to the program may be utilized for short-term projects during the period leading up to the launch of the BASET program, we do not yet accurately know what will need to be done after the space is vacated, and therefore cannot develop a detailed estimate for the work. It is also possible that preparation of the space for the short-term projects the other programs may answer some of the BASET facility needs, thereby reducing the cost.

Additionally, $60,000 during the launch phase (AY16/17 and 17/18), plus $25,000 per year thereafter has been allocated in the program budget to cover equipment costs.

In order to support the anticipated needs and demands of the BASET program, the annual program budget also includes additional funds for the library to be used for targeted collection and resource development. These funds will provide digital and print library collections that reflect the best and most recent scholarship in their fields at the baccalaureate level and provide support for research conducted by faculty and students. The choice of specific data and reference sources to be used will be informed by the lesson planning process, but our library staff believes that the funding included in this budget will be sufficient to meet the needs of the program.

College Commitment

BTC's Business Office has reviewed the proposed budget and confirmed that the college is fully committed to funding the costs associated with the launch of the program through payments from college reserves and/or other sources. Excluding fees associated with the NWCCU approval process, and the cost of refurbishing the assigned space, the launch costs are currently estimated to be as follows:

AY 16/17	$ 122,220
AY 17/18	$ 167,479
Total	$ 289,700

Table 6 – Program Costs and Funding

Student FTE

	*AY 16/17**	*AY 17/18*	*AY 18/19*	*AY 19/20*	*AY 20/21*	*AY 21/22*
Junior Year	0	27	27	28	30	30
Attrition		-2.7	-2.7	-2.8	-3	-3
Senior Year			24.3	24.3	25.2	27
Projected Enrollment (FTE)	0	27	51.3	52.3	55.2	57

Student Credits

	*AY 16/17**	*AY 17/18*	*AY 18/19*	*AY 19/20*	*AY 20/21*	*AY 21/22*
Junior Year	0	1269	1269	1316	1410	1410
Senior Year	0	0	1434	1434	1487	1593
Total Credits	0	1269	2703	2750	2897	3003

Faculty and Staff FTE

	*AY 16/17**	*AY 17/18*	*AY 18/19*	*AY 19/20*	*AY 20/21*	*AY 21/22*
Program Director (FTE)	1.0	1.0	1.0	1.0	1.0	1.0
Teaching Faculty - BASET (FTE)		1.0	1.5	1.5	1.5	1.5
Teaching Faculty - Other (FTE)		0.3	0.5	0.5	0.5	0.5
Lab Technician (FTE)		0.5	1.0	1.0	1.0	1.0
Student Services (FTE)	1.0	1.0	1.0	1.0	1.0	1.0
Librarian (FTE)		0.3	0.3	0.3	0.3	0.3

Program Costs

	*AY 16/17**	*AY 17/18*	*AY 18/19*	*AY 19/20*	*AY 20/21*	*AY 21/22*
Program Director	38,015	76,031	76,791	77,559	78,335	79,118
Teaching Faculty - BASET	0	67,727	102,606	103,632	104,668	105,715
Teaching Faculty - Other	0	20,845	31,899	32,218	32,540	32,865
Lab Technician	0	18,204	36,772	37,139	37,511	37,886
Student Services	22,889	45,777	46,235	46,697	47,164	47,636
Librarian	0	15,315	15,468	15,623	15,779	15,937
Faculty & Staff Salaries	60,904	243,898	309,770	312,868	315,996	319,156
Benefits @ 35%	21,316	85,364	108,419	109,504	110,599	111,705
FACULTY & STAFF COSTS	82,220	329,262	418,189	422,371	426,595	430,861

	*AY 16/17**	*AY 17/18*	*AY 18/19*	*AY 19/20*	*AY 20/21*	*AY 21/22*
Goods & Services	5,000	7,500	7,500	7,500	7,500	7,500
Professional Development	0	5,000	10,000	10,000	10,000	10,000
Equipment & Software	30,000	30,000	25,000	25,000	25,000	25,000
Marketing & Outreach	5,000	15,000	15,000	10,000	10,000	10,000
Library Resources	0	15,000	10,000	10,000	10,000	10,000
OTHER COSTS	40,000	72,500	67,500	62,500	62,500	62,500

