**NARRATIVE TEMPLATE for a (credit) Traditional Associate Degree: Associate in Arts (A.A.) and Associate in Science (A.S.)**

**Please adhere to the following format conventions:**

* Use the heading (item) and numbering convention (for example: Item 1. Program Goals and Objectives).
* Ensure the description provided under each item is removed from the narrative prior to submission.

**Item 1. Program Goals and Objectives**

The associate in science (AS) degree in biomanufacturing is aligned with MiraCosta’s mission as a career and technical education program and as an effort to support the economic and educational well-being of the communities served. This modified biomanufacturing degree explicitly builds upon the College’s existing biotechnology certificates. The modified AS degree allows students who complete this local associate degree or equivalent course work from other colleges to successfully transfer into our bachelor’s degree program, which will better prepare them for entry-level positions in biotechnology within the region and beyond.

The modified biomanufacturing program will serve the needs of the growing biotechnology economic sector in San Diego County. There will be significant growth in biomanufacturing positions in coming years, and MiraCosta College’s AS degree is well-positioned to serve this need.

The MiraCosta Community College Educational Plan 2016-2020 (addendum to the college’s Comprehensive Master Plan 2011-2020) contains 14 institutional objectives that describe strategies for achieving the College’s five institutional goals. The modified degree program in biomanufacturing is aligned with Institutional Goal I, as an innovative practice that will broaden access to higher education for students, Institutional Goal II, as an institution that maximizes student success, and Institutional Goal V, as a conscientious community partner in serving to provide students with the needed skills to participate in the growing biotechnology sector.

The modified associate in science degree program will prepare students for careers a manufacturing technician/associate, environmental monitoring technician/associate, process development technician/associate, quality control technician/associate/analyst, quality assurance technician/associate, or documentation specialist within the biotechnology industry. The modification adds coursework options in advanced skills, such as CRISPR gene editing, and curriculum exploring the impact of biotechnology and workforce skills needed for this growing industry. These modifications were proposed after discussions with the advisory board and local companies during individual site visits.

This modified degree further ensures that the student will complete the appropriate preparation to be eligible to apply to the bachelor’s degree program in Biomanufacturing at MiraCosta. Upon completion of this program, students will be able to successfully perform a technical laboratory task common to the biomanufacturing environment by employing the appropriate equipment and tools, safely and effectively.

**Item 2. Catalog Description**

**Description**

The biomanufacturing degree expands on the skills and theoretical foundation presented in the bioprocess technology certificate to further prepare entry-level technicians for employment in the regulated environment of biomanufacturing. Technicians in this field must learn and implement laboratory procedures and use specialized laboratory equipment in the production of a cell-based product. Competency in organizational, computational, and communication skills is required. This program is designed to give students the theoretical background and practical experience necessary to work effectively in biomanufacturing at the entry level as well as to prepare them for advancement to the baccalaureate degree in biomanufacturing at MiraCosta College. Graduates of this program can expect to be employed in various capacities, including quality control, quality assurance, production, process development, and analytical testing.

**Career Opportunities**

The current workforce demand for students with academic experience in biotechnology and bioprocessing is well documented. Career opportunities exist as a manufacturing technician/associate, environmental monitoring technician/associate, process development technician/associate, quality control technician/associate/analyst, quality assurance technician/associate, or documentation specialist. This degree further ensures that the student will complete the appropriate preparation to be eligible to apply to the bachelor’s degree program in Biomanufacturing at MiraCosta.

**Program Learning Outcomes**

Upon completion of this program students will be able to successfully perform a technical laboratory task common to the biomanufacturing environment by employing the appropriate equipment and tools, safely and effectively.

**Item 3. Program Requirements**

**A.S. Biomanufacturing**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Requirements** | **Dept. Name/#** | **Name** | **Units** | **CSU-GE** | **IGETC** | **Sequence** |
| Required Core (16 units) | BTEC107  BTEC110  (110H)  BTEC120  BTEC210  BTEC211  BTEC221  BTEC222 | Exploring Biotechnology: Emerging Trends, Careers, and the Local Industry  Basic Techniques in Biotechnology  Business and Regulatory Practices in Biotechnology  Data Analysis with Excel  Technical Writing for Regulated Environments  Bioprocessing: Cell Culture and Scale-up  Bioprocessing: Large Scale Purifications | 3  5  3  1  1  1.5  1.5 | E  NA  NA  NA  NA  NA  NA | NA  NA  NA  NA  NA  NA  NA | Yr 1, Fall  Yr 1, Spring  Yr 2, Fall  Yr 1, Spring  Yr 2, Fall  Yr 2, Spring  Yr 2, Spring |
| One course  (3 units) | BTEC108  (108H)  BIO105 | Biomanufacturing: From Gene to Product  Genes and Technology in Society | 3  3 | B2  B2 | 5B  5B | Yr 1, Fall  Yr 1, Fall |
| One course  (4 units) | BTEC180  (180H) | Biostatistics | 4 | B4 | 2A | Yr 1, Spring |
| Two courses (10 units) | CHEM150(150H)  CHEM151(151H) | General Chemistry (Honors)  General Chemistry (Honors) | 5  5 | B1  B1 | 5A  5A | Yr 2, Fall  Yr 2, Spring |
| Required electives (2 units) | BTEC201  BTEC203  BTEC204  BTEC206  BTEC207  BTEC231  BTEC292  BTEC299 | Advanced Cell Culture  Techniques in DNA Amplification  Recombinant DNA  Principles of Separation and HPLC  Techniques in Immunochemistry and ELISA  Gene Editing Techniques: CRISPER-Cas9  Internship Studies  Occupational Cooperative Work Experience | 1  1  1  1  1  1  1  1 | NA  NA  NA  NA  NA  NA  NA  NA | NA  NA  NA  NA  NA  NA  NA  NA | Yr 2, Spring  Yr 2, Fall  Yr 2, Spring  Yr 2, Spring  Yr 2, Fall  Yr 2, Fall  Yr 2, Spring |
| One course  (4 units) | ENGL100  (100H) | Composition and Reading | 4 | A2 | 1A | Yr 1, Fall |

