**Revised September 2015**

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| Proposing New CSU Degree Programs Bachelor’s and Master’s LevelsOffered through Self-Support and State-Support Modes |

This document presents the format, criteria, and submission procedures for CSU bachelor’s and master’s degree program proposals. Please see the [Academic Program Planning](http://www.calstate.edu/APP/) website for doctoral degree proposal formats. (<http://www.calstate.edu/APP/>)

**Templates for Doctoral Proposals**

* [CSU Ed.D. Programs](http://www.calstate.edu/app/EdD/)
* [UC CSU Joint Doctoral Programs](http://www.ucop.edu/institutional-research-academic-planning/_files/jointdochandbook.pdf)
* [Joint Doctorates with Independent Institutions](http://www.calstate.edu/app/documents/Joint_Doc_Other.pdf)

**Criteria**

Proposals are subjected to system-level internal and external evaluation, through which reviewers seek evidence indicating that current campus budgetary support levels provide sufficient resources to establish and maintain the program. Review criteria include: curriculum, financial support, number and qualifications of faculty, physical facilities, library holdings, responsiveness to societal need and regional and workforce needs, academic assessment plans, and compliance with all applicable CSU policies, state laws, and accreditation standards.

**Procedures**

Before a proposal is submitted to the Chancellor’s Office, the campus adds the projected degree program to the campus academic plan. Subsequent to the CSU Board of Trustees approval of the projection, a detailed, campus-approved program implementation proposal is submitted to Chancellor’s Office for review and approval. Proposals are to be submitted in the academic year preceding projected implementation. Only programs whose implementation proposals have been approved by the CSU Chancellor may enroll students. [Campus Academic Plans](http://www.calstate.edu/BOT/agendas/Mar05/EdPol.pdf) appear in the Educational Policy Committee Agenda Item of the annual March meeting of the Board of Trustees.

**Submission**

1. The degree program proposal should follow the format and include information requested in this template. If the proposed program is subject to WASC Substantive Change, the Chancellor’s Office will accept the WASC Substantive Change Proposal format in place of the CSU format. If campuses choose to submit the WASC Substantive Change Proposal, they will also be required to submit a program assessment plan using the format found in the CSU program proposal template. For undergraduate degrees, the total number of units required for graduation must still be made explicit.
2. Submit **ONE** hard copy of the campus-approved degree implementation proposal, including documentation of campus approval, to:

Academic Programs and Faculty Development  
CSU Office of the Chancellor  
401 Golden Shore  
Long Beach, California 90802-4210

1. Submit **ONE** electronic copy to [APP@calstate.edu](mailto:APP@calstate.edu). A Word version is preferred.

**CSU DEGREE PROPOSAL**

**Faculty Check List**

**Please confirm (√) that the following are included in the degree proposal:**

**\_\_x\_\_ Board of Trustees Academic Master Plan approval date.**

**\_\_x\_\_ The total number of units required for graduation is specified (not just the total for the major):**

\_\_\_ a proposed bachelor’s program requires no fewer than 120 semester units

**\_\_\_ any** proposed bachelor’sdegree program with requirements exceeding 120 units must request an exception to the 120 semester unit limit policy

**\_N/A Please specify the total number of prerequisite units required for the major.**

**Note: The prerequisites must be included in the total program unit count.**

**List all courses and unit counts that are prerequisite to the major:**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**N/A\_\_Title 5 minimum requirements for bachelor’s degree have been met, including:**

**\_\_\_** minimum number of units in major (BA 24 semester units), (BS 36 semester units)

**\_\_\_** minimum number of units in upper-division (BA 12 semester units), (BS 18 semester units)

**\_\_x\_\_Title 5 requirements for proposed master’s degree have been met, including:**

**\_x\_** minimum of 30 semester units of approved graduate work are required

**\_x\_** no more than 50% of required units are organized primarily for undergraduate students

**\_x\_\_** maximum of 6 semester units are allowed for thesis or project

**\_x\_\_** Title 5 requirements for master’s degree culminating experience are clearly explained.

**\_x\_\_** for graduate programs, at least five-full time faculty with terminal degrees in appropriate disciplines are on staff.

**\_N/A\_For self-support programs:**

**(in conformance with EO 1099 and EO 1102)**

**\_\_\_\_** specification of how all required EO 1099 self-support criteria are met

**\_\_\_\_** the proposed program does not replace existing state-support courses or programs

\_\_\_\_ academic standards associated with all aspects of such offerings are identical to those of comparable state-supported CSU instructional programs

**\_\_\_\_** explanation of why state funds are either inappropriate or unavailable

**\_\_\_\_** a cost-recovery program budget is included\*

**\_\_\_\_** student per-unit cost is specified

\_\_\_\_ total cost for students to complete the program is specified

\* Basic Cost Recovery Budget Elements

(Three to five year budget projection)

Student per-unit cost

Number of units producing revenue each academic year

Total cost a student will pay to complete the program

Revenue - (yearly projection over three years for a two-year program; five years for a four-year program)

Student fees

Include projected attrition numbers each year

Any additional revenue sources (e.g., grants)

Direct Expenses  
Instructional costs – faculty salaries and benefits

Operational costs – (e.g., facility rental)

Extended Education costs – staff, recruitment, marketing, etc.

Technology development and ongoing support (online programs)

Indirect Expenses  
Campus partners   
Campus reimbursement general fund   
Extended Education overhead   
Chancellor’s Office overhead

\*Additional line items may need to be added based on program needs

**California State University, Long Beach**

**Department of Chemical Engineering**

**Master of Science in Chemical Engineering (MSChE)**

**Degree Program Proposal**

1. **Program Type**
   1. State-Support

b. Delivery Type: Face to face

c. New Program

1. **Program Identification**
2. **Campus**

California State University, Long Beach

1. **Full and exact degree designation and title**

Master of Science in Chemical Engineering (MSChE)

1. **Date the Board of Trustees approved adding this program projection to the campus Academic Plan.**
2. **Term and academic year of intended implementation.**

Fall 2017

1. **Total number of units required for graduation.**

30 semester units

1. **Name of the department(s), division, or other unit of the campus that would offer the proposed degree major program. Please identify the unit that will have primary responsibility.**

Under the College of Engineering, the new degree program will be managed by the Department of Chemical Engineering, which has the primary responsibility.

1. **Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.**

Dr. Larry K. Jang, Professor and Department Chair

Dr. Roger C. Lo, Associate Professor and Graduate Advisor

1. **Statement from the appropriate campus administrative authority that the addition of this program supports the campus mission and will not impede the successful operation and growth of existing academic programs.**

Please see letter from Dr. Forouzan Golshani, Dean of College of Engineering (attached)

1. **Any other campus approval documents that may apply (e.g. curriculum committee approvals).**

This new degree program has been reviewed and approved by the Department of Chemical Engineering in September 2015 and the College of Engineering Curriculum Committee in March, 2016.

1. **Please specify whether this proposed program is subject to WASC Substantive Change review. The campus may submit a copy of the WASC Sub-Change proposal in lieu of this CSU proposal format. If campuses choose to submit the WASC Substantive Change Proposal, they will also be required to submit a program assessment plan using the format found in the CSU program proposal template.**

This new program is not subject to WASC Substantive Change review.

1. **Optional: Proposed Classification of Instructional Programs and CSU Degree Program Code**

CSU Degree Program Code: 09061

Paired CIP Code: 14.0701

1. **Program Overview and Rationale**
2. **Provide a rationale, including a brief description of the program, its purpose and strengths, fit with institutional mission, and a justification for offering the program at this time. A comprehensive rationale also explains the relationship between the program philosophy, design, target population, and any distinctive pedagogical methods.**

The Master of Science in Chemical Engineering (MSChE) program aims at professionals with diverse undergraduate backgrounds in engineering and science. The purpose of the MSChE program is to prepare multidisciplinary professionals for advanced technical activities in their careers of choice.

The strengths of the MSChE program are:

* It provides students with an advanced understanding of core subjects, i.e., thermodynamics, reaction kinetics, transport phenomena, and the knowledge of cutting-edge fields in elective courses;
* It provides students interdisciplinary research opportunities, including advanced polymer and composite materials, catalysis and reaction engineering, process control and automation, microfluidics and its chemical/biological applications, green technologies for energy and materials, and computational/experimental research on chemical processes at the atomic level, to train students for either Ph.D. studies or R&D positions in industry; and
* It provides students with needed expertise through both theory and practice for a wide variety of employment opportunities in many areas, including pharmaceuticals, high-performance materials in the aerospace and automotive industries, biotechnologies, semiconductors in the electronics industry, paints and plastics, petroleum refining, synthetic fibers, artificial organs, biocompatible implants and prosthetics, etc.

1. **Provide the proposed catalog description, including program description, degree requirements, and admission requirements. For master’s degrees, please also include catalog copy describing the culminating experience requirement(s).**

The MSChE program aims at educating and training multidisciplinary professionals in order to provide them with the needed expertise for advanced technical activities in Chemical Engineering and any relevant areas of engineering and sciences.

*Admission to Graduate Study*

In addition to applying to the University Office of Admissions and Records (UOAR), an applicant for graduate study in the MSChE must also apply to and be admitted by the Chemical Engineering Department and the College of Engineering. It is the responsibility of the student to follow a current CSULB Catalog, which sets forth the policies of the University, the College of Engineering, and Chemical Engineering Department graduate programs.

*Admission Process*

* 1. Students interested in applying to the MSChE program at CSULB should submit University application. The applicant must complete and submit the application in order to be considered for admission into MSChE graduate program. The applicant should also submit a MSChE application with a statement of purpose, and three letters of recommendation to the Chemical Engineering Department.
  2. One complete set of official transcripts of all college work attempted are required and must be sent to:

California State University, Long Beach

Office of Admissions and Records

1250 Bellflower Boulevard

Long Beach, CA 90840, USA

* 1. Graduate Record Exam (GRE) scores must be forwarded directly from the Educational Testing Service to the UOAR. Test scores over 5 years old will not be considered.
  2. International students should first contact the Center for International Education on campus for special deadlines.
  3. International students are required to take the TOEFL test and achieve a minimum score of 550 for the paper-based test or 80 for the internet-based test, for admission consideration.
  4. All transcripts, the MSChE application packet, the GRE scores, and the TOEFL scores (if applicable) must be filed by the application deadline.

It is always advised that students submit their applications to the program early. No action can be taken on applications until all required documents are received. Application materials submitted after these dates will be reviewed, and students will be admitted as time and space permit.

*Criteria*

Admission will be granted to students who show high promise of success in post-baccalaureate Chemical Engineering study. Each applicant's potential for MSChE program will be evaluated on the basis of the following four major criteria:

* 1. Past academic record, as reflected in the undergraduate GPA
  2. Scores of the Graduate Record Exam (GRE)
  3. Statement of purpose, which includes leadership potential, educational goals and academic strengths
  4. Three letters of recommendation

*Enrollment*

Application to the University as a graduate student does not constitute admission to graduate study in the College of Engineering. The MSChE program requires additional admissions criteria, such as leadership potential, educational goals, and academic strengths.

*Admissions to Graduate Courses*

Students admitted to the MSChE program or approved by the ChE Graduate Advisor may take graduate courses in Chemical Engineering.

*Continuous Enrollment*

Once a student is accepted and enrolled in the MSChE program, he/she is expected to attend classes in both semesters of each academic year. (Spring and Fall semesters are considered the regular semesters of an academic year, while the summer attendance is optional.) Registration and completion of at least one course each semester satisfies the continuous enrollment requirement. If a student is unable to satisfy the continuous enrollment requirement, he/she must complete the Educational Leave of Absence procedures detailed below. The continuous enrollment status will only be preserved if the student's absence from a regular semester has been processed and approved through the Educational Leave of Absence procedures.

Students failing to maintain the continuous enrollment status will be administratively removed from the MSChE program. Registration privileges will be revoked. Students planning to continue in the MSChE program who have been administratively removed due to the violation of the continuous enrollment condition will be required to re-apply to the MSChE program and to the University.

*Leave of Absence*

Any MSChE student in good academic standing may request an educational leave. Students requesting an educational leave must complete an Educational Leave form, in advance, including an explanation of their reasons for seeking the leave and a statement of when they intend to resume their academic work. The completed form is to be submitted for approval to the COE Graduate Program Office and the University Admission and Records Office in accordance with University Policy.

The minimum initial leave will be one full semester, and the maximum will be one calendar year. In advance, a student may request, in writing, an extension of leave. Under no circumstances will the total number of approved educational leaves exceed two, nor will the duration of approved educational leaves extend beyond two calendar years.

An Educational Leave of Absence, if properly requested and processed, allows a student to satisfy the continuous enrollment requirement and therefore does not affect their good standing status. Students on an approved education leave of absence will continue to receive registration information and access to the MyCSULB system until the authorized leave time expires.

Graduate students who plan to enroll for credits at another institution of higher education during the leave period must obtain prior approvals for the transfer of course credits to the student's program from the department chair in question and the graduate advisor.

The period of an educational leave is counted in the calculation of elapsed time under the regulations governing the seven-year maximum period for completion of the MSChE degree requirements.