Program Income

	*AY 16/17**	*AY 17/18*	*AY 18/19*	*AY 19/20*	*AY 20/21*	*AY 21/22*
Tuition	0	151,798	323,297	328,919	346,515	359,219
Additional Student Fees	0	82,485	175,676	178,731	188,292	195,195
From State Allocation	0	0	0	0	0	0
College Support	122,220	167,479	0	0	0	0
TOTAL FUNDING	122,220	401,762	498,972	507,650	534,807	554,414

	*AY 16/17**	*AY 17/18*	*AY 18/19*	*AY 19/20*	*AY 20/21*	*AY 21/22*
TOTAL COSTS	122,220	401,762	485,689	484,871	489,095	493,361
TOTAL FUNDING	122,220	401,762	498,972	507,650	534,807	554,414
BALANCE	0	0	13,283	22,778	45,712	61,053

** = AY 16/17 includes winter & spring quarters only*

6. Program-Specific Accreditation

Upon SBCTC approval of the Engineering Technology degree, BTC will immediately file a Substantive Change Request with the Northwest Commission on Colleges and Universities (NWCCU).

As noted in the Introduction, the primary accreditation body for engineering and engineering technology programs in the USA is ABET. It was also noted that, although the ABET ETAC standards do not appear to preclude the accreditation of applied baccalaureate programs, there are no examples of such programs being accredited. Furthermore, a program cannot apply for accreditation until it has started to graduate students. Therefore, our plan is to develop the BASET program in a way that is consistent with the quality standards established by ABET ETAC, and with the intention of applying for accreditation if and when this becomes possible.

7. Pathway Options

Masters' Degrees

A number of potential post-baccalaureate pathways for BASET graduates have been identified, including (but not limited to) those shown in Table 7.

Table 7 – Potential Post-Baccalaureate Pathways

Central Washington University	Master of Science in Engineering Technology
Western Governors University	Master of Science in IT Management
Western Governors University	Master of Business Administration in IT Management
Western Washington University	Master of Business Administration

Professors Johnson and Pringle at CWU noted in their review:

> Just like the BS Mechanical Engineering Technology (MET) program at CWU, we would generally consider this a terminal degree program. However, students graduating from BTC's proposed degree would easily meet the entrance requirements for CWU's MS Engineering Technology program as it is currently structured.

Jean Floten – Chancellor of WGU Washington – wrote:

> Based on reviewing the information that you have provided us, we have determined that Bellingham Technical College's proposed Bachelor of Applied Science (BAS) Engineering Technology is compatible for admission in Western Governors University's Masters of Science or MBA in Information Technology Management.

Her letter of support is included here as Appendix D.

Michael Barr, Associate Dean of the Graduate School at Western Washington University, notes that:

> "Articulation" is kind of among the nomenclature of undergraduate transfer admissions – there really is no articulation to a graduate program. If the BAS is regionally accredited, it will meet our minimum admissions requirement of having a Bachelor's from a regionally accredited institution just as we've recently seen from Bellevue College, Peninsula College, and others. How students fare in the program-level admissions process will depend greatly on their own credentials – the quality of their academic work and research, GRE/GMAT scores, and potential for success in their respective program. That decision lies with the graduate faculty. The content of the BAS could certainly have implications for prerequisites prior to enrollment, but that is all case-by-case and determined by the Graduate faculty.

Professional Engineer Status

In Washington State, neither the lack of ABET accreditation nor the program being Engineering Technology rather than Engineering would prevent program graduates from seeking Professional Engineer status, although it does lengthen the approval process[9].

Double-Major – Engineering Technology and Operations Management

The overlap between the proposed BASET degree and BTC's BAS Operations Management (BASOPS) degree means that, with careful selection of technical electives, a student could graduate from the BASET degree with up to 40 credits of the BASOPS degree already completed. This would mean that the student could then complete a double major in Engineering Technology and Operations Management by taking as few as 50 credits of additional coursework.

