




**MEMORANDUM**

**To:** Julio Frenk  
University President

**From:** Linda L. Neider  
Chair, Faculty Senate 

**Date:** April 22, 2021

**Subject:** Faculty Senate Legislation #2020-87(B) – Transfer Four Tenured Faculty Members Who Identify as Belonging in the Environmental Engineering (ENV) from the Department of Civil and Architectural Engineering (CAE) to the Department of Chemical Environmental, and Materials Engineering (CEM), College of Engineering

Reference Legislation:

#2020-84(B) – Creation of a Department of Chemical Environmental, and Materials Engineering (CEM), College of Engineering.

#2020-85(B) – Name Change of the Department of Civil, Environmental and Architectural Engineering TO the Department of Civil and Architectural Engineering (CAE), College of Engineering.

#2020-86(B) – Transfer of the Undergraduate Program in Environmental Engineering (ENV) from the Department of Civil and Architectural Engineering (CAE) to the Department of Chemical Environmental, and Materials Engineering (CEM), Including the Bachelor of Science (B.S.) in ENV Inclusive of the B.S. within the 5-year B.S./M.S. program (B.S. in ENV/M.S. in Civil Engineering), plus the Minor in Environmental Engineering, College of Engineering

#2020-88(B) – Creation of a Ph.D. in Chemical, Environmental, and Materials Engineering, College of Engineering.

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The Faculty Senate, at its April 21, 2021 meeting, had no objections to the transfer four Tenured faculty members who identify as belonging in the Environmental Engineering (ENV) from the Department of Civil and Architectural Engineering (CAE) to the Department of Chemical Environmental, and Materials Engineering (CEM) in the College of Engineering.

The proposal is enclosed for your reference.

This legislation is now forwarded to you for your action.


LLN/rh/va

Enclosure

cc: Jeffrey Duerk, Executive Vice President and Provost  
Pratim Biswas, Dean, College of Engineering  
Helena Solo-Gabriel, Professor, College of Engineering  
Qingda Yang, Professor, College of Engineering

**CAPSULE:** Faculty Senate Legislation #2020-87(B) – Transfer Four Tenured Faculty Members Who Identify as Belonging in the Environmental Engineering (ENV) from the Department of Civil and Architectural Engineering (CAE) to the Department of Chemical Environmental, and Materials Engineering (CEM), College of Engineering

**PRESIDENT'S RESPONSE**

APPROVED:  DATE: 4/22/21  
(President's Signature)

OFFICE OR INDIVIDUAL TO IMPLEMENT: Pratim Biswas, Dean, College of Engineering

EFFECTIVE DATE OF LEGISLATION: IMMEDIATELY  
(pending any additional approval by the Board of Trustees)

NOT APPROVED AND REFERRED TO: \_\_\_\_\_

REMARKS (IF NOT APPROVED): \_\_\_\_\_

Please refer to the [Procedures for Program Changes](#) document for information on the approvals and notifications needed for program changes and the [Proposal Submissions Specifications](#) document for an explanation of the process and a list of the materials required.

(Please note that change approvals can take 2 semesters to complete.)

**FORM INSTRUCTIONS:**

1. Save/download the form as a pdf.
2. After completing the information below, print and scan the form.
3. Insert it with the background materials that are specified, in the order listed, and submit to [facsen@miami.edu](mailto:facsen@miami.edu).

**Please note:** only scanned versions can be accepted.

Include this checklist at the beginning of each proposal.

## KEY CONTACT PERSONNEL INFORMATION

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First Name

Pratim

Last Name

Biswas

Proponent's Title

Professor and Dean, College of Engineering

Department, if applicable

School/College

College of Engineering

E-mail

pbiswas@miam.edu

Phone

305-284-5986

Title of Proposal

Proposal for a New Department of Chemical, Environmental, and Materials Engineering

Inclusive of: 1) Creation of new CEM Department, 2) Name Change of CAE, 3) Transfer of undergraduate ENV program from CAE to CEM, and 4) Transfer of 4 faculty from CAE to CEM

## MANDATORY MEMORANDA AND FORMAT

Please check that each item listed below is included in the proposal package of materials, in the ORDER as listed. The applicable title (i.e. Letter of Explanation, Memo from the Dean, etc. ) is to precede each section in the materials.

Only proposals conforming to this format will be accepted.