In the period of an educational leave, the student's rights under the "Election of Regulation" rule are preserved, maintaining the right for the student to elect regulations as if he or she had maintained continuous attendance. See the CSULB catalog, General Rules and Procedures section, for a complete explanation of the Election of Regulation - "Catalog Rights".

An educational leave presupposes no expenditure of University resources and faculty/staff time on behalf of the student during the period of the leave. In addition, no computer facilities, library privileges, and student services are available to a student on the educational leave.

*Credit Transfer*

Assuming the continuous enrollment requirement has been satisfied, a maximum of six credits that closely complement the student's degree objectives may be applied toward the requirements for the MSChE degree under the following conditions:

1. The credits under consideration must be graduate credits
2. The course work must be taken at an accredited institution
3. Prior approval must be obtained from the ChE graduate advisor and department chair

The remaining units must be completed in courses at CSULB reserved exclusively for graduate students.

*Scholastic Standards/Probation/Disqualification*

A student who fails to maintain a cumulative GPA of 3.0 or higher in all work completed as a graduate student at this University or in all transferred work applied to the program will be placed on academic probation. The semester in which the student's GPA falls below 3.0 is the first probationary semester.

A student on probation, who at the end of the second probationary semester (or summer, if classes are taken) fails to obtain a cumulative GPA of 3.0 or higher on all units attempted in the post-baccalaureate work at CSULB, will be disqualified and removed from the graduate program. The student should note that the cumulative GPA is calculated by the University Admissions and Records and includes all upper division and graduate courses taken while enrolled in the graduate program.

1. **Curriculum**

**a. These program proposal elements are required:**

* Institutional learning outcomes (ILOs)

Graduates will be:

1. Well-prepared with communication, numeracy and critical thinking skills to successfully join the workforce of California and the world or to pursue advanced study;
2. Critically and ethically engaged in global and local issues;
3. Knowledgeable and respectful of the diversity of individuals, groups, and cultures;
4. Accomplished at integrating the skills of a liberal education with disciplinary or professional competency;
5. Skilled in collaborative problem-solving, research, and creative activity.

* Program learning outcomes (PLOs)

The MSChE program is to produce graduates who will be able to

1. Apply foundational knowledge of mathematics, science, humanities, and social sciences;
2. Synthesize technical knowledge of engineering analysis and design to identify, formulate, and solve problems;
3. Develop skills necessary to organize and manage groups, to make ethical decisions, to assume leadership roles in their work place, to function professionally in a globally competitive world, and to communicate engineering results effectively.

* Student learning outcomes (SLOs)

Students who complete the MSChE program will be able to

1. Solve problems in mathematics through probability, statistics, and differential equations;
2. Select and conduct engineering experiments, and analyze and evaluate the resulting data;
3. Apply relevant knowledge, techniques, skills, and modern engineering tools to identify, formulate, and solve engineering problems, including problems in process development, chemical production, and chemical plant safety;
4. Develop solutions to well-defined chemical engineering problems;
5. Design a system or process to meet desired needs, including sustainability and within other realistic constraints, such as environmental, economic, social, political, ethical, health and safety, and manufacturability;
6. Analyze a situation involving multiple conflicting professional, legal, and ethical interests, and determine an appropriate course of action;
7. Organize and deliver effective written, verbal, and graphical communications;
8. Assemble new knowledge through life-long, independent learning without the aid of formal instruction;
9. Demonstrate attributes supportive of the professional practice of engineering; apply leadership principles to direct the efforts of a small group to solve a relatively constrained problem; and function effectively as a member of a multidisciplinary team to solve open-ended engineering problems;

**b. These program proposal elements are required:**

* Comprehensive assessment plan

Based on the experience of offering our graduate program under the umbrella of the interdisciplinary MS in Engineering program for over 20 years, the Department of Chemical Engineering has developed an assessment process to ensure continuous improvement and maintain program quality. A standard course outline (SCO) has been developed for each course in the program. Each SCO specifies leaning objectives and assessment methods in each course syllabus. Analysis shows that students will be meeting all learning goals upon completion of the program. Specifically, problem-solving skills and proficiency of advanced engineering knowledge are reinforced throughout the entire curriculum. The constituents involved in the assessment plan include faculty, students in the program, alumni, and most importantly, the departmental advisory council members from industry. The formats of assessment include semester-end surveys, exit surveys, alumni surveys, advisory council meetings, and industry surveys. The plan of assessment is outlined in the table below:

**Table 1.** Assessment plan for the MSChE program

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Student Learning Outcomes (SLOs) | | | | | |
|  | 1 | 2 | 3 | 4 | 5 |
| Term | Fall 2017 | S2018 | F2018 | S2019 | F2019 |
| Assessor | F | F | F | F | F |
| S | S | A | A | A |
| \*\*\* | \*\*\* | \*\*\* | \*\*\* | \*\*\* |
| Program Learning Outcomes (PLOs) | | | | | |
|  | 1 | 2 | 3 | 4 | 5 |
| Term | F2018 | S2019 | F2019 | S2020 | F2020 |
| Assessor | F | F | F | F | F |
| C | C | C | C | C |
| A | A | A | A | A |
| Institutional Learning Outcomes (ILOs) | | | | | |
|  | 1 | 2 | 3 | 4 | 5 |
| Term | F2019 | S2020 | F2020 | S2021 | F2021 |
| Assessor | F | F | F | F | F |
| C | C | C | C | C |
| A | A | A | A | A |

Note: F = faculty, S = students, A = alumni, and C = Chemical Engineering Advisory Council

* Curriculum Mapping Matrix

Please see Appendix A

1. **Indicate total number of units required for graduation.**

30 semester units

1. **Include a justification for any baccalaureate program that requires more than 120-semester units or 180-quarter units. Programs proposed at more than 120 semester units will have to provide either a Title 5 justification for the higher units or a campus-approved request for an exception to the Title 5 unit limit for this kind of baccalaureate program.**

Not applicable.

1. **If any formal options, concentrations, or special emphases are planned under the proposed major, identify and list the required courses. Optional: You may propose a CSU degree program code and CIP code for each concentration that you would like to report separately from the major program.**

CSU Degree Program Code: 09061

Paired CIP Code: 14.0701

1. **List all requirements for graduation, including electives, for the proposed degree program, specifying course catalog numbers, course titles, total units required for completion of the degree, major requirements, electives, and prerequisites or co-requisites (ensuring there are no “hidden prerequisites that would drive the total units required to graduate beyond the total reported in 4c above). Include proposed catalog descriptions of all new courses.**

The Master of Science in Chemical Engineering degree program at CSULB requires completion of **30 units** of graduate courses, as specified below. Each student must satisfy all the requirements of the University, College, and Department. All courses listed below already exist in the department’s catalog and have been regularly offered for many years.

**Table 2.** Required courses for the MSChE Program

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Required Courses for Graduation*** | | | | | | |
| *Catalog #* | *Title* | *Units* | *Major Reqmt.?*  *(Y/N)* | *Pre req. or Co req.?*  *(Y/N)* | *Elective*  *(Y/N)*  *(For grad programs only, G or UG)* | *New Course*  *(Y/N)* |
| *CHE 505* | *Advanced Chemical Engineering Thermodynamics* | *3* | *Y* | *N* | *G* | *N* |
| *CHE 520* | *Advanced Transport Phenomena* | *3* | *Y* | *N* | *G* | *N* |
| *CHE 530* | *Advanced Reactor Kinetics* | *3* | *Y* | *N* | *G* | *N* |
| *CHE 560* | *Advanced Chemical Process Control* | *3* | *Y* | *N* | *G* | *N* |
| *CHE 580* | *Theoretical Methods in Chemical Engineering* | *3* | *Y* | *N* | *G* | *N* |
| *MAE 501, MAE 502, or STAT 510* | *One external mathematics-based course* | *3* | *Y* | *N* | *G* | *N* |
|  | *Electives and/or Thesis/Industrial Project* | *12* | *Y* | *N* | *G* | *N* |
| *Total Units Required for Degree Completion* | | *30* |  | | | |
| *Catalog Description of All New Courses:* | | *Not applicable due to no new courses required.* | | | | |

*Core Courses*: 12 units required

* CHE 505 Advanced Chemical Engineering Thermodynamics (3)
* CHE 520 Advanced Transport Phenomena (3)
* CHE 530 Advanced Reactor Kinetics (3)
* CHE 560 Advanced Chemical Process Control (3)

*Mathematics*: 6 units required

* CHE 580 Theoretical Methods in Chemical Engineering (3)
* One external mathematics-based course, e.g., MAE 501, MAE 502, STAT 510, or a course approved by the graduate advisor (3)

For the following two categories of elective courses, 12 units are required for the two categories combined, with a maximum of 6 units allowed for the Approved Multidisciplinary Elective Courses category:

*Approved Chemical Engineering Elective Courses:* 6-12 units required

* CHE 515 Occupational and Environmental Safety Engineering

and Management (3)

* CHE 531 Heterogeneous Catalysts (3)
* CHE 532 Microfabrication and Microfluidics Technology (3)
* CHE 533 Green Engineering I (3)
* CHE 537 Materials Purification Processes (3)
* CHE 545 Pollution Prevention (3)
* CHE 555 Environmental Compliance (3)
* CHE 575 Environmental Pollution (3)
* CHE 585 Air Pollution (3)
* CHE 697 Directed Research (3)

*Approved Multidisciplinary Elective Courses:*  up to 6 units allowed

* CE 543 Waste Management and Landfill Engineering (3)
* CE 562 Waste and Wastewater Treatment Design I (3)
* CE 563 Waste and Wastewater Treatment Design II (3)
* CE 564 Environmental Health Engineering (3)
* CE 566 Unit Operations in Environmental Engineering (3)
* CE 567 Liquid and Solid Waste Project Planning (3)
* EE 506 Theory and Practice of Biomedical Instrumentation (3)
* EE 507 Advanced Biomedical Systems (3)
* EE 536 Microfabrication and Nanotechnology (3)
* MAE 512 Computer Aided Design in Mechanical Engineering (3)
* MAE 522 Composite Materials (3)
* MAE 527 Metals and Plastics Manufacturing Processes (3)
* MAE 531 Advanced Heat Transfer (3)
* MAE 532 Combustion I (3)
* MAE 533 Gas Dynamics (3)
* MAE 535 Computational Fluid Dynamics I (3)
* MAE 537 Advanced Fluid Dynamics I (3)
* MAE 538 Heating, Ventilation, Air Conditioning, and Refrigeration (3)
* MAE 631 Viscous Flow Theory (3)
* MAE 635 Computational Fluid Dynamics II (3)
* MAE 637 Advanced Fluid Dynamics II (3)

*Options*

* Thesis/Industrial Project

Students are required to complete 24 units of courses and 6 units of CHE 698, Thesis/Industrial Project. Student are also required to successfully pass their thesis/project defense.

* Comprehensive Exam

Students are required to complete 30 units of required courses and successfully pass the Chemical Engineering Comprehensive Exam.

1. **List any new courses that are: (1) needed to initiate the program or (2) needed during the first two years after implementation. Include proposed catalog descriptions for new courses. For graduate program proposals, identify whether each new course would be at the graduate-level or undergraduate-level.**

None.

1. **Attach a proposed course-offering plan for the first three years of program implementation, indicating likely faculty teaching assignments.**

Please see Appendix B.

1. **For master’s degree proposals, include evidence that program requirements conform to the minimum requirements for the culminating experience, as specified in** [**Section 40510**](http://www.calstate.edu/APP/documents/Title5_MastersDegree_requirements.doc) **of** [**Title 5 of the California Code of Regulations**](http://government.westlaw.com/linkedslice/search/default.asp?RS=GVT1.0&VR=2.0&SP=CCR-1000&tempinfo=TOC)**.**

The MSChE degree requirements conform completely to the following minimum requirements as specified by Section 40510, Title 5 of the California Code of Regulations:

* Thirty semester units are required;
* Twenty-one semester units in residence is required; students are allowed to take no more than 9 units via University Extensions or transferred no more than 9 units from other institutions;
* More than one-half of courses required are graduate-level courses. The MSChE allows no more than two 400-level courses (6 units), which is more rigorous than what the Section 40510, Title 5 requires;
* Thesis or Project (CHE 698) is 6 units, which conform to the max 6 units allowed in Section 40510, Title 5;
* The MSChE program clearly states that oral defense and written thesis or project reports are required for students choosing thesis/project option, and that comprehensive exam is required for students choosing non-thesis/project option;
* The MSChE program requires GPA of 3.0 (letter grade “B”) of the student to obtain the degree.

1. **For graduate degree proposals, cite the corresponding bachelor’s program and specify whether it is (a) subject to accreditation and (b) currently accredited.**

The BS in Chemical Engineering is currently accredited by Accreditation Board for Engineering and Technology, Inc. (ABET) until 2018.