This combination of subjects would be an excellent preparation for anyone preparing for a senior technical and/or management career in manufacturing.

[9] http://www.dol.wa.gov/business/engineerslandsurveyors/engintraining.html

8. External Expert Evaluations

At the current time, we are not aware of any PhD programs in Engineering Technology – the pathways after a MS Engineering Technology are typically in Engineering Management, or in Engineering[10]. As a result, we have been unable to identify external reviewers with PhD qualifications in Engineering Technology.

We have, however, been able to engage reviewers from Western Washington University (WWU) and Central Washington University (CWU) who have extensive teaching and research experience in the field.

> **Nicole Hoekstra** is Professor, Department of Engineering and Design at WWU, where she teaches and researches in the field of Plastics and Composites Engineering. She is also actively engaged in teaching innovations including the development of project-based curriculum, the addition of analytical tools and manufacturing processes to courses, and the development of concurrent engineering practices in engineering courses.
>
> **Nicole Larson** is Associate Professor, Department of Engineering and Design at WWU, where she teaches upper division courses in the Plastics and Composites Engineering program as well as a broad range of courses in the Engineering and Design department. She is actively involved in working with women and minorities, as well as WWU students, to engage them in the science and technology fields.
>
> **Dr. Craig Johnson** is a Professor in the Department of Engineering Technology, Safety and Construction at CWU, and is the Coordinator of Mechanical Engineering Technology and Industrial Technology. He has taught undergraduate courses in in Metallography, Plastics, Ceramics, Composites, Casting, Advanced Foundry, Statics, Strengths, Industrial Design, CAD, CADCAM, FEA, Machine Design, Diffraction, Economics, Dynamics, Tool Design, Aviation Systems, Aerodynamics, and Hydraulics; and graduate courses in Numerical Analyses and Composites. He is a licensed Professional Engineer.
>
> **Charles Pringle** is Associate Professor, Mechanical Engineering Technology at CWU, where he teaches in both baccalaureate and master's level Engineering Technology programs. His primary research interests are in Systems Engineering, and Energy Management/Conservation. He has also published papers relating to classroom pedagogy and systems.

The full text of their reviews, together with each reviewer's professional vitae and BTC's response to their recommendations, will be provided in a supplementary document.

[10] "On Engineering Technology Education: BS to PhD" by Enrique Barbieri, Vijay Vaidyanathan & Owe G. Petersen https://www.researchgate.net/publication/261358920_On_Engineering_Technology_Education_BS_to_PhD

Appendix A – Course Descriptions

Note: The following course descriptions do not include lower division courses that might be taken during the Bridge in order to meet the requirements for entry to the Junior year.

Seminars

ENGT 301 – Introduction to Engineering Technology **2 credits**

Introduces students to the Engineering Technology program at BTC. Information will be provided to help with transitional needs (including time management, study skills, and resources), involvement opportunities (student organizations, research, tours of engineering facilities, and interactive learning). Includes a technology orientation including an introduction to Canvas, and a review of math and Excel related to engineering applications.
Prerequisites: MATH& 142

ENGT 302 – Project Planning and Management **2 credits**

This course examines the engineering design process and teaches students techniques necessary to develop realistic and comprehensive project plans. Topics include how to effective manage resources, coordinating multiple tasks associated with design projects, conflict resolution, and the use of Microsoft Project to develop and manage project plans.
Prerequisites: ENGT 301

Engineering Technology Core

ENGT 311 – Materials and Manufacturing Processes **5 credits**

Examines the relationship between design, manufacturing processing and materials properties. The fundamental principles behind the various manufacturing processes will be discussed with the intent of providing a working knowledge of various manufacturing methods. For each manufacturing method, students will assess the capabilities, limitations, and potential of the processes. Examples are drawn from the aerospace, biomedical and marine industries.
Prerequisite: MATH& 142