### 1. This completed checklist.

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### 2. Letter of explanation. (2-3 pages only, double spaced, 12 pt font)

Yes     No

If no, explain why:

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### 3. A memo from the dean(s) signifying approval of the faculty of the relevant School(s) / Colleges(s).

Yes     No

If no, explain why:

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### 4. A memo that all affected or relevant School / College Council(s) have approved.

Yes     No

If no, explain why:

**5. A memo from the department chair(s) signifying approval of the faculty of the relevant department(s).**

Yes     No

If no, explain why:

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**6. A memo from the Office of Accreditation and Assessment (OAA) if the proposal involves academic programs (degrees, certificates, majors, minors, concentrations, specializations, tracks, etc.) such as new programs, closing programs, or program changes (such as changes in requirements, program length, modality, name, location).**

Applicable     Not applicable.

If not, explain why:

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**7. A memo from the Graduate School Dean signifying approval of the Graduate Council (for graduate programs only) OR the University Curriculum Committee (for undergraduate programs only) recommendation form.**

Applicable     Not applicable.

If not, explain why:

**8. Academic Deans Policy Council (ADPC) approval, for interdisciplinary issues and as appropriate. Please consult with the Dean of the Graduate School or the Secretary of the Faculty Senate to check if this is needed.**

Yes       No

If no, explain why:

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**9. Additional required documents as listed on the "Proposal Submissions Specifications," i.e. market analysis, budget information, assessment of library collections, etc. as specified.**

List additional documents included:

**ADDITIONAL DOCUMENTS**

- 1) CEM Mission Statement
- 2) Market Analysis and Demand
- 3) Library Collections
- 4) Budget (*Submitted Separately*)
- 5) Appendix 1, Vision of CAE Department given the transfer of the environmental engineering program to CEM
- 6) Appendix 2, Draft Strategic Plan for College of Engineering
- 7) Appendix 3, Library Holdings and Expenditures Report

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End form.

## **EXECUTIVE SUMMARY**

This proposal for a New Department of Chemical, Environmental and Materials Engineering proposes the following:

- 1) Creating the new Department of Chemical, Environmental and Materials Engineering (CEM\*)
- 2) Changing the name of the Department of Civil, Environmental and Architectural Engineering to the Department of Civil and Architectural Engineering (CAE)
- 3) Transferring the undergraduate program in Environmental Engineering (ENV) from CAE to CEM. This includes the BS in ENV inclusive of the BS within the 5 year BS-MS program (BS in ENV/MS in Civil Engineering), plus the minor in Environmental Engineering.
- 4) Transferring four faculty from CAE that identify as ENV faculty to CEM.

A separate companion package has been developed for approval of a new PhD program in CEM.

\*Note: Acronym will be changed to CET once the program is entered into the University Bulletin due to CEM acronym already being used by another program. Also early during the proposal process the CEME acronym was used. CEM and CEME are synonymous and will be replaced by CET.

## **LETTER OF EXPLANATION**

### **Establishment of a new Department of Chemical, Environmental and Materials Engineering in the College of Engineering, University of Miami**

#### **Background**

The College of Engineering (CoE) is a 74-year-old college and has changed over the years adding new departments over time. It currently has 5 departments – Biomedical Engineering (BME), Civil, Architectural and Environmental Engineering (CAE), Electrical and Computer Engineering (ECE), Industrial Engineering (IEN), and Mechanical and Aerospace Engineering (MAE). A notable absence is a Chemical Engineering department that is present in most engineering schools. Chemical engineering is a discipline influencing numerous areas of science and technology. In broad terms, chemical engineers conceive and design processes to produce, transform, and transport materials — beginning with experimentation in the laboratory followed by the implementation of the technology in full-scale production. More importantly, to meet the aspirations and address challenging issues, it is a notable absence that precludes not only the College, but also the University holistically to address and work on challenging issues. The University of Miami has a great opportunity to create this much needed department in the College of Engineering with a new outlook that will be impactful. The goal is to consolidate Environmental and Materials Science and Engineering aspects of the College into a new department – Chemical, Environmental and Materials Engineering (CEM).