1. **For graduate degree programs, specify admission criteria, including any prerequisite coursework.**

*Criteria*

Admission will be granted to students who show high promise of success in post-baccalaureate Chemical Engineering study. Each applicant's potential for MSChE program will be evaluated on the basis of the following four major criteria:

1. Past academic record, as reflected in the undergraduate GPA
2. Scores of the Graduate Record Exam (GRE)
3. Statement of purpose, which includes leadership potential, educational goals and academic strengths
4. Three letters of recommendation
5. **For graduate degree programs, specify criteria for student continuation in the program.**

*Continuous Enrollment*

Once a student is accepted and enrolled in the MSChE program, he/she is expected to attend classes in both semesters of each academic year. (Spring and Fall semesters are considered the regular semesters of an academic year, while the summer attendance is optional.) Registration and completion of at least one course each semester satisfies the continuous enrollment requirement. If a student is unable to satisfy the continuous enrollment requirement, he/she must complete the Educational Leave of Absence procedures detailed below. The continuous enrollment status will only be preserved if the student's absence from a regular semester has been processed and approved through the Educational Leave of Absence procedures.

Students failing to maintain the continuous enrollment status will be administratively removed from the MSChE program. Registration privileges will be revoked. Students planning to continue in the MSChE program who have been administratively removed due to the violation of the continuous enrollment condition will be required to re-apply to the MSChE program and to the University.

*Leave of Absence*

Any MSChE student in good academic standing may request an educational leave. Students requesting an educational leave must complete an Educational Leave form, in advance, including an explanation of their reasons for seeking the leave and a statement of when they intend to resume their academic work. The completed form is to be submitted for approval to the COE Graduate Program Office and the University Admission and Records Office in accordance with University Policy.

*GPA and Satisfactory Academic Progress*MsChE students must maintain a GPA of 3.0 and make satisfactory academic progress for continuation in the program.

1. **For undergraduate programs, specify planned provisions for articulation of the proposed major with community college programs.**

Not applicable.

1. **Provide an advising “roadmap” developed for the major.**

**Table 3.** Advising roadmap for the MSChE Program

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Master of Science in Chemical Engineering (MSChE)***  ***Advising Roadmap and Recommended Course Sequence*** | | | | | |
| ***Year 1*** *(18 units)* | | | | | |
| *Fall* | *Units* | *Summer* | *Units* | *Spring* | *Units* |
| *CHE 530* | *3* |  |  | *CHE 505* | *3* |
| *CHE 560* | *3* |  |  | *CHE 520* | *3* |
| *CHE 580* | *3* |  |  | *MAE 501/MAE 502/STAT 510* | *3* |
|  | *Total: 9* |  | *Total:* |  | *Total: 9* |
| ***Year 2*** *(12 units)* | | | | | |
| *Fall* | *Units* | *Summer* | *Units* | *Spring* | *Units* |
| *Electives and Thesis/Industrial Project* | *9* |  |  | *Electives and Thesis/Industrial Project* | *3* |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  | *Total: 9* |  | *Total:* |  | *Total: 3* |
|  | | | | *Total Units:* | *30* |

1. **Describe how accreditation requirements will be met, if applicable, and anticipated date of accreditation request (including the WASC Substantive Change process).**

Not applicable.

1. **Societal and Public Need for the Proposed Degree Major Program**
2. List other California State University campuses currently offering or projecting the proposed degree major program; list neighboring institutions, public and private, currently offering the proposed degree major program.

**Table 4.** M.S. in Chemical Engineering programs in neighboring institutions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Institution** | **Degree Title** | **Required Credit Hours** | **Modality** | **Term Schedule** | **Program Length (Years)** | **Tuition Cost per Academia Year** |
| San Jose State University | M.S. in Chemical Engineering | 30 | On Campus | Semester | 1.5-2.0 | $8,644 |
| UCLA | M.S. in Chemical Engineering | 36 | On Campus | Quarter | 1.5-3.0 | $15,909.74 |
| UC Irvine | M.S. in Chemical Engineering | 36 | On Campus | Quarter | 1.5-3.0 | $16,493.50 |
| UC Riverside | M.S. in Chemical and Environmental Engineering | 36 | On Campus | Quarter | 1.5-3.0 | $16,665.54 |
| UC San Diego | M.S. in Chemical Engineering | 36 | On Campus | Quarter | 1.5-3.0 | $16,434.63 |
| University of Southern California | M.S. in Chemical Engineering | 28 | On Campus | Semester | 1.5-2.0 | $24,732.00 |

1. **Describe differences between the proposed program and programs listed in Section 5a above.**

There are several differences that will make CSULB’s Master of Science in

Chemical Engineering stand out from the other listed programs.

First, the CSULB MSChE is the only CSU program in Southern California to

provide advanced training for working professionals with multidisciplinary

backgrounds, who are interested in the industries relevant to Chemical

Engineering.

Second, the CSULB MSChE is an interdisciplinary program offering both

courses and research training in various directions, ranging from the

conventional areas of chemical, energy, and oil industries to process

automation, biotechnology, pharmaceutical, materials, and environmental

engineering. This combination would be attractive to potential students who

desire to advance their specific technical skills and to their employers who

cover the program costs and expect an immediate return from their

investments.

Third, the CSULB MSChE program has the Chemical Engineering Advisory

and Development Council, which consists of outstanding engineers and

executives from industry and government in Southern California. The council

has provided guidance to our MSChE program regarding necessary skills for

students to succeed in the industry. This liaison between the University and

industry ensures that industry concerns are addressed in our curricula and

provides career guidance for our graduates.

All these differences are intended to place students at the center of the proposed graduate program. The curriculum, research projects, external advice, and up-to-date demand analysis all work together to ensure that from students’ perspective, the MSChE is smooth running and completely relevant to the engineers and executives they are striving to become.

1. **List other curricula currently offered by the campus that are closely related to the proposed program.**

None.

1. **Describe community participation, if any, in the planning process. This may include prospective employers of graduates.**

Most of our graduates work in local industry, and we constantly invite them to

serve on our advisory council. The Chemical Engineering Advisory and

Development Council provides guidance in defining and implementing

program goals, evaluating program and student success, and strengthening

our university-industry partnership.

1. **Provide applicable workforce demand projections and other relevant data.**

Table 5 shows the pattern of job growth nationally, statewide and in Southern California. Chemical engineers work in very diverse areas, including chemical engineering, biomedical engineering, environmental engineering, and petroleum engineering, and many chemistry-related areas. The data from these engineering areas have demonstrated continued strong demand for chemical engineers.

**Table 5.** Workforce demand for Chemical Engineering and related areas

|  |  |  |  |
| --- | --- | --- | --- |
| **Source** | **Number of Jobs** | **Growth Rate** | **10-year Growth** |
| US Department of Labor,  Bureau of Labor Statistics | 33,300  (2012; chemical) | 4% | 1,500 new positions |
| 19,400  (2012; biomedical) | 27% | 5,200 new positions |
| 53,200  (2012; environmental) | 15% | 8,100 new positions |
| 38,500  (2012; petroleum) | 26% | 9,800 new positions |
| California Employment Development Department (EDD) | 2,300  (2015; chemical) | 21.7% | 500 new positions plus 500 net replacements |
| 5,400  (2015; biomedical) | 42.6% | 2,300 new positions plus 1,400 net replacements |
| 7,300  (2015; environmental) | 24.7% | 1,800 new positions plus 1,800 net replacements |
| 2,300  (2015; petroleum) | 13% | 300 new positions plus 600 net replacements |
| CA EDD Los Angeles County | 750  (2015; chemical) | 14.7% | 110 new positions plus 170 net replacements |
| 590  (2015; biomedical) | 23.7% | 140 new positions plus 150 net replacements |
| 1,500  (2015; environmental) | 25.3% | 380 new positions plus 370 net replacements |
| 690  (2015; petroleum) | 15.9% | 110 new positions plus 180 net replacements |
| CA EDD San Diego County | 230  (2015; chemical)) | 30.4% | 70 new positions plus 50 net replacements |
| 410  (2015; biomedical) | 31.7% | 130 new positions plus 100 net replacements |
| 640  (2015; environmental) | 35.9% | 230 new positions plus 160 net replacements |

1. **Student Demand**
2. **Provide compelling evidence of student interest in enrolling in the proposed program. Types of evidence vary and may include (for example), national, statewide, and professional employment forecasts and surveys; petitions; lists of related associate degree programs at feeder community colleges; reports from community college transfer centers; and enrollments from feeder baccalaureate programs.**

The CSULB Department of Chemical Engineering currently has a

baccalaureate student enrollment of 361 (as of Fall 2016) and graduates on

average over 35 students annually, as shown in the table below. In addition to

CSULB graduates, all the graduates from local baccalaureate programs in

chemical engineering or related fields can also pursue their degrees in the

proposed MSChE program. We currently have enrolled students from nearby

institutions, such as USC, Cal Poly Pomona, UC Los Angeles, UC Irvine, UC

Riverside, and UC San Diego. These students currently pursue graduate

degrees in chemical engineering from our department via the COE Master of

Science in Engineering (MSE) with an emphasis on chemical engineering. As

supported by the statistics from the graduation status report (LBSR0401),

there is a strong demand for the MSChE program, even though the official

MSChE program is not in place yet.

**Table 6.** Enrollment of undergraduate and graduate students in chemical

engineering coursework at CSULB

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **2011** | **2012** | **2013** | **2014** | **2015**  **(Spring & Summer)** |
| **Number of BS in ChE Awarded at CSULB** | 36 | 28 | 41 | 45 | 32 |
| **Number of MSE in ChE Awarded at CSULB** | 20 | 14 | 11 | 12 | 8 |

The major reason why prospective students did not choose our department for

their graduate studies is that the current MSE program name does not reflect

the nature of their degrees, which significantly impacts their sponsorships and

job search. The chemical engineering graduate advisor has written many letters explaining why the name does not match the degree, as requested by our prospective students and graduates, to remedy this situation. More students are expected to pursue the MSChE degree at CSULB, once the program is officially established.

1. **Identify how issues of diversity and access to the university were considered when planning this program. Describe what steps the program will take to insure ALL prospective candidates have equitable access to the program. This description may include recruitment strategies and any other techniques to insure a diverse and qualified candidate pool.**

The proposed MSChE program will be offered through the Department of

Chemical Engineering and will be in line with the policies set forth by

CSULB with respect to issues of diversity and access to the university in its

planning and organizational structure, as well as in accessing resources

available to aid prospective students.

The CSULB campus and CSU system as a whole serve a widely diverse

population of students. As such, policies and procedures advancing access to

the University are in place across the campus and will be employed in the

proposed MSChE program. Included in such an environment committed to

diversity and accessibility is the affordability of university programs and

student financial aid opportunities.

1. **For master’s degree proposals, cite the number of declared undergraduate majors and the degree production over the preceding three years for the corresponding baccalaureate program, if there is one.**

The primary target audience for the MSChE program will be individuals with a baccalaureate degree in engineering and sciences. The following table shows the number of engineering degrees awarded in the US for the previous years.

**Table 7.** Undergraduate engineering degrees in the US

|  |  |  |
| --- | --- | --- |
| **Year** | **Number of Undergraduate Engineering Degrees** | **Growth from Prior Year** |
| 2014 | 99,173 | 6% |
| 2013 | 93,360 | 6% |
| 2012 | 88,176 | 6% |

As indicated in Table 7, the number of engineering graduates in the U.S. is substantial and growing. The number of graduate students in chemical engineering programs has also increased, as shown in Table 8.

**Table 8.** Number of graduate students enrolled in chemical engineering programs in the US

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Full Time Students** | **Part Time Students** | **Total** |
| 2014 | 2,176 | 755 | 2,931 |
| 2013 | 2,099 | 681 | 2,780 |
| 2012 | 1,824 | 643 | 2,467 |

**Table 9.** Number of awarded Master’s degree in chemical engineering in the US

|  |  |
| --- | --- |
| **Year** | **Master of Science in**  **Chemical Engineering Degrees** |
| 2014 | 1,545 |
| 2013 | 1,456 |
| 2012 | 1,440 |

As shown in Table 9, the number of awarded Master’s degrees in chemical engineering has increased over the years. All the data here indicate that there will a strong demand for the proposed MSChE program.

Reference: Brian L. Yoder, Ph.D., Engineering by the Numbers, American Society for Engineering Education, 2012-2014

1. **Describe professional uses of the proposed degree program.**

Graduates will be well-positioned for the following employment areas and positions as chemical engineers and managers. With their advanced knowledge and technical skills, these individuals could expect to perform any or all of the following tasks, depending on the size and capabilities of their employers, as outlined below.

* Conduct research to develop new and improved manufacturing processes
* Develop safety procedures for those working with potentially dangerous chemicals
* Develop processes to separate components of liquids and gases or to generate electrical currents using controlled chemical processes
* Design and plan the layout of equipment
* Do tests and monitor performance of processes throughout production
* Troubleshoot problems with manufacturing processes
* Evaluate equipment and processes to ensure compliance with safety and environmental regulations
* Estimate production costs for management

1. **Specify the expected number of majors in the initial year, and three years and five years thereafter. Specify the expected number of graduates in the initial year, and three years and five years thereafter.**

The Master of Science in Chemical Engineering program aims at professionals with diverse undergraduate backgrounds in engineering and

sciences. The purpose of the MSChE program is to prepare multidisciplinary

professionals for advanced technical activities in their careers of choice. The expected numbers of students are shown in Table 10.

**Table 10.** Anticipated enrollment and graduates over time

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** | **Year 7** |
| **Expected Students** | 30 | 35 | 35 | 40 | 40 | 40 | 40 |
| **Expected Graduates** | 0 | 30 | 35 | 35 | 40 | 40 | 40 |

1. **Existing Support Resources for the Proposed Degree Major Program**

**Note:** Sections 7 and 8 should be prepared in consultation with the campus administrators responsible for faculty staffing and instructional facilities allocation and planning. A statement from the responsible administrator(s) should be attached to the proposal assuring that such consultation has taken place.