ENGT 312 – Electricity and Electronics **5 credits**

A foundational course for all students who will be working with electronic equipment in industry. Topics include DC and AC components, circuit analysis techniques, semiconductors, electromagnetism, sources, energy conversion and electrical instruments. The focus of the course is on gaining a basic knowledge of electronics and understanding the concepts used in industrial electronics applications.
Prerequisites: AMAT 312 or concurrent enrollment

ENGT 313 – Structural Analysis **5 credits**

Examines experimental techniques common in structural engineering, interpretation of experimental data, comparison of measurements to numerical/analytical predictions, finite element analysis, and engineering report writing. Topics covered in the course include strength, deformation, fracture, creep, stress-strain relations and cyclic fatigue properties of engineering materials such as metals, plastics, composites and ceramics.
Prerequisites: ENGL& 101, ENGT 311, AMAT 313 or concurrent enrollment, familiarity with 3D parametric CAD software

ENGT 314 – Dynamics and Vibration **5 credits**

This course focuses on the study of the kinematics and dynamics of particles and rigid bodies. Topics include principles of motion of mechanical systems, inertia, work and energy, linear and angular momentum, vibrational analysis, and impact.
Prerequisites: AMAT 314 or concurrent enrollment

ENGT 315 – Heat Transfer and Fluid Mechanics **5 credits**

This course is designed to provide students with the fundamental aspects of fluid mechanics and heat transfer in a context consistent with engineering practice. Topics include fluid statics and dynamics, conduction, convection, radiation, and heat exchangers.
Prerequisites: AMAT 315 or concurrent enrollment

AMAT 312 – Numerical Linear Algebra **5 credits**

Explores the application of numerical methods and algorithms to problems in engineering. Topics include vector spaces, linear transformations, matrix operations, eigenvalues, and applications. MATLAB will be introduced and used for numerical computation and solution of engineering problems.
Prerequisites: MATH& 142

AMAT 313 – Calculus and Its Applications **5 credits**

Covers the fundamental concepts of calculus with the aim of developing intuition and skill sets associated with advanced engineering problem solving. Topics include functions, limits, derivatives, integration, vector calculus, and evaluation methods.
Prerequisites: AMAT 312

AMAT 314 – Applied Differential Equations and Waves **5 credits**

This course covers the application of differential equations to solve engineering problems. Topics include first and second order differential equations, initial values problems, Fourier series, Laplace transformation, and separation of variables. Focus is on applications to engineering problems such as waves, vibrations and fluid dynamics. Presents various methods for solving mathematical problems using MATLAB.
Prerequisites: AMAT 313

AMAT 315 – Statistics **5 credits**

Review of descriptive statistics concepts introduced in the labs of the Engineering Technology Core (graphical and tabular summaries of data, measures of central tendency and variability). Course topics include probability theory, probability distributions, confidence intervals, hypothesis testing, linear regression, ANOVA and design of experiments. Presents methods for solving statistics problems including the use of Excel, and applies these to engineering problems.
Prerequisites: MATH& 142

Projects

ENGT 391 – Junior Project **5 credits**

Explores the role of engineering design and collaborative problem-solving in the context of a small scale design projects. Students work in teams to develop their problem-solving and teamwork skills. This class serves as a foundational engineering design experience supporting the Senior Project.
Prerequisites: ENGT 302 or concurrent enrollment

ENGT 490 – Senior Project: Planning **2 credits**

Senior Project: Planning is the first in a three-course sequence in which students will work in teams to design, build, and test systems with real world applications. The focus of this course will be on selecting and identifying a project, and developing and documenting a comprehensive plan for completing the project.
Prerequisites: ENGT 302, ENGT 391

ENGT 491 – Senior Project I / ENGT 492 – Senior Project II **5 credits each**

Senior Project is a culminating course sequence in Engineering Technology that builds on the knowledge gained through the extensive lab-based, hands-on curriculum. Students work in teams to design, build and test systems with real world applications. Students will apply the engineering design process including defining functional requirements, conceptualization, analysis, identifying risks and countermeasures, selection, and fabrication. Student teams design and build working, physical prototypes to validate their solutions.
Prerequisites: ENGT 490

Electives

Note: Additional electives may be added to support the needs of students' Senior year projects.