Required Major Total 39 units

Completion of IGETC 40 units

TOTAL UNITS 65 units

(Possible double counting of major and GE units)

Proposed Sequence:

Year 1, Fall = 16 units

Year 1, Spring = 16 units

Year 2, Fall = 18 units

Year 2, Spring = 15 units

TOTAL UNITS: 65 units

Minutes from the Biotechnology Industry Advisory Board on May 3, 2019, and February 21, 2020, are included and reflect the confirmation of the degree requirements (21st century skills and technical skills).

**Item 4. Master Planning**

The modified A.S. in biomanufacturing is aligned with MiraCosta’s mission as a career and technical education program and as an effort to support the economic and educational well-being of the communities served. The modified degree will better support students as they continue on and earn a baccalaureate in biomanufacturing, which will prepare them for entry-level positions in biotechnology within the region and beyond.

The biomanufacturing program will serve the needs of the growing biotechnology economic sector in San Diego County. As described in more detail, below, there will be significant growth in biomanufacturing positions in coming years, and MiraCosta College’s proposed degree will be well-positioned to serve this need.

Further evidence of the degree’s alignment to the College mission is its relationship to MiraCosta’s institutional goals. The MiraCosta Community College District 2011 Comprehensive Master Plan (CMP) covers ten years and consists of an Educational Plan and a Facilities Plan. Both plans are based on thorough research conducted internally and externally over two years. The CMP resulted in the MiraCosta’s adoption of institutional goals, which are intended to advance the mission of the College and address anticipated changes. The MiraCosta College Educational Plan 2016-2020 (addendum to the college’s Comprehensive Master Plan 2011-2020) contains 14 institutional objectives that describe strategies for achieving the College’s five institutional goals. The proposed degree program in biomanufacturing is aligned with Institutional Goal I, as an innovative practice that will broaden access to higher education for students, Institutional Goal II, as an institution that maximizes student success, and Institutional Goal V, as a conscientious community partner in serving to provide students with the needed skills to participate in the growing biotechnology sector.

The AS in biomanufacturing is a high unit associate’s degree, requiring approximately 65 units to award. The intention of the AS degree is to form the first two years of the new BS degree in biomanufacturing. There is significant front-loading of preparatory, major coursework in these first two years. The final two years only require 45 units so students will still be able to complete the bachelor’s degree in 120 units.

The Life Sciences and Biotech sector accounts for almost 60,000 jobs in the San Diego-Imperial region and about 17% of all Life Sciences and Biotech jobs in California (“Sector Analysis Highlights--Life Sciences and Biotechnology: Middle-Skills Jobs in the San Diego-Imperial Region” by the Centers of Excellence in Spring 2019). The sector is projected to grow 7% between 2018-2023 in both San Diego and Imperial Counties (Centers of Excellence 2019 Sector Analysis). The average earnings per Life Sciences & Biotech job is $127,753 making this a high-wage industry that allows students to be financially independent (“California Life Sciences Sector Report 2020” by the California Life Sciences Association).

The recent analysis by the Centers of Excellence regarding recession- and pandemic-resilient jobs in San Diego indicated that entry-level technician positions (weighers, inspectors, samplers) were resilient to both recessions and the pandemic. This modified degree thus prepares students for employment that allows them to earn a living wage in an industry that has continued to grow despite economic and global health challenges. In the local region, there is a projected supply gap of over 1,100 graduates to fill the annual openings in middle skills positions (Centers of Excellence 2019 Sector Analysis). This provides further justification for the importance of this modified program to prepare students for in-demand jobs.

**Item 5. Enrollment and Completer Projections**

This modified A.S degree in biomanufacturing is being used to complete the first two years of the B.S. in biomanufacturing that MiraCosta College was awarded through SB850 and subsequent approval by the Board of Governors.

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Description automatically generatedIn preparation for the application to the Chancellor’s Office, the College’s Biotechnology Department surveyed 138 current and former biotechnology students. The results indicated 48 percent were very interested and an additional 34 percent were interested in the baccalaureate program, as illustrated below, pending more detail on course work developed in partnership with industry. Therefore, there was clear demand to support not only the new bachelor’s degree but also this modified A.S. degree. Since the launch of the BS program, we have consistently welcomed 23-30 students to each cohort, which has a maximum size of 30 students per year.

As noted in Item 4, there is a large gap of about 1,100 between employment demand for middle skills workers (1,233 openings per year) and the supply from regional colleges (61 graduates annually) in San Diego County. This supports the adequate demand for the program. The reports referenced above are included in the Supporting Documentation.

**Item 6. Place of Program in Curriculum/Similar Programs**

Before completing this section, review the college’s existing program inventory in the CCC Curriculum Inventory, then address the following questions:

1. Do any active inventory records need to be made inactive or changed in connection with the approval of the proposed program?

No.

1. Does the program replace any existing program(s) on the college’s inventory? Provide relevant details if this program is related to the termination or scaling down of another program(s).

No.

1. What related programs are offered by the college?

A.S. Research and Development

**Item 7. Similar Programs at Other Colleges in Service Area**

There are no other biomanufacturing programs in the service area. The biomanufacturing program has been shown to be unique and non-duplicative of other biotechnology programs, which was a requirement under SB850. Further, this program was approved by the Region X CTE deans at their September 2016 meeting and this is included as Supporting Documentation.