1. **List faculty who would teach in the program, indicating rank, appointment status, highest degree earned, date and field of highest degree, professional experience, and affiliations with other campus programs. Note: For all proposed graduate degree programs, there must be a minimum of five full-time faculty members with the appropriate terminal degree. (Coded Memo EP&R 85-20)**

Listed below are the faculty members who will teach in the proposed MSChE program. CVs of these faculty members could be found in Appendix C.

**Table 11.** Chemical Engineering Faculty

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Rank** | **Appointment Status** | **Highest Degree** | **Degree Dated** | **Field of Highest Degree** |
| Ehsan Barjasteh | Assistant Professor | Full-time | Ph.D. | 2011 | Chemical Engineering |
| Sepideh Faraji | Assistant Professor | Full-time | Ph.D. | 2010 | Chemical Engineering |
| Larry K. Jang | Professor | Full-time | Ph.D. | 1984 | Chemical Engineering |
| Roger C. Lo | Associate Professor | Full-time | Ph.D. | 2008 | Chemical Engineering |
| Sergio Mendez | Associate Professor | Full-time | Ph.D. | 2004 | Chemical Engineering |
| Yu Yang | Assistant Professor | Full-time | Ph.D. | 2011 | Chemical Engineering |
| Ted H. Yu | Assistant Professor | Full-time | Ph.D. | 2012 | Materials Engineering |

1. **Describe facilities that would be used in support of the proposed program.**

The existing chemical engineering laboratories, such as ECS 109, 110, 111,

114, and 214, are sufficient to support the new program.

1. **Provide evidence that the institution provides adequate access to both electronic and physical library and learning resources.**

In consultation with the library faculty representative in charge of Chemical Engineering, it has been determined that the CSULB University Library provides adequate access to electronic and physical resources. Any additional resources needed are noted in Appendix 8c.

1. **Describe available academic technology, equipment, and other specialized materials.**

The Department of Chemical Engineering has adequate equipment (e.g., pilot-scale instruments for lab courses) and software (such as Pro/II and MATLAB) to support the proposed MSChE Program.

1. **Additional Support Resources Required**

Note: If additional support resources will be needed to implement and maintain the program, a statement by the responsible administrator(s) should be attached to the proposal assuring that such resources will be provided.

1. **Describe additional faculty or staff support positions needed to implement the proposed program.**

None.

1. **Describe the amount of additional lecture and/or laboratory space required to initiate and to sustain the program over the next five years. Indicate any additional special facilities that will be required. If the space is under construction, what is the projected occupancy date? If the space is planned, indicate campus-wide priority of the facility, capital outlay program priority, and projected date of occupancy. Major capital outlay construction projects are those projects whose total cost is $610,000 or more (as adjusted pursuant to Cal. Pub. Cont. Code §§ 10705(a); 10105 and 10108).**

None.

1. **Include a report written in consultation with the campus librarian which indicates any necessary library resources not available through the CSU library system. Indicate the commitment of the campus to purchase these additional resources.**

Please see Appendix D - Assessment of Additional Library Resources Needed to Support the Proposed Program.

1. **Indicate additional academic technology, equipment, or specialized materials that will be (1) needed to implement the program, and (2) needed during the first two years after initiation. Indicate the source of funds and priority to secure these resource needs.**

None.

1. **Self-Support Programs**
2. **Confirm that the proposed program will not be offered at places or times likely to supplant or limit existing state-support programs.**

Not applicable.

1. **Explain how state-support funding is either unavailable or inappropriate.**

Not applicable.

1. **Explain how at least one of the following additional criteria shall be met:** 
   1. **The courses or program are primarily designed for career enrichment or retraining;**
   2. **The location of the courses or program is significantly removed from permanent, state-supported campus facilities;**
   3. **The course or program is offered through a distinct technology, such as online delivery;**
   4. **For new programs, the client group for the course or program receives educational or other services at a cost beyond what could be reasonably provided within CSU Operating Funds;**
   5. **For existing programs, there has been a cessation of non-state funding that previously provided for educational or other services costing beyond what could be reasonably provided within CSU Operating Funds.**

Not applicable.

1. For self-support programs, please provide information on the per-unit cost to students and the total cost to complete the program (in addition to the required cost recovery budget elements listed in the CSU degree proposal faculty check list found earlier in this document).

Not applicable.

**Submit completed proposal packages to:**

[APP@calstate.edu](mailto:APP@calstate.edu)

Academic Programs and Faculty Development

CSU Office of the Chancellor

401 Golden Shore

Long Beach, CA 90802-4210

## Contact Us

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Assistant Vice Chancellor   
Academic Programs and Faculty Development

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**Appendix A**

Comprehensive Assessment Plan

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *a* | *b* | *c* | *d* | *e* | *f* | *g* | *h* | *i* | *j* | *k* |
| *ILOs* | *PLOs* | *SLOs* | *Course*  *where each SLO is assessed* | *Assessment activity/*  *assignment used to measure each SLO* | *Assessment tool used to measure outcome success* | *Assessment schedule – how often SLOs will be assessed?* | *How will data/*  *findings be quantitatively or qualitatively reported?* | *Designated personnel to collect, analyze, and interpret student learning outcome data* | *Program*  *data/*  *findings*  *dissemination schedule* | *Closing the loop strategies* |
| *1* | *1* | *4* | *CHE 520* | *Exams* | *Faculty evaluation of student exams, oral/poster presentations, and written papers* | *Once every year* | *Scores of exams, oral/poster presentations, written papers and SPOT survey* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Spring 2018* | *Curriculum revision for course content updates* |
| *2* | *3* | *9* | *CHE 533* | *Homework assignments* | *Faculty evaluation of student homework assignments, project oral presentations and written project report* | *Once every year* | *Scores of student homework assignments, project oral presentations and written project report SPOT survey* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Spring 2018* | *Curriculum revision for course content updates* |
| *3* | *3* | *3* | *CHE 698* | *Oral defense* | *Oral defense and review of thesis by Faculty Committees* | *Once every year* | *Scores of thesis defense* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Spring 2018* | *Offer thesis or oral presentation workshop; encourage students to present papers in professional conferences.* |
| *4* | *2* | *1* | *CHE 580* | *Oral presentations on applications of differential equations* | *Faculty evaluation of student exams and oral/poster presentations* | *Once every year* | *Exam and paper scores based on rubrics for direct assessment and SPOT survey* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Fall 2018* | *Curriculum revision for course content updates* |
| *5* | *2* | *8* | *CHE 555* | *Term papers* | *Faculty evaluation of student papers; rubrics for direct assessment* | *Once every year* | *Scores of direct assessments based on rubrics by faculty and SPOT survey* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Fall 2018* | *ChE Department Curriculum Committee meetings* |
| *3* | *1* | 2 | *CHE 698* | *Written thesis* | *Oral defense and review of thesis by Faculty Committees* | *Once every year* | *Scores of thesis defense* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Spring 2018* | *Offer thesis or oral presentation workshop; encourage students to present papers in professional conferences.* |
| *2* | *3* | 5 | *CHE 533* | *Project oral presentations and written project report* | *Faculty evaluation of student homework assignments, project oral presentations and written project report* | *Once every year* | *Scores of student homework assignments, project oral presentations and written project report SPOT survey* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Spring 2018* | *Curriculum revision for course content updates* |
| *5* | *2* | 6 | *CHE 555* | *Safety certificate program for chemical engineers* | *Faculty evaluation of student papers; rubrics for direct assessment* | *Once every year* | *Scores of direct assessments based on rubrics by faculty and SPOT survey* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Fall 2018* | *ChE Department Curriculum Committee meetings* |
| *1* | *3* | 7 | *CHE 520* | *Written papers on transport phenomena* | *Faculty evaluation of student exams, oral/poster presentations, and written papers* | *Once every year* | *Scores of exams, oral/poster presentations, written papers and SPOT survey* | *Graduate Advisor/Chair of ChE Curriculum Committee* | *Spring 2018* | *Curriculum revision for course content updates* |

\*SPOT: Student Perception of Teaching (SPOT), or student evaluation of instructors at the end of semester at CSULB

SPOT 1.2 “Concepts were presented in a manner that helped me learn”

SPOT 1.3 “Assignments contribute to my learning”

SPOT 1.5 “This instructor was effective at teaching the subject matter in this course”

Curriculum Mapping Matrix

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | *Student Learning Outcomes* | | | | | | | | |
| *UNITS* | *Course Number and Title* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* |
| *6* | *ChE 580 Theoretical Methods in Chemical Engineering*  *One external mathematics-based course*  *(MAE 501, MAE 502, or STAT 510)* | *I* | *I* | *I* | *I* | *I* | *I* | *I* | *I* | *I* |
| *12* | *ChE 505 Advanced Chemical Engineering Thermodynamics*  *ChE 520 Advanced transport Phenomena*  *ChE 530 Advanced Reactor Kinetics*  *ChE 560 Advanced Chemical Process Control* | *D* | *D* | *D* | *D* | *D* | *D* | *D* | *D* | *D* |
| *12* | *Electives\** | *M* | *M* | *M* | *M* | *M* | *M* | *M* | *M* | *M* |
|  | | *I = Introduced*  *D = Developed*  *M = Mastered* | | | | | | | | |

\*For students choosing thesis option, this category includes 6 units of thesis and 6 units of electives.

**Appendix B**

CSULB MSChE Course-offering Plan

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Chemical Engineering Graduate Course Offerings** | | | | | | |
|  | **Fall** | **Spring** | **Fall** | **Spring** | **Fall** | **Spring** |
| **2017** | **2018** | **2018** | **2019** | **2019** | **2020** |
| **Mathematics** | 580 | 580 | 580 | 580 | 580 | 580 |
| **Core** | 505, 560 | 520, 530 | 505, 560 | 520, 530 | 505, 560 | 520, 530 |
| **Elective** | 537, 575 | 545, 555, 585 | 515, 533 | 531, 537, 575 | 545, 555 | 515, 533, 585 |
| **Special Topics** | 697, 698 | 697, 698 | 697, 698 | 697, 698 | 697, 698 | 697, 698 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Chemical Engineering Graduate Course Offerings** | | | | | | |
|  | **Fall** |  |  |  |  |  |
| **2020** |  |  |  |  |  |
| **Mathematics** | 580 |  |  |  |  |  |
| **Core** | 505, 560 |  |  |  |  |  |
| **Elective** | 537, 575 |  |  |  |  |  |
| **Special Topics** | 697, 698 |  |  |  |  |  |

**Likely Faculty Teaching Assignments**

Ehsan Barjasteh:

ChE 545, ChE 560, ChE 575, ChE 585, ChE 697, and ChE 698

Sepideh Faraji:

ChE 505, ChE 530, ChE 531, ChE 585, ChE 697, and ChE 698

Larry Jang:

ChE 505, ChE 531, ChE 560, ChE 580, ChE 697, and ChE 698

Roger C. Lo:

ChE 515, ChE 520, ChE 555, ChE 580, ChE 697, and ChE 698

Sergio Mendez:

ChE 505, ChE 533, ChE 537, ChE 575, ChE 697, and ChE 698

Yu Yang:

ChE 530, ChE 545, ChE 575, ChE 560, ChE 697, and ChE 698

Ted Yu:

ChE 515, ChE 520, ChE 555, ChE 580, ChE 697, and ChE 698

**Appendix C**

Faculty CV

**Larry K. Jang, Ph.D.**

**Present Position** Professor and Chair, Department of Chemical Engineering, California State University Long Beach (CSULB), Long Beach, CA 90840 (562)-985-7533 e-mail: [jang@csulb.edu](mailto:jang@csulb.edu).

**Education**

* PhD in Chemical Engineering (December 1983), University of Southern California, Los Angeles, CA
* MS in Chemical Engineering (June 1979), National Taiwan University, Taipei, Taiwan
* BS in Chemical Engineering (June 1975), National Taiwan University, Taipei, Taiwan

**Honors Received**

* Outstanding faculty in the category of scholastic activities, 1995-1996, CSULB.
* Chosen by the College of Engineering Outstanding Graduates to receive recognition as the Most Valuable Professor in the Commencement and the Alumni Award Banquet in May, 2005, 2009, and 2011

**Areas of Expertise**

* Computer Automatic Control—Created Internet-based remote automatic control and monitoring system using LabVIEW hardware and software in the Chemical Engineering Unit Operation Laboratory at CSULB. Eight major unit operations in the laboratory are operated remotely from the“Control Station” created by Jang.
* Recovery of Heavy Metals by Biopolymers
* Rheology of Non-Newtonian Fluids

**Major Research Grants & Contracts**

* Purification of Poly(ethylene oxide-propylene oxide) Block Copolymer by Supercritical Fluids for Medical Applications (PI: Larry Jang, Co-PI’s: Chih-Cheng Lo and Yuan Yu Lee), Unicare, Inc, award amount $12,000, Jan. 1, 2016-Dec. 31, 2016
* **Extraction of Polyphenols and Antioxidants from Avocado Seeds and Skins**—(PI: Larry Jang, Co-PI’s: Chih-Cheng Lo and Yuan Yu Lee), Universal Research Group, LLC, award amount: $ 10,035, Jan. 1, 2014- Dec. 31, 2014
* **Characterization of Rheological Properties of Sludge** (PI—Larry Jang), Project No. J605-P001 from Earth Tech, Inc., under Orange County Sanitation District Project P1-100. Contract Amount: $ 9,500. A project report is submitted to the funding corporation.
* **Proposal to Involve Minority Students and Disadvantaged Students in Researc**h (PI—Gill G. Geesey, Co-PI—Larry K. Jang), Grant No. ECD-8907039, Center for Biofilm Process Engineering, Montana State University, Bozeman. Larry Jang’s share: $58,060. Duration: June 1991-May 1994.
* **A Novel Three-phase Biochemical Reactor for the Removal of Copper from Aqueous Media** (PI—Larry K. Jang; Co-PI—Gill G. Geesey) Grant No. CBT-8721943, National Science Foundation, Award Amount: $30,000. Duration: May 1988-Oct. 1989.