ENGT 410 – Design of Machine Elements **5 credits**

Examines concepts, procedures, and analysis techniques necessary to design and integrate machine elements. Topics include the principles of machine design, stress analysis techniques (loads, stresses, deflections, material selection, fatigue failure, finite elements), and analysis of mechanical power transmission components including gearing, bearings, shafting, and frictional devices.
Prerequisites: ENGT 313, AMAT 313

ENGT 411 – Tooling and Fixture Design **5 credits**

Design of tooling used for machining, locating and transferring multiple parts for fixed and flexible manufacturing. Design, setup and development of tooling for robots, computer numerical control machines and other production equipment.
Prerequisites: ENGT 311, basic understanding of machining or ENGT 415

ENGT 412 – Finite Element Analysis **5 credits**

The finite element method and its applications to engineering problems: truss and frame structures, heat conduction, and linear elasticity; use of application/modeling software; overview of advanced topics such as structural dynamics, fluid flow, and nonlinear structural analysis.
Prerequisites: ENGT 313, familiarity with 3D parametric CAD software

ENGT 413 – Applied Thermodynamics **5 credits**

This course describes the fundamentals of thermodynamics including work and heat; the first and second laws of thermodynamics; ideal gas, entropy, reversibility, irreversibility; and study of various processes and cycles. Students will learn the laws of thermodynamics and their applications in mechanical systems.
Prerequisites: CHEM& 121, AMAT 313

ENGT 414 – Introduction to Industrial Controls **5 credits**

Covers concepts, devices, and common practices associated with modern industrial control systems. Students learn how to wire, program, and troubleshoot programmable logic controller (PLC) based control systems. PLC applications focus on interfacing and controlling a variety of electromechanical devices such as motors and pneumatic actuators. Industrial safety practices and procedures are emphasized throughout the course.
Prerequisites: ENGT 312, AMAT 313

ENGT 415 – Machining **5 credits**

Machine shop techniques and design for machining are discussed using a combination of lectures and projects. Students will learn about design for machining guidelines, the specifications of machining operations, and the practical techniques of handling machines tools. Upon successful course completion, students will be able to identify and schedule machine tool operations required to safely manufacture engineering parts.
Prerequisite: MATH& 142

OPM 313 – Quality Management **5 credits**

This course is designed to equip students with the managerial concepts and quantitative tools used in effective and efficient management of quality in manufacturing and service organizations. The course begins with the quality management concepts espoused by Deming and discusses some of the resulting approaches such as Total Quality Management (TQM), Six Sigma, ISO 9000 and AS 9100. Quality requirements specific to regulated industries such as biomedical devices and aerospace will also be surveyed.
Note: Co-listed with BAS Operations Management

OPM 315 – Lean Concepts and Applications **5 credits**

This course introduces students to the theory behind Lean including concepts such as value stream mapping, workplace organization and standardization, 5-S and cellular flow. The importance of workforce development and ongoing training to Lean implementation is stressed, and students will learn about the how to apply Lean techniques to both industrial and service operations.
Note: Co-listed with BAS Operations Management

OPM 411 – Facility Layout and Materials Handling **5 credits**

This course covers the design and optimal layout of industrial facilities, materials handling systems, and warehousing for the most efficient flow of raw materials, work-in-process, and completed product. Students, working in groups, will be required to develop a written proposal for a newly designed or modified facility including a financial justification for the project, and carry out a verbal presentation of their results.
Note: Co-listed with BAS Operations Management

OPM 413 – Measurement and Statistical Process Control **5 credits**

In this course, students will be introduced to key tools used in statistical process control (SPC) include control charts, continuous improvement, acceptance sampling, and the design of experiments. Students will also be taught about fundamental metrology principles including error measurement and analysis, the impact of temperature and pressure on precision measurement; equipment calibration; and advanced test and measurement techniques.
Note: Co-listed with BAS Operations Management