The following is a summary of the reasons:

- 1) Areas of CEM research and education are needed to advance the Strategic Initiatives (see Appendix I) of the CoE and are absent amongst current departments.
- 2) The absence hampers visibility and recognition as a holistic College of Engineering, recruiting, rankings, and more.
- 3) The new department would be synergistic with Frost Institute of Chemistry & Molecular Science.
- 4) Provides an opportunity to consolidate synergistic areas of Environmental Engineering and provide a base for Materials efforts. Environmental engineering currently relies on multiscale studies ranging from molecular to the field scale, a disciplinary aspect covered well in chemical engineering. A similar approach is relevant for advanced materials synthesis – a current gap in CoE.
- 5) The potential to enhance our visibility by drawing attention to the CoE and the University of Miami in areas such as Aerosol Science and Technology (jointly with RSMAS) and in Water Quality (jointly with RSMAS).
- 6) Hiring in two additional cluster areas of synthetic biology and materials synthesis would synergize and promote holistic groups in several of the strategic thrusts adopted by CoE

A brief description of the proposed department is provided.

## Faculty

The College of Engineering is requesting the establishment of a new Department to be called, the Department of Chemical, Environmental, and Materials Engineering (CEM). **Faculty from the Department of Civil, Architectural, and Environmental Engineering (CAE) who affiliate as Environmental Engineering (ENV) faculty will have the choice to transfer their primary appointment to CEM. These faculty include Drs. Pratim Biswas (Dean), David Chin (Professor), James Englehardt (Professor), and Helena Solo-Gabriele (Professor).** Their tenure is to be retained within the College of Engineering in the new department (CEM). CAE has since established a new vision with an emphasis on sustainable construction and faculty will be hired within the new CAE strategic areas to replace those that will be transferring to CEM.

With the arrival of the new Dean, additional faculty positions have been committed to CoE. CoE has adopted an approach of new hires supporting the strategic thrusts of the College and the University. We anticipate hiring about 10 new faculty into this new Department over the next 5 years. Doing so will not only be consistent with advancing the strategic thrusts in an impactful manner, but also fill gaps in much needed expertise and strength. Overlap in expertise exists throughout the College Departments and other University units in both Chemical and Materials engineering and this expertise will be tapped in developing research and educational programs within CEM. It is anticipated that some of the hires will be joint with other Colleges and Schools (such as in Aerosol Science and Technology with RSMAS, and synthetic biology with the Frost Institute). Other areas of overlap are with the Departments of Chemistry, Biology, and Physics, and RSMAS, and the Miller School of Medicine. Synergies are



also envisioned with other units of the University such as the Miami Herbert Business School and School of Communication. Continued assessment will be conducted to identify gaps in faculty expertise.

## **Curriculum**

This department will initially offer the following degrees:

- a) An undergraduate degree in Environmental Engineering (existing degree in CoE)
- b) Five year BS/MS corresponding to the BS program in Environmental Engineering. Students in the five-year BS/MS will receive their BS degree in Environmental Engineering from CEM and their MS in Civil Engineering from CAE.
- c) Minor in Environmental Engineering
- d) PhD degree in CEM (details provided in CIM system)

The existing ENV undergraduate degree programs (a, c, and the BS portion of b in the above list) will be transferred from CAE to CEM. Details on this ABET accredited program are available in existing school documents. As new faculty with expertise are recruited, the Environmental Engineering curricular offerings will be enhanced by offering concentrations in chemical engineering and materials engineering. CEM will utilize the existing MS programs in Civil Engineering (regular MSCE and 5 year BS-environmental/MSCE) with environmental emphasis to facilitate the award of MS degrees to students interested in pursuing environmental engineering focused MS degrees. An MS in CEM is not being pursued at this time. The CEM Department intends to establish a new PhD program in Chemical, Environmental, and Materials Engineering. The details of this program are described in the documentation required for the establishment of curricular programs and have since been uploaded into the CIM system.