**Key Journal Publications and Conference Papers Since 2003**

* Larry K. Jang, Level Control by Regulating Control Valve at the Bottom of a Gravity-Drained Tank, *Chemical Engineering Education*, Vol. 50, No. 4 (Fall, 2016), in press.
* Larry K. Jang and Roger C. Lo, Spreadsheet Procedure for Simulating Setpoint Tracking in SISO by Dynamic Matrix Control, *Chemical Engineering Education*, Vol. 49, No. 3 (Summer 2015), 175-183.
* Larry K. Jang and Roger C. Lo, Developing a Straightforward Tuning Method for Weak Acid or Weak Base Neutralization Control System, *Chemical Engineering & Process Techniques*, Vol. 2, No. 1 (June, 2014), 1023-1035.
* **Larry K. Jang**, Chih-Cheng Lo, Internet-based System for Undergraduate Process Control Lab, accepted for presentation at ASEE Zone IV Conference, California State University Long Beach, April 24-26, 2014,
* **Larry K. Jang**, Chih-Cheng Lo, A Difficult Topic Made Easy: Developing A Straightforward Tuning Method for Acid Neutralization Control System, accepted for presentation at ASEE Zone IV Conference, California State University Long Beach, April 24-26, 2014,
* Roger L. York, Kaitlin M. Bratlie, Lloyd R. Hile, **Larry K. Jang**. Dead zones in porous catalysts: Concentration profiles and efficiency factors. *Catalysis Today*, 160 (2011), 204-212
* **L.K. Jang**, R.L. York, and L.R. Hile. A Note on Zero-Order Reactions in Porous Catalysts. *J. Chin. Inst. Chem. Engrs*., Vol. 34, No. 3, 319-325 (2003).

*Larry Jang’s journal papers, particularly those dealing with heavy metal recovery by biopolymers, published since 1984 have been cited for more than 1200 times by the research community.*

**CURRICULUM VITAE**

**Roger C. Lo**

California State University, Long Beach

Department of Chemical Engineering

1250 Bellflower Boulevard

Long Beach, CA 90840

Telephone: 562-985-1508

Email: roger.lo@csulb.edu

**Research Interests**

Microfluidics; 3D Printing; Open-source Instrumentation; Electrophoresis; Immunoassays; Laboratory Automation; High-throughput Separation Technology; Microreactor Technology

**Education**

Ph.D. Chemical Engineering, Texas A&M University, College Station, TX, USA, 2008

*Dissertation Title:*

DNA Electrophoresis in Photopolymerized Polyacrylamide Gels on a Microfluidic Device

*Academic Advisor:* Professor Victor M. Ugaz

M.E. Chemical Engineering, Texas A&M University, College Station, TX, USA, 2002

B.S. Chemical Engineering, National Chung Hsing University, Taichung,

TAIWAN, 1997

**Academic and Professional Experiences**

Associate Professor of Chemical Engineering 08/2015 – Present

California State University, Long Beach, CA

Associate Professor of Biomedical Engineering 06/2016 – Present

California State University, Long Beach, CA

Assistant Professor of Chemical Engineering 08/2009 – 08/2015

California State University, Long Beach, CA

Part-time Lecturer, Department of Chemical Engineering 09/2008 – 08/2009

California State University, Long Beach, CA

Postdoctoral Fellow, Department of Chemistry and Biochemistry 07/2008 – 08/2009

California State University, Los Angeles, CA

**Publications**

* Jang, L. K. and **Lo, R. C.**, “Spreadsheet procedure for simulating setpoint tracking in SISO by dynamic matrix control”, *Chemical Engineering Education*. v49 n3 p175-183, Summer 2015
* **Lo, R. C.**, Bhatia, H., Venkatraman, R., and Jang, L. K., “Microfluidics @ the Beach: Introduction of Microfluidics Technology to the ChE Curriculum at Cal State Long Beach”, *Chemical Engineering Education*. v49 n2 p111-117, Spring 2015
* Jang, L. K. and **Lo, R. C.**, “Developing a straightforward tuning method for weak acid or weak base neutralization control system”, *Chemical Engineering & Process Techniques*. Vol. 2, pp 1023, 2014
* **Lo, R. C.**, “Application of microfluidics in chemical engineering”, *Chemical Engineering & Process Techniques*. Vol. 1, pp 1002, 2013
* Farahani, B. H., Rahai, H. R., **Lo, R. C.**, and Faraji, S., “Experimental investigations of the effects of a humid air system and an exhaust scrubber on diesel emissions”, *2013 I-NUF 5th METRANS Urban Freight Conference Proceedings*, 2013
* **Lo, R. C.**, “Application of microfluidics in bioprocesses”, *Journal of Bioprocessing and Biotechniques*. Vol. 2, pp e109, 2012
* **Lo, R. C.** and Joffe, A., “Influence of DNA-dye complex stability on separation resolution in microchip electrophoresis”, *Bioanalysis*, Vol. 4, pp 693-701, 2012
* **Lo, R. C.**, Joffe, A., Truong, T., and Dinh, O. H., “Microfluidics @ the Beach: An inexpensive imaging system for microfluidics labs”. *2012 PSW ASEE Conference Proceedings*, pp 147-152, 2012
* Riveros, T. A., **Lo, R. C.**, Salgado, M., Carmona, H., and Gomez, F. A., “Microchip capillary electrophoresis to study the binding of ligands to teicoplanin derivatized on magnetic beads”, Capillary Electrophoresis and Microchip Capillary Electrophoresis, Garcia, C. D. and Carrilho, E., Eds. John Wiley & Sons, Inc. pp 359-365, 2013
* Truong, T., Ferguson, S. W., **Lo, R. C.**, “Microfluidics @ the Beach: Introduction of microfluidics technology to the chemical engineering curriculum at CSULB”. *2011 ASEE Conference Proceedings*, AC 2011-1943, 2011.
* Mendez, S., Ko, Y.-F., **Lo, R. C.**, Bahr, D., and Cheng, K., “Preliminary studies of natural fiber composites for use in wind turbine blades”, *SAMPE 2011 Conference Proceedings*, 1398, 2011
* Liu, X., **Lo, R. C.**, Gomez, F. A., “Facile fabrication of an enzyme microreactor using magnetic microbeads”. *NSTI-Nanotech 2010*. Vol. 3, pp 141-144, 2010
* Riveros, T. A., **Lo, R. C.**, Liu, X., Valdez, A, Lozano, M., and Gomez, F. A. “The use of magnetic beads in microfluidic binding assays and on-chip enzymatic microreactions”. *American Laboratory*. pp 11-19, 2010
* Goldberg, M. D., **Lo, R. C.**, Abele, S., Macka, M., and Gomez, F. A. “Development of microfluidic chips for heterogeneous receptor-ligand interaction studies”. *Analytical Chemistry*. Vol. 81, pp 5095-5098, 2009
* Sariikhanikhorami, M., **Lo, R. C.**, and Gomez, F. A. “Use of magnetic beads to study the interaction of ristocetin with peptides and bacteria”. *Bioanalysis*. Vol. 1, pp 721-727, 2009
* Liu, X. J., **Lo, R. C.**, and Gomez, F. A. “Fabrication of a microfluidic enzyme reactor utilizing magnetic beads”. *Electrophoresis*. Vol. 30, pp 2129-2133, 2009
* **Lo, R. C.** and Ugaz, V. M. “Microchip gel electrophoresis of DNA with integrated whole-column detection”. *Lab on a Chip Technologies and Applications*, Avi Rasooly and Keith E. Herold, Editors. Horizon Scientific Press, Norwich, UK. 2009
* **Lo, R. C.** and Ugaz, V. M. “Microchip DNA electrophoresis with automated whole-gel scanning detection”. *Lab on a Chip*. Vol. 8, pp 2135-2145, 2008
  + **Lo, R. C.** and Ugaz, V. M. “Separation performance of single-stranded DNA electrophoresis in photopolymerized crosslinked polyacrylamide gels”. *Electrophoresis*. Vol. 27, pp 373-386, 2006
* Ugaz, V. M., Elms, R. D., **Lo, R. C.**, Shaikh, F. A. and Burns, M. A. “Microfabricated electrophoresis systems for DNA sequencing and genotyping applications: current technology and future directions”. *Philosophical Transactions of the Royal Society of London A*. Vol. 362, pp 1105-1129, 2004
* Lin, S.-C., Lin, K.-G., **Lo, C.-C.**, and Lin, Y.-M. “Enhanced biosurfactant production by a *Bacillus licheniformis* mutant”. *Enzyme and Microbial Technology*. Vol. 23, pp 267-273, 1998
* **Lo, C.-C.** and Lin, S.-C. “The dispersion of oil from oil sludge by a biosurfactant”. *Journal of Chinese Colloid and Interface Society*. Vol. 20, pp 117-124, 1997

**Conference Presentations**

* **28th Annual CSU Biotechnology Symposium**, Garden Grove, CA, January 2016

Poster: “Extraction of polyphenols and antioxidants from avocado seeds and skins”

Jang, L. K., **Lo, R. C.**, Lee, Y., Phan, N., and Cherngchaosil, L.

* **2014 ASEE Zone IV Conference**, Long Beach, CA, April 2014

Presentation: “Internet-based system for undergraduate process control lab”

Jang, L. K. and **Lo, R. C.**

* **2014 ASEE Zone IV Conference**, Long Beach, CA, April 2014

Presentation: “A difficult topic made easy: Developing a straightforward tuning method for weak acid/base neutralization control system”

Jang, L., **Lo, R. C.**, and Mushonga, S.

* **25th Annual CSU Biotechnology Symposium**, Anaheim, CA, January 2013

Poster: “Droplet-based microfluidics for high-throughput chemical kinetics studies”

Braun, K., Fhur, A., **Lo, R. C.**, and Mendez, S.

* **AIChE Annual Meeting**, Minneapolis, MN, October 2011

Poster: “Developing a miniaturized assay for label-free, high-throughput biomolecule

analysis”

Joffe, A., Truong, T., Ferguson, W. S., and **Lo, R. C.**

* **AIChE Annual Meeting**, Minneapolis, MN, October 2011

Poster: “Droplet-based microfluidics for high-throughput studies of enzyme catalyzed

reactions”

Mendez, S., Cheng, K., and **Lo, R. C.**

* **AIChE Annual Meeting**, Minneapolis, MN, October 2011

Poster: “Chemical and mechanical analysis of green composites materials made from

natural fibers of hemp, flax, and hay”

Cheng, K., Bahr, D., **Lo, R. C.**, and Mendez, S.

* **118th ASEE Annual Conference and Exposition**, Vancouver, BC, Canada, June

2011

Presentation: “Microfluidics @ the Beach: Introduction of microfluidics technology

to the chemical engineering curriculum at CSULB”

**Lo, R. C.\***, Troung, T., Ferguson, W., and Joffe, A.

* **SAMPE 2011 Conference**, Long Beach, CA, May 2011

Presentation: “Preliminary studies of natural fiber composites for use in wind turbine

blades”

Mendez, S., Ko, Y.-F., **Lo, R. C.**, Bahr, D., and Cheng, K.

* **SCURC 2011,** Santa Barbara, CA, April 2011

Poster: “Facile fabrication of microfluidic chips for UV absorbance-based detection”,

Joffe, A. and **Lo, R. C.**

* **SCURC 2011,** Santa Barbara, CA, April 2011

Presentation: “Chemical and mechanical analysis of green composites made from

fibers of hemp, flax, and hay”,

Bahr, D., Cheng, K., Chiang, J., Mendez, S., **Lo, R. C.**, Ko, Y.-F., and Bahr, B.