Business Skills

ENGL 310 – Business Communications **5 credits**

This course focuses on audience-oriented communication in the business environment. Course content includes writing reports, proposals, memoranda, and e-mails; graphical presentation of data using Excel; and developing and delivering presentations using PowerPoint and other visual aids. Students will develop and demonstrate these communication skills individually, in smaller groups, and in presentations to larger audiences.
Note: Co-listed with BAS Operations Management

ECON 310 – Managerial Economics **5 credits**

This course focuses on forecasting and estimating techniques; and on tools used to analyze projects, compare alternatives, and make sound business decisions based on economic principles such as time value of money, internal rate of return, and cost-benefit ratios. The course includes the use of Excel as a tool for analysis and decision making.
Note: Co-listed with BAS Operations Management

PHIL 310 – Professional Ethics **5 credits**

This course aims to raise students' awareness of ethical dilemmas that might occur at work, to show how such ethical issues are subject to management analysis and decision-making action, and to provide students with the conceptual tools necessary to identify and then develop an acceptable resolution of these dilemmas. The course will include the presentation of ethical arguments to groups, and debate on their merits.
Note: Co-listed with BAS Operations Management

PSYC 310 – Industrial Organizational Psychology **5 credits**

This course examines how people behave and interact with each other at work with an emphasis on the way that this affects job performance. Topics covered in this course include the development of leadership skills; recruitment and retention; motivation and team building; managing change; and conflict resolution. Group work is used to build and practice the interpersonal skills critical for workplace management.
Note: Co-listed with BAS Operations Management

Appendix B – Program Faculty

Key faculty members identified to date are listed below.

Dr. Steve Addison	PhD, Engineering – University of Cambridge BA, Engineering – University of Cambridge Post-doctoral Research – Imperial College, London
Dr. Mel Oyler	PhD, Business (Industrial Engineering) – University of Washington MS, Computer & Electrical Engineering – University of California, Davis MS, Chemical Engineering – University of California, Davis BS, Chemical Engineering – University of California, Davis
Jill Davishahl	MS, Mechanical Engineering – University of Washington BS, Mechanical Engineering – Union College
Sam Cheung	MEd, Continuing and College Education – Western Washington University MS, Electrical Engineering – University of Vermont Graduate work (MSEE, Applied Mathematics and Optics) at University of Arizona, University of Santa Clara, San Jose State University, and California Polytechnic in Pomona BS, Electrical Engineering – California State University, Los Angeles
Scott Reiss	MS, Mechanical Engineering – Rensselaer Polytechnic Institute BS, Mechanical Engineering – University of Vermont
Jason Kefover	MS, Manufacturing Systems – East Carolina University BS, Mechanical Engineering – Penn State University BA, Physics – Mansfield University of Pennsylvania
Tiffany Windmeyer	MS, Industrial and Organizational Psychology – Walden University BA, Psychology – Langston University Lean Six Sigma Green Belt – University of Washington, Tacoma
Tanya Sorenson	MDiv, Divinity/Ministry – Seattle University MEd, Mastery Teaching – Heritage College BA, Criminal Justice/Law Enforcement Administration – Washington State Univ.
Larry Price	MEd, Continuing and College Education – Western Washington University MBA – Columbia College BS, Forest Resource Management – West Virginia University

Additional faculty may be added as new areas of emphasis are identified, or if student enrollments exceed the currently anticipated numbers. The faculty and administrators responsible for technical courses will meet certification requirements for professional and technical administrators and instructors in the Washington Administrative Code WAC 131-16-094.

The following table indicates the primary courses that faculty would teach. Faculty will be chosen to supervise the project courses (ENGT 391, 490, 491 and 492) based on their area of expertise, and on the subject chosen by the student(s).