		CoE Thrust Areas					
		Health Engr. (HE)	Adv. Materials (AM)	Energy and Envir.(EE)	Data Sciences & Simulations (DSS)	Sustain. & Resilience (SR)	Space Sciences & Engineering (SSE)
CoE Departments and Clusters	BME						
	Neural Engineering	•	•		•		
	Regenerative Medicine	•	•				
	Imaging	•			•		
	CAE						
	Structures					•	
	Materials		•	•		•	
	Buildings Env Systems			•	•	•	
	CEM						
	Aerosols	•	•	•		•	•
	Water			•	•	•	
	Syn Bio	•		•			
	Materials Syn		•		•		•
	ECE						
	Artificial Intelligence	•			•	•	
	Cyberphysical Systems				•	•	
	Nanotechnology	•	•		•		
	IEN						
	Data Analytics				•	•	
	Energy & Electricity			•	•	•	
	Healthcare Informatics	•					
	MAE						
	Mechanics, Materials & Manufacturing	•	•	•		•	•
Aerodynamics & Propulsion	•		•	•	•	•	
Astroynamics & Control	•					•	
Green Energy		•	•		•	•	

Table 1: Strategic organizational table illustrating the intersection between College of Engineering thrusts and clusters. Red rectangle emphasizes the clusters and thrusts associated with the proposed CEM Department.

### Areas of Emphasis

Consistent with the CoE Departmental structure, the new department will also have clusters which then support a variety of College wide thrusts. A listing of the CEM clusters and their intersection with the CoE strategic thrust areas is provided in Table 1. Below is a short description of each cluster that will be part of the proposed CEM Department.

#### *Aerosol Science and Technology*

Aerosol science and technology is focused on understanding the formation, growth, transport and application of fine particulate matter systems. This group is focused on the characterization of fundamental aerosol formation and transformation processes to determine impacts on the Environment, Climate, and Human Health; and to utilize these processes to develop new materials to enable Energy, Environmental & Medical technologies. The new Dean, Dr. Biswas brings with him considerable expertise in aerosol science and engineering. Aerosol science in the context of atmospheric science and marine systems is the area of focus of RSMAS' Department of Atmospheric Science (ATM). Faculty from the RSMAS ATM will be recruited for collaboration in research and education initiatives at the graduate level in developing concentrations and tracks within the new CEM PhD program.

### *Water Quality*

Considerable expertise in water related research already exists within CAE and the faculty transferring from CAE to CEM will bring with them such expertise. Dr. Solo-Gabriele's research has focused on evaluating the relationship between the environment and human health. Her research has spanned diverse areas including evaluating the impacts of chemicals in the environment and evaluating the impacts of microbial contaminants in coastal zones. Dr James Englehardt's effort focus on developing energy-positive systems to manage municipal water and wastewater systems. Dr. David Chin's area of expertise is in water systems focused on water quality, watershed management, flood modeling, coastal systems and water security. Synergies in water related engineering issues are also available through faculty at RSMAS and within other units of the University, in particular within the life and physical sciences.

### *Synthetic Biology*

New hires will be made in the other two areas of Synthetic Biology and Materials Synthesis. Areas of interest include synthetic biology, a field of science that involves redesigning organisms for useful purposes by engineering them to have new abilities. Applications to energy, biomaterials synthesis and medicine will be explored. Other synergistic areas include systems biology and bioprocessing. The focus area in synthetic biology will draw from the expertise in the College of Arts and Sciences (CAS) Department of Biology, the RSMAS Department in Marine Biology and Ecology, and the Science Departments of the Miller School of Medicine (MSOM). The Frost Institute will have a significant connectivity to this cluster in the new CEM department.

### *Materials Synthesis*

The Materials Synthesis focus area will also rely on the hire of core faculty members with expertise in this area. Faculty in this area will primarily focus on bottoms up synthesis methodologies, guided by robust first principles. Efforts will be made to translate knowledge gained in this area to materials technology and production through partnerships with industry. We will synergize with faculty in CAE focused on fundamental properties of building materials and with faculty of MAE focused on developing new materials for batteries and energy storage. Additionally, faculty with expertise in molecular design of materials will also be recruited to augment existing expertise in CAE in molecular analysis of nanostructured materials. This focus area will also draw upon expertise available from some of the aerosol science and technology faculty, and those in biomaterial synthesis in BME, the CAS Department of Chemistry, Biology, and Physics, and expertise available in the science departments of the MSOM.

UNIVERSITY OF MIAMI  
COLLEGE of ENGINEERING



Pratim Biswas, Ph.D.  
Dean

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Coral Gables, FL 33146

Ph: 305-284-6035  
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pbiswas@miami.edu

DATE: February 22, 2021  
TO: Linda Neider, Chair of the Faculty Senate  
FROM: Pratim Biswas, Dean College of Engineering *Biswas*