* **SCURC 2011,** Santa Barbara, CA, April 2011

Poster: “Creation and development of high-throughput microfluidics to study enzyme

catalyzed reactions”,

Cheng, K., Chiang, Jay, Nazmi, A., Mendez, S., and **Lo, R. C.**

* **AIChE Annual Meeting**, Salt Lake City, UT, November, 2010

Poster: “Microfluidic organic synthesis system with automated two-dimensional UV

absorbance imaging detection for online process optimization”,

Ferguson, S. W. and **Lo, R. C.**

* **CSU Biotechnology Symposium**, Los Angeles, CA, January 2009

Poster: “Study of the interaction of ristocetin with peptides using magnetic beads coupled with fluorescence microscopy”,

**Lo, R. C.**, Sariikhanikhorami, M., and Gomez, F. A.

* **LabAutomation 2007 Conference**, Palm Springs, CA, January 2007

Poster: “An automated rapid whole-gel scanning system for microfluidic gel electrophoresis”,

**Lo, R. C.** and Ugaz V. M.

* **23rd Annual Houston Conference on Biomedical Engineering Research**, Houston, TX, February 2006

Presentation: “Fast characterization of separation performance in single-stranded DNA electrophoresis using a portable microfluidic device”,

**Lo, R. C.** and Ugaz V. M.

* **MSB’2006 (20th International Symposium on Microscale Bioseparations)**, Amsterdam, The Netherlands, January, 2006

Poster: “Rapid characterization of sieving gels for DNA electrophoresis using microfluidic devices”,

**Lo, R. C**. and Ugaz, V. M.

* **AIChEAnnual Meeting,** Cincinnati, OH, Nov., 2005

Presentation: **“**A microfluidic platform for rapid screening of separation performance in gel matrices for DNA electrophoresis”,

**Lo, R. C.** and Ugaz, V. M.

* **American Physical Society Annual Meeting,** Los Angeles, CA, March 2005

Poster: **“**Using measurements of mobility, diffusion, and dispersion to predict separation resolution in DNA electrophoresis”,

**Lo, R. C**. and Ugaz, V. M.

* **American Physical Society Annual Meeting,** Montreal, Canada, March 2004

Poster: **“**Diffusion, dispersion, and mobility of single-stranded DNA in polyacrylamide gel electrophoresis”,

**Lo, R. C**. and Ugaz, V. M.

**Honors and Awards**

* Travel Grant, QEM Network NSF Major Research Instrumentation Proposal Development Workshop, New Orleans, LA, USA, 2010
* 2007 NATEA-Dallas Scholarship Award, NATEA-Dallas, Dallas, TX, USA, 2007
* Academic Travel Award, LabAutomation 2007, Palm Springs, CA, USA, 2007
* Young Scholars Program 2006, NATPA, Newark, CA, USA, 2006
* Travel Grant, MSB’2006 (20th International Symposium on Microscale Bioseparations), Amsterdam, The Netherlands, 2006
* 3rd place in Graduate Oral Engineering Panel 6, Student Research Week 2005,

Texas A&M University, College Station, TX, USA

* DBP Travel Grant, APS March Meeting, Los Angeles, CA, USA, 2005
* DBP Travel Grant, APS March Meeting, Montreal, Canada, 2004
* Graduate Enhancement Scholarship, Department of Chemical Engineering, 2002

Texas A&M University, College Station, TX USA

**Professional Associations**

American Institute of Chemical Engineers

American Society for Engineering Education

American Physical Society

**Synergistic Activities**

* Editorial Board Member, Chemical Engineering & Process Techniques, JSciMed Central, 2013-Present
* Peer Reviewer, Computer Methods and Programs in Biomedicine, Elsevier, 2011-Present
* Editorial Board Member, Journal of Bioprocessing and Biotechniques, OMICS Publishing Group, 2010-Present
* Peer Reviewer, Bioanalysis, Future Science Ltd., 2010-Present
* Member in College of Engineering Research Advisory Committee, California State University, Long Beach, 2010-Present
* Member in Biomedical Engineering Committee, California State University, Long Beach, 2009-Present

**Collaborators**

Professor Frank A. Gomez, California State University, Los Angeles

Professor Hamid Rahai, California State University, Long Beach

Professor Antonella Sciortino, California State University, Long Beach

Professor Larry Jang, California State University, Long Beach

Professor Sergio Mendez, California State University, Long Beach

Professor Houng-Wei Tsai, California State University, Long Beach

**SEPIDEH FARAJI**

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<http://www.csulb.edu/colleges/coe/che/views/faculty/faraji.shtml>

# EDUCATION

* Ph.D. in Chemical Engineering, May 2010

The University of Kansas, Lawrence, KS, USA.

Dissertation: Hydrogen production from hydrocarbons using oxygen-permeable ceramic membranes.

* M.S. in Chemical Engineering, March 2003

University of Tehran, Tehran, Iran.

Thesis: Hydrogen recovery from refinery off-gases.

* B.S. in Chemical Engineering, July 1998

University of Tehran, Tehran, Iran.

**TEACHING EXPERIENCE**

**Assistant Professor,** California State University, Long Beach, CA, USA, August 2010-present.

* Planned and taught 6 courses. (material and energy balance, process design, kinetics and reaction engineering, heterogeneous catalysts, Introduction to Engineering profession, environmental engineering)

**Graduate Teaching Assistant,** The University of Kansas, Lawrence, KS, USA, 2008-2009.

* Taught one course. (Thermodynamics)

# RESEARCH AND INDUSTRIAL EXPERIENCE

**Graduate Research Assistant,** The University of Kansas, Lawrence, KS, USA, 2006-2010.

* Prepared ceramic membrane materials (SFC & BSCF) and supported metal catalysts (Pt-Ni/CeZrO2 , Pt-Ni/Al2O3 , and Ni/Al2O3).
* Characterized the ceramic membrane material and the supported metal catalyst by using SEM, TGA, TEM, and ICP.
* Conducted reaction tests on oxygen-permeable ceramic membranes in conjunction with supported metal catalysts (Pt/CeZrO2 , Pt/ZrO2 , Pt-Ni/Al2O3 , and Ni/Al2O3 ) to generate syngas from different hydrocarbons (methane, propane, butane).
* Applied Raman Spectroscopy to study chemical bonding.
* Analyzed the experimental data.
* Maintained the laboratory equipment.
* Investigated different catalysts and ceramic materials used in the literature for hydrogen production.
* Generated peer reviewed publications and presented research results in national meetings.
* Mentored undergraduate students.

**Head of Process Engineering Department**, HICECO Engineering Co., Tehran, Iran, 2005-2006.

* Led and coordinated a team of 3 process engineers for basic design of a high impact polystyrene plant (HIPS) as well as an expandable polystyrene plant (EPS).
* Checked the process design (including analysis, process simulation and calculations, equipment selection, and process documents like PFD and P&ID) and solved the problems.
* Collaborated with other engineering departments.
* Attended engineering meetings and corresponded with clients.
* Conducted interviews with potential process engineers; hired and trained a new process engineer.
* Assisted with writing proposals as well as cost and man-hour estimations.

**Senior Process Design Engineer**, TARH-O-PALAYESH Engineering Co., Tehran, Iran, 2001-2005.

* Led and coordinated a team of 3 process engineers for basic design of two projects: utility and auxiliary systems for Tabriz power plant in Iran and basic design of MARUN condensate transmission, for National Iranian south oil field Co. in Iran.
* Twice rewarded with cash bonus for strong work ethic.
* Checked the process design (analysis, process simulation and calculations, equipment selection).
* Checked the process documents (PFD, P&ID, data sheets, equipment list, process description).
* Collaborated with engineers from other disciplines.
* Attended engineering meetings and corresponded with client.
* Assisted with engineering team in simulation and design of BINAK associated gas gathering and transmission project for National Iranian south oil field Co.

**Graduate Research Assistant,** University of Tehran, Tehran, Iran, 2001-2003.

* Developed a model for hydrogen production and separation by applying MATLAB and Hysys softwares.

**Junior Process Design Engineer**, TARH-O-PALAYESH Engineering Co., Tehran, Iran, 2000-2001.

* Assisted with equipment sizing and selection under the team leader supervision in three projects: TANG-E-BIJAR gas field development, GASHU gas field development, and Phthalic Anhydride unit revamp.
* Developed process flow diagrams (PFD) and piping and instrumentation diagrams (P&ID) under the team leader supervision.
* Prepared heat and material balance tables.
* Helped with plant simulation using Hysys and PROII.
* Generated other process documents like equipment lists, process equipment data sheets, process line lists, process descriptions, operating manuals, and block flow diagrams under the team leader supervision.
* Provided process data to instrumentation department and other departments as requested.

## SKILLS

* Hands-on experience on flow sheet simulators like Aspen, PROII, Hysys, ChemCAD, and PIPEPHASE.
* Followed ISO 9001:2000 International Standards in process design.
* Computer programming: MATLAB, C++, Matcad, GAMS.

## HONORS/GRANTS

* Received about $100,000 research grant.
* Received CSULB Faculty Research Stimulation Award.
* Received CSU Chancellor’s office WRPI Release Time Award.
* Received RSCAC Award.
* Being featured on “Inside CSULB” <http://www.csulb.edu/misc/inside/?p=29978>
* Golden Key International Honor Society.
* Received travel grant from University of Kansas Engineering School.
* Received travel grant from NAMS.
* Received International Student Scholarship from University of Kansas graduate school (twice).
* Ranked second in class (class size: 40 students), University of Tehran, Chemical Engineering Department (undergraduate level), Tehran, Iran.

### PEER REVIEWED PUBLICATIONS

* E.G. Mahoney, J. Pusel, **S. Faraji**, and S.M. Stagg-Williams, "The Effects of Pt Addition to Supported Ni Catalysts on Dry (CO2) Reforming of Methane to Syngas", Journal of CO2 Utilization, vol. 6, pp. 40-44, 2014.
* K. Collins, A. Martinez, N. Mangabat, and **S. Faraji**, "The CO2 Adsorption and Desorption on ZIF-8", Journal of Engineering and Technology Research, vol. 1, pp. 1-6, 2013.
* **S. Faraji**, "The Enhancement of Students’ Learning in both Lower Division and Upper Division Classes by a Quiz-Based Approach", Chemical Engineering Education, vol. 46, pp. 213-216, 2012.
* Q. Jiang, **S. Faraji**, D.A. Slade, and S.M. Stagg-Williams. "A Review of Mixed Ionic and Electronic Conducting Ceramic Membranes (MIECs) as Oxygen Sources for High Temperature Reactors", in *Inorganic, Polymeric and Composite Membranes: Structure, Function and Other Correlations*, 1st edition, New York: Elsevier, 2011.
* Q. Jiang, **S. Faraji**, K.J. Nordheden, and S.M. Stagg-Williams, "CO2 Reforming Reaction Assisted with Oxygen Permeable Ba0.5Sr0.5Co0.8Fe0.2Ox Ceramic Membranes", Journal of Membrane Science, vol. 368, pp. 69-77, 2011.
* **S. Faraji**, K.J. Nordheden, and S.M. Stagg-Williams, "A Comparative Study of Ba0.5Sr0.5Co0.8Fe0.2Ox (BSCF) and SrFeCo0.5Ox (SFC) Ceramic Membranes Used for Syngas Production", Applied Catalysis B: Environmental, vol. 99, pp. 118-126, 2010.
* **S. Faraji**, K.J. Nordheden, and S.M. Stagg-Williams, "The Interaction Between SrFeCo0.5Ox Ceramic Membranes and Pt/CeZrO2 During Syngas Production from Methane", Catalysis Letters, vol. 131, pp. 114-121, 2009.
* **S. Faraji**, R. Sotudeh-Gharebagh, and N. Mostoufi, "Hydrogen Recovery from Refinery Off-gases", Journal of Applied Science, vol. 3, pp. 459-464, 2005.

### INVITED TALK

* 2013 CA Higher Education Sustainability Conference, June 24, 2013, Santa Barbara, CA: "An Integrated Water Recycling, Treatment, and Efficient Landscape Design System for Water Conservation at the American Gold Star Manor, Long Beach".

### PRESENTATIONS

* 17 oral and poster presentations in national meetings.

Ted Yu (310)621-9583

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La Crescenta, CA 91214 www.its.caltech.edu/~tedhyu/

EMPLOYMENT:

**CSULB** (2013 – Present*)*: *Assistant Professor* – Chemical Engineering

**UCLA** (2012 - 2013): *Postdoctoral Scholar* - Development of hybrid materials for solar cells

**Caltech** (2007 - 2012): *PhD Student* - Development of catalyst and materials for fuel cells

**Industrial Experience** (2000-2007): Various engineering positions in industry.

**Lawrence Berkley Lab** (1997-2000): *Graduate Student* - Development of Li/S batteries.

EDUCATION:

Caltech PhD in Materials Science 2012

UC Berkeley M.S. Materials Science 2000

UCLA B.S. Chemistry/Materials Science 1997 (Department Honors)

RESEARCH:

My research focus is understanding the fundamental aspects of electrochemical materials. The research involves both theoretical and experimental approaches. The theoretical approach uses atomistic quantum mechanics simulation to study materials at the atomic level. The experimental work involves developing new battery and fuel cell materials and testing them to see changes in electrochemical performance. The combined theoretical and experimental research gives understanding how the performance of materials are affected by changes at the atomic level.