	Steve Addison	Mel Oyler	Jill Davishahl	Scott Reiss	Sam Cheung	Jason Kefover	Tiffany Windmeyer	Tanya Sorenson	Larry Price
Engineering Technology Core									
ENGT 311 – Materials and Manufacturing Processes	✓	✓	✓			✓			
ENGT 312 – Electricity and Electronics	✓	✓	✓		✓	✓			
ENGT 313 – Structural Analysis	✓	✓	✓	✓					
ENGT 314 – Dynamics and Vibration	✓	✓	✓			✓			
ENGT 315 – Heat Transfer and Fluid Mechanics	✓	✓	✓			✓			
AMAT 312 – Numerical Linear Algebra	✓	✓	✓		✓				
AMAT 313 – Calculus and Its Applications	✓	✓	✓		✓				
AMAT 314 – Applied Differential Equations and Waves	✓	✓	✓		✓				
AMAT 315 – Statistics	✓	✓	✓		✓				
Technical Electives									
ENGT 410 – Design of Machine Elements			✓	✓		✓			
ENGT 411 – Tooling and Fixture Design			✓	✓		✓			
ENGT 412 – Finite Element Analysis			✓	✓					
ENGT 413 – Applied Thermodynamics	✓	✓	✓						
ENGT 414 – Introduction to Industrial Controls					✓	✓			
ENGT 415 – Machining						✓			
OPM 313 – Quality Management	✓	✓							
OPM 315 – Lean Concepts and Applications							✓		
OPM 411 – Facility Layout and Materials Handling						✓			✓
OPM 413 – Measurement and Statistical Process Control		✓							
Seminar and Project Courses									
ENGT 301 – Introduction to Engineering Technology	✓	✓	✓	✓	✓	✓			
ENGT 302 – Project Planning and Management	✓	✓	✓	✓	✓	✓			
Business Skills									
ENGL 310 – Business Communications								✓	
ECON 310 – Managerial Economics		✓							
PHIL 310 – Professional Ethics							✓	✓	
PSYC 310 – Industrial Organizational Psychology							✓		

Appendix C – Program Advisory Committee

David Cohn	4D Technologies
Bill Karman	Airtech International
Darin Wines	Anvil Corporation
Jim Loeb	Anvil Corporation
Brian Nasralla	Boeing Commercial Airplanes
Mark Gessel	Boeing Commercial Airplanes
Bob Warren	BP Cherry Point
Jeff Tetrick	Career & Tech Ed Director
Dan McKitrick	CH2M-Hill
Kevin Smeall	Ershigs Inc
David deLisle	HeathTechna
Dana Hickenbottom	Itek Energy
Jim LaHatt	LaHatt Engineering Corporation
Justin Kaufman	LittleFuse
Gil Lund, Jr	Lund Engineering
Scott Korthuis	Oxbo International Corp
Joel Swisher	Institute of Energy Studies
Matt Manske	URS Corporation
Sandra Kint	WorkSource
Nicole Larson	WWU
Christ Locke	Zodiac Aerospace
David Bergeron	Zodiac Aerospace
James Waltman	Zodiac Aerospace

Appendix D – WGU Confirmation of Post-Baccalaureate Transfer Options

WGU WASHINGTON

20435 72nd Avenue, South, Suite 301, Kent, WA 98204

Dr. Steve Addison
Director of Applied Baccalaureate Development
Bellingham Technical College
steve.addison@btc.edu

April 27, 2016

Dear Steve,

Based on reviewing the information that you have provided us, we have determined that Bellingham Technical College's proposed Bachelor of Applied Science (BAS) Engineering Technology is compatible for admission in Western Governors University' s Master's of Science or MBA in Information Technology Management.

Admission to any of WGU's graduate programs requires an applicant to have a bachelor's degree from a recognized, accredited institution, and the BAS degree (when approved) would satisfy that requirement. For admission into these program, we also highly recommend that applicants have at least three year's of work experience.

Please contact me directly should more information be required.

Sincerely,

Jean Floten

Jean
Chancellor
WGU Washington
jfloten@wgu.edu