REFERENCES:

William A. Goddard, Caltech Professor, [wag@wag.caltech.edu](mailto:wag@wag.caltech.edu), (626)395-2731

Christian Ratsch, UCLA Associate Professor, cratsch@ipam.ucla.edu, (310)825-4127

Eva Graham, Caltech Director of Minority Student Education, egraham@caltech.edu, (625)395-6207

MISC:

U.S. Citizen, Fluent in Chinese

JOURNAL ARTICLES (Impact Factor) during CSULB tenure:

1) (5.15) “First-Principles Modeling of Ni4M (M = Co, Fe, and Mn) Alloys as Solid Oxide Fuel Cell Anode Catalyst for Methane Reforming”.” Tsai, HC; Morozov, SI; **Yu, TH**; Merinov, BV, Goddard, WA; *Journal of Physical Chemistry C*, 120(1), 207-214, **2016**.

2) (2.276) "Computational study of ridge states in GaAs nanopillars" **Yu, TH**; Ratsch, C, *Journal of Applied Physics*, **2015**, 118, 055703.

3) (2.188) "A fast method for predicting the formation of crystal interfaces and heterocrystals" A.-M. Raclariu, S. Deshpande, J. Bruggemann, W. Zhuge, **T.H. Yu**, C. Ratsch, S. Shankar *Computational Materials Science*, **2015,**108 (A), pp 26703–26712.

4) (5.27) "DFT Study of Oxygen Reduction Reaction on Os/Pt Core–Shell Catalysts Validated by Electrochemical Experiment" Tsai, HC; Hsieh, YC; **Yu, TH**; Lee, YJ; Wu, YH; Merinov, BV; Wu, PW; Chen, SY, Adzic RR; Goddard, WA, *ACS Catalysis*, **2015,**5(3). pp. 88-93

5) (5.15) “Density Functional Theory Study of Pt3M Alloys Surface Segregation with Adsorbed O/OH and Pt3Os as Catalysts for Oxygen Reduction Reaction” Tsai, HC; **Yu, TH**; Sha, Y; Merinov, BV, Goddard, WA; *Journal of Physical Chemistry C*, 118(46), 26703-26712, **2014**.

6) (11.34) "Dramatic Increase in the Oxygen Reduction Reaction for Platinum Cathodes from Tuning the Solvent Dielectric Constant" Fortunelli, A; Goddard WA; Sha, Y; **Yu, TH**; Sementa, L; Barcaro G; Andreussi, O. Angewandte Chemie-International Edition, **2014,**53 (26). pp. 6669-6672.

7) (6.03) "Dealloyed Pt2Os nanoparticles for enhanced oxygen reduction reaction in acidic electrolytes" Lee, YJ; Hsieh, YC; Tsai, HC; Lu, IT; Wu, YH; **Yu, TH**; Lee, JF; Merinov, BV, Goddard, WA, Wu,, PW Applied Catalysis B-Environmental, **2014,**150. pp. 636-646.

8) (5.27) "DFT Prediction of Oxygen Reduction Reaction on Palladium-Copper Alloy Surfaces" Sha Y.; **Yu, T.H.**; Merinov, B.V.; Goddard, W.A. ACS Catalysis, **2014,**4 (4). pp. 1189-1197.

9) (5.15) "Finding Correlations of the Oxygen Reduction Reaction Activity of Transition Metal Catalysts with Parameters Obtained from Quantum Mechanics" **Yu, T.H.**; Hofmann, T.; Sha, Y.;Merinov, B.V.; Myers, D.J.; Heske, C.; Goddard, W.A Journal of Physical Chemistry C, **2013,**117 (50). pp. 26598-26607.

10) (3.52) "The Effect of Passivation on Different GaAs Surfaces" **Yu, T.H.**; Liang, Y.; You, W.; Laghumavarapu, R.B.; Huffaker, D.; Ratsch, C. Applied Physics Letters, **2013,**103 (17). 173902.

MEETING PRESENTATIONS during CSULB tenure:

1. “DFT study on the Improved Performance of the ORR of Noble Metal Alloys“ Raja Kalavacherla, Karan Sautbine, and Ted H. Yu. ASEI American Society of Engineers of Indian Origin Annual Conference, Nov. 7, 2015.
2. "Theoretical Study to Improve O -> OH Reactions in the Fuel Cell ORR" Yu, TH, Torres, R, Goddard, W.A. ECS Fall Meeting 2015, Wednesday, 27 May 2015, #1801
3. “New Method to Determine Eley-Rideal Barriers for 2e- and 4e- Oxygen Reduction Reactions in Fuel Cells " Yu, TH, Ratsch C, ECS Fall Meeting 2015, Monday, 25 May 2015, #1761
4. "Atomic Level Simulation of Ridge Reconstruction and Passivation in GaAs Nanopillars" Yu, TH, Tsai, HT, Sundararaman, R, Goddard, WA, ECS Fall Meeting 2015, Monday, 25 May 2015, #141

# EHSAN BARJASTEH, Ph.D.

**Assistant Professor at CSULB Contact: ●**  (408) 605-2785 **●**  ehsan.barjasteh@csulb.edu

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**EDUCATION:**

**Ph.D. in Chemical Engineering & Material Science,** University of Southern California, 2011

**M.Sc. in Chemical Engineering,** University of Southern California, 2011

**M.Sc. in Polymer Science and Engineering,** Sharif University of Technology, 2005

**B.Sc. in Chemical Engineering, process,** Sharif University of Technology, 2001

**TEACHING EXPERIENCE (Excluding CSULB):**

**1. 2015 Fall Professor of “Materials Science and Engineering” undergraduate course at California State University, Long Beach, CA**

**2. 2013 Spring Lecturer of “Composite Materials” graduate course (Master and Ph.D.) at University of Southern California, Los Angeles, CA**

The course covers fundamental aspects of composite materials, composite manufacturing and composite testing. The emphases are devoted on advanced composite with polymer/metal/ceramics matrix currently applied in aerospace. In the first portion of the course, the basics of material forms and properties, fibers and reinforcements, thermoset and thermoplastic matrices and curing are introduced. During the second portion of the course, current state-of-the-art manufacturing techniques are introduced including autoclave and out-of-autoclave processing. Then the course next moves to introduce the basics of mechanics of composite materials with laminate analysis followed by failure modes and strength analysis. Last portion of course is devoted to composite testing, introducing destructive and nondestructive testing, mechanical and physical testing (fiber and matrix dominated testing), and respective standard test methods.

**3. 2013 Fall Lecturer of “Mechanical Behavior of Materials” undergraduate course at San Jose State University, San Jose, CA**

Elasticity, plasticity, an-elasticity; deformation mechanisms; effect of microstructure and imperfections; fatigue, creep, fracture; plane stress and plane strain; failure analysis for structural applications involving engineering devices and systems, bulk and nano-materials, material compatibility, and interfacial bonding in thin films.

**4. 2011 Teaching Assistant in “Introduction to Separation Process”,** core course for chemical Eng. University of Southern California, Los Angeles, CA

**5. 2004 Teaching in “General Heat Transfer”,** core course for chemical and mechanical Eng. Sharif University of Technology.

**6. 2005 Teaching Assistant in “Transport Phenomena in Chemical Engineering”,** core course for chemical Eng. Sharif University of Technology.

**7. 2004 Teaching Assistant in “Polymer Processing and Polymerization Laboratory” (Single screw extruder, film blowing, hot press molding, injection molding, and etc.),** elective course for chemical and mechanical Eng. Sharif University of Technology.

**8. 2004 Teaching Assistant in “Numerical Methods for Chemical Engineering”,** Sharif University of Technology.

**PROFESSIONAL EXPERIENCE:**

**2015- Present Assistant Professor at California State University, Long Beach, CA**

**2014-2015 Research and Development Manager, Tencate Advanced Composites, Morgan Hill, CA**

* Product development in advanced composite areas for variety of customers including Boeing, Space X, Janicki, etc.
* Managing a group of engineers and technicians to develop thermoset materials including epoxies and cyanate ester for space and aerospace applications.

**2010-2014 Product Development Lead and Mechanical Lab Manager, Henkel Aerospace, Bay Point, CA**

* Process development, scale up, and qualification of polymer matrix composite products manufactured with processes such as Prepreg (HLU, ATL, AFP), Resin infusion (RTM, VaRTM. RFI), Hand Lay-up, pultrusion and etc.
* Intensive customer interaction to adapt newly developed technology
* Thermoset resin formulation (e.g. Epoxies and Benzoxazine) to tailor resin properties such as toughness and service temperature to meet customer specifications including Boeing, Airbus, Goodrich, etc.
* Developing and optimizing out-of-autoclave processes.
* Developing and executing short-term & long-term composite materials research programs with Universities
* Collaborating with different fibers, fabrics, resins, and additive suppliers to develop state-of-the-art high performance polymer composites.
* Presenting technical papers at specialized conferences and seminars, and managing and expanding research collaborations with technical universities and particular suppliers for fundamental research projects
* Manager of adhesive and composite mechanical test lab.
* Managing 12 direct and indirect reports
  1. **Chemical and Material Scientist**, ***Composite Technology Corporation* Irvine, CA**
* Manufacturing and developing polymer composites via Pultrusion process for overhead conductors.
* Developing new systems for pultrusion manufacturing process to increase the consistency in mechanical and thermal properties for large volume production.
* Develop several protocols for Quality Control (QC) of continuous manufacturing process of composite products.
* Technical service for customers with various in-the-field technical issues.

**2006-2011 Chemical and Material Science Research Assistant, *M.C. Gill Composite Center, USC***

* Examining the thermal and mechanical properties of polymers and matrix composites subjected to hygrothermal and thermal degradation.
* Modeling of polymer oxidation using diffusion-reaction, thin-film coating and oxidation, composite structure fatigue, and inorganic polymer composite oxidation.
* Presenting my research at several conferences,
* mentored four MS and five BS students
* Lab captain of the USC composite center thermal lab equipped with DSC, TGA, DMA, FTIR, TGA-FTIR, and Rheometer instruments.

**2009-2010 Social Chair, *Graduate and Professional Student Senate, US***

**PROFESSIONAL AFFILIATIONS AND LEADERSHIP:**

**2006-2011 Lab Captain** at the USC composite center thermal lab equipped with DSC, TGA, DMA, FTIR, TGA-FTIR, and Rheometer instruments.

**2006-2011 Student Mentor:** Mentoring over a dozen of undergrad and grad students in the area of composites.

**2008-2011, President** **of MRS** (Material Research Society) student chapter at USC.

**2009-2010** **Social Programming** **chair** of GPSS at the University of Southern California.

**2008-2009** **Vice president** of IGSA (Iranian Graduate Student Association) at USC.

**2004 Member of Student Branch** of Association of Chemical Engineers (IACHE).

**2000-2001 Member** **of Student Branch** of Association of Chemical Engineers in Sharif University of Technology.

**2003-2004 Member** of Soccer Team of Sharif University of Technology.

**PUBLICATIONS:**

**Barjasteh E**, Bosze E J, Tsai Y I, Nutt S R. Thermal Aging of Fiberglass/carbon fiber Hybrid Composites. J. Composite A, Applied Science and Manufacturing, vol. 40, pp. 2038-2045, 2009.

**Barjasteh E**, Kar N, Nutt S R. [Effect of Filler on Thermal Aging of Composites for Next-generation Power Lines](http://www.sciencedirect.com/science/article/pii/S1359835X11002661). J. composite A, Applied Science and Manufacturing, [vol. 42](http://www.sciencedirect.com/science/journal/1359835X/42/12), pp. 1873–1882, 2011.

**Barjasteh E**, Nutt S R. [Moisture Absorption of Unidirectional Hybrid Composites](http://www.sciencedirect.com/science/article/pii/S1359835X11003289). J. Composite A, Applied Science and Manufacturing, [vol. 43,](http://www.sciencedirect.com/science/journal/1359835X/43/1) pp. 158–164, 2011.

**Barjasteh E**, Bosze E J, Nutt S R. Thermal Oxidation of Anhydride Cured Epoxy and Epoxy Matrix Composites. SAMPE proc 2008; 52:12.

Tsai Y I, Bosze E J, **Barjasteh E**, Nutt S R. Influence of Hygrothermal Environment on Thermal and Mechanical Properties of Carbon fiber/fiberglass Composites. Composite Science and Technology, vol. 69, pp. 432–437, 200

Kar N, **Barjasteh E**, Hu Y, Nutt S R. Bending Fatigue of Hybrid Composites Rods. J. Composite A, Applied Science and Manufacturing, [vol. 42,](http://www.sciencedirect.com/science/journal/1359835X/42/3) pp. 328–336, 2011.

Kar N, Hu Y, **Barjasteh E**, Nutt S R. [Tension-tension fatigue of hybrid composite rods](http://www.sciencedirect.com/science/article/pii/S135983681200203X). J. Composite Part B: Manufacturing, vol. 43, pp. 2115-2124, 2012.

**Barjasteh E**, Du X, Li W. H. Improvement in High Temperature Infusion Resin. SAMPE proc 2012; 42:10.

Tsai Y I, Bosze E J, **Barjasteh E**, Nutt S R. Influence of Hygrothermal Environment on Thermal and Mechanical Properties of Carbon fiber/fiberglass Composites. Composite Science and Technology, 2009. 69: p. 432–437.

**Barjasteh E**, Ramazani S.A. A, R. Dermanaki Farahani. Manufacturing and Investigation of Mechanical Properties of Thermoplastic Elastomer Nanocomposites of PP Copolymer with MAg-SEBS/nanoclay. European Polymer Congress, June 27 July 1, 2005, Moscow.

**Barjasteh E**, Ramazani S.A. A,Frounchi M. Effects of Clay Treatment on Physical-Mechanical Properties of PP/Clay Nanocomposites. 21th Annual Meeting of Polymer Processing Society (PPS21), June, 19-23, 2005. Leipzig, Germany.

Dermanaki Farahani R, Ramazani S.A. A, **Barjasteh E**. Preparation and Investigation of Physical and Mechanical Properties of Rubber Toughened Polyamid 6, 6/Nanoclay. European Polymer Congress, June 27 -July 1, 2005, Moscow.

**Yu Yang**

CONTACT

INFORMATION

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RESEARCH

INTERESTS

PROFESSIONAL

EXPERIENCE

Robust Design/Control/Optimization for Process Systems.

**California State University, Long Beach**, Chemical Engineering, Long Beach, CA

*Assistant Professor* November, 2016--

**Massachusetts Institute of Technology**, Process Systems Engineering Laboratory

(PSEL), Department of Chemical Engineering, Cambridge, MA

*Postdoctoral Associate* September, 2013 – August, 2016

Supervisor: Paul I. Barton

Industry collaborator: BP

**University of Alberta**, Chemical and Materials Engineering, Edmonton, AB, Canada

*Postdoctoral Associate* November, 2011 – August, 2013

Supervisor: Stevan Dubljevic

Industry collaborator: Jacktek Inc.

EDUCATION **University of Alberta**, Edmonton, AB, Canada

Ph.D., Chemical Engineering (Computer Process Control), August 2011

*•* Thesis: “*Computationally effective optimization methods for complex process con- trol and scheduling problems*”

*•* Advisor: Jong Min Lee and Fraser Forbes

**Zhejiang University**, Hangzhou, China

M.Sc., Automation (Process Control), July 2007

*•* Thesis: “*Model and Controller Reduction for Linear System*”

**Beijing Institute of Technology**, Beijing, China

B.Sc., Automation, July 2004

TEACHING

EXPERIENCE

*•* Process Dynamics and Control, 2009

Taught in the class seminar and supervised experiments in the process control lab

PATENT Title: Optimization techniques in the presence of uncertainties

Filing Date: November 17, 2014

U.S. Pub. No.: US 2016/0140448 A1

JOURNAL

PUBLICATIONS

**Yang, Y.** and P. I. Barton, “Stochastic programming for refinery optimization inte- grated with a nonlinear crude distillation unit model”, in preparation.

**Yang, Y.** and P. I. Barton, “Integrated crude selection and refinery optimization under uncertainty”, *AIChE Journal*, 62(4), pp.1038–1053, 2016.

**Yang, Y.** and S. Dubljevic, “Linear matrix inequalities (LMIs) observer and controller design synthesis for parabolic PDE”, *European Journal of Control*, 20(5), pp. 227–236,

2014.

**Yang, Y.** and S. Dubljevic, “Boundary model predictive control of thin film thickness modeled by Kuramoto-Sivashinsky equation with input and state constraints”, *Journal of Process Control*, 23(9), pp. 1362–1379, 2013.

**Yang, Y.** and J. M. Lee, “A value function-based switching robust control scheme for nonlinear systems”, *Journal of Process Control*, 23(6), pp. 852–869, 2013.

**Yang, Y.** and J. M. Lee, “Design of robust control Lyapunov function for nonlinear affine systems with uncertainty”, *IET Control Theory & Applications*, 6(14), pp. 2248–2256,

2012.

**Yang, Y.** and J. M. Lee, “A tighter cut generation strategy for acceleration of Benders decomposition”, *Computers & Chemical Engineering*, 44, pp. 84–93, 2012.

Lee, C. J., **Y. Yang**, V. Prasad, and J. M. Lee, “Sample-based approaches to decision making problems under uncertainty”, *Canadian Journal of Chemical Engineering*,

90(2), pp. 385–295, 2012

**Yang, Y.** and J. M. Lee, “An iterative optimization approach to design of control Lya- punov functions”, *Journal of Process Control*, 22(1), pp. 145–155, 2011.

**Yang, Y.** and J. M. Lee, “Probabilistic modeling and dynamic optimization for per- formance improvement and risk management of plant-wide operation”, *Computers & Chemical Engineering*, 34(4), pp. 567–579, 2010.

Nosair, H., **Y. Yang**, and J. M. Lee, “Min-max control using parametric approximate dynamic programming”, *Control Engineering Practice*, 18(2), pp. 190–197, 2010.

**Yang, Y.**, J. Wu, R. Xiong, W. Xu and S. Chen, “Single-input and single-output (SISO) controller reduction based on the L1-norm”, *Asia-Pacific Journal of Chemical Engineer- ing*, 3(6), pp. 688–694, 2008.

CONFERENCES **Yang, Y.** and P. I. Barton, “Refinery planning under uncertainty integrated with a nonlinear crude distillation unit model”, *AIChE Annual Meeting*, Salt Lake City, UT, Nov. 12, 2015.

**Yang, Y.** and P. I. Barton, “Refinery optimization integrated with a nonlinear crude distillation unit model”, *Advanced Control of Chemical Processes*, Vol. 48(8), pp.205-

210, Elsevier, 9th IFAC International Symposium on Advanced Control of Chemical

Processes, Whistler, Canada, 7–10th July, 2015.

**Yang, Y.** and P. I. Barton, “Refinery optimization under uncertainty”, *AIChE Annual*

*Meeting*, Atlanta, GA, 2014.

**Yang, Y.** and S. Dubljevic, “LMI based observer and controller design for second or- der parabolic PDE”, *2014 American Control Conference (ACC)*, pp.3363-3368, IEEE, Portland, OR, 2014.

**Yang, Y.** and S. Dubljevic, “Boundary moving horizon estimator for approximate mod- els of parabolic PDEs”, *The 21th Mediterranean Conference on Control and Automation*

*(Med 2013)*, pp.1035-1041, IEEE, Greece, 2013.

**Yang, Y.** and S. Dubljevic, “Discrete mechanics optimal control (DMOC) and model predictive control (MPC) synthesis for 3D spatial actuation”, *AIChE Annual Meeting*, Pittsburgh, PA, 2012.

**Yang, Y.** and S. Dubljevic, “Modeling and dynamical analysis of the wave equation of sucker-rod pumping system”, *The SPE Annual Technical Conference and Exhibition*, San Antonio, TX, 2012.

**Yang, Y.** and S. Dubljevic, “Boundary model predictive control of thin film thickness modeled by Kuramoto-Sivashinsky equation with input and state constraints”, *The20th Mediterranean Conference on Control and Automation (Med 2012)*, pp.1085-1091, IEEE, Spain, 2012.

**Yang, Y.** and J. M. Lee (**Outstanding paper award**) “Robust nonlinear model predic- tive control via approximate value function”, *Proceedings of 11th International Confer- ence on Control, Automation and Systems (ICCAS)*, Korea, pp.1816–1821, 2011.

**Yang, Y.** and J. M. Lee, “Acceleration of Benders decomposition for mixed integer linear programming”, *Proceedings of 2011 International Symposium on Advanced Control of Industrial Processes (Adconip 2011)*, Thousand Islands Lake, Hangzhou, P.R. China, pp.222–227, May 24 (May 23–26), 2011.

**Yang, Y.** and J. M. Lee, “Design of a control Lyapunov function for stabilizing specified states”, *Proceedings of the 9th International Symposium on Dynamics and Control of Process Systems (DYCOPS 2010)*, Leuven, Belgium, pp.515–520, 2010.

**Yang, Y.** and J. M. Lee, “Probabilistic modelling and stochastic dynamic optimiza- tion for managing abnormal situations in plant-wide operations”, *Proceedings of the*

*10th International Symposium on Process Systems Engineering (PSE 2009)*, Salvador, Bahia, Brazil, pp.1287–1292, 2009.

**Yang, Y.** and J. M. Lee, “Probabilistic modeling and dynamic optimization for perfor- mance improvement of plant-wide operation”, *58th Canadian Chemical Engineering Conference (CSChE), Ottawa, ON, 2008.*

PROFESSIONAL

SKILLS

MATLAB/SIMULINK, C/C++, ASPEN, AMPL/GAMS/CPLEX

COURSES Transport Phenomenon, Machine Learning, Process Dynamics and Control, Stochas- tic Process, Reinforcement Learning, Mathematical Programming, Advanced Process Control and Optimization, System Identification, Digital Signal Processing, Dynamic System Theory, Engineering Mechanics, Adaptive Control

**Appendix D**

Assessment of Additional Library Resources Needed to Support Proposed Programs

**Assessment of Additional Library Resources Needed to Support Proposed Programs**

**Name of Proposed Program \_\_\_M.S. in Chemical Engineering \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Department \_\_\_\_\_\_\_\_Chemical Engineering \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Assessed by (library faculty member) \_Hema Ramachandran**

**Date \_\_\_\_\_\_2/12/2016\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

*Following is a template for assessing additional Library resources needed to support proposed program. The new program proposal process requires assessments of additional resources needed, including library resources. While departments/programs may believe the Library has sufficient resources, it is the Library Faculty member for the relevant department/program, in consultation with the department/program, who has responsibility for this assessment. The Library’s collection development officer will assist where needed, and should review assessments where new resources are deemed necessary.*

*A shorter assessment may be sufficient for new minors in programs where the librarian and the department believe there are sufficient library resources.*

1. **Department faculty and library faculty jointly identify key journals needed by students and faculty in the program, noting those for which ILL options are sufficient, and those needed in house or online.**
   1. **Department faculty identify journals they see as key to program success.**

A survey was sent to the chemical engineering faculty who identified 28 key journals of relevance and importance to the proposed M.Sc. program. Of these only 6 journals are not ***currently*** received. We have online access to them up to 2014 when we canceled our Wiley subscription due to excessive cost increases. The Library has recently expanded the list of Wiley chemistry journals that it subscribes to and **may be** able to re-negotiate to include some of the journals that were canceled. However, we are unlikely to get all of them since, for example, the cost of *Journal of Polymer Science, Part B* alone is about $31,000 per year. On the other hand, we are hopeful that we may be able to add the *Canadian Journal of Chemical Engineering*.

If the department considers the journals listed below (identified by faculty) to be critical it will need to provide additional funding to re-subscribe. Of course our inter-library loan service (BeachReach) efficiently provides access to journal articles for which we do not have access.

* Journal of Polymer Science, Part B: Polymer
* Advanced Materials
* Journal of the American institute of Chemical Engineers (AIChE J)
* Electrophoresis
* Canadian Journal of Chemical Engineering
* Polymer Engineering and Science
  1. **Library faculty may suggest other titles including:**
     1. *Journals in the field with high impact factors*

In addition, library faculty for this discipline examined the ***Journal Citation Reports*** database. This database ranks journal titles by “impact factors” in a given category; in this case Engineering, Chemical. The top 50% of the list was examined and we have access to all but three of the titles. This is sufficient for supporting the proposed M.Sc. program. Of course, BeachReach (our interlibrary loan service) is available to provide articles on demand.

* + 1. Journals appearing in surveys or literature reviews that are highly rated by that discipline’s faculty.

Not reviewed (not necessary)

* + 1. Journals in the field with high numbers of interlibrary loan requests

Not reviewed.

* 1. **For each new journal title, librarian will determine:**

(No new journals are recommended. See 1a on issues related to continuing subscription to 6 Wiley journal titles.)

* + 1. The subscription cost
    2. What has interlibrary loan demand been over past two years?

1. **Identify new/other databases key to program success.**
   1. ***Library faculty will identify suggested additional relevant databases. Department faculty may want to suggest other databases.***

No new databases were identified that are needed to support the program – we have the required, relevant databases to cover the curriculum. See the Engineering research guide http://csulb.libguides.com/ENG under the tab “Databases”: Compendex, SciFinder, ACS Web, Environmental Sciences and Pollution Management, OnePetro etc. are the important databases for the proposed highly multidisciplinary M.Sc in Chemical Engineering.

* 1. **For any new databases, library faculty will identify cost.**

N/A

1. **Identify other additional print and online resources (e.g. eBooks, streaming video, maps, digital collections/institutional repository access) that are key to program success. For each resource identified by Library or departmental faculty, Library faculty will include resource costs.**

If funding remains at the current level for monographs (books), the library will be able to support any additional books that are required for the new program.

1. **Librarian-led research instruction:** 
   1. What is anticipated additional Library faculty instructional demand?

Difficult to anticipate, but there will be at least one or two additional library classes – especially one focused on research methods.

* 1. If this is a graduate program, are there potential additional library instructional or one-on-one consultation needs anticipated?

Undoubtedly, there will be an increase in the number of instructional sessions and one-on-one consultations especially to support theses and projects.

* 1. Can anticipated instructional demand be accommodated with existing Library faculty?

One library faculty member is dedicated to the entire College of Engineering and will be able to absorb the additional instructional sessions and one-on-one consultations. Also, given that the library faculty member now has at least 10 office hours on site per week makes it very convenient for student and librarian to meet. If necessary, the engineering librarian may request the occasional assistance of her science colleague to give the graduates better support in the discipline of chemistry.

1. **How will additional resources be funded? Additional campus funding to library? Absorbed by current Library budget? An ongoing contribution from the proposing department? Outside funding?**

See 1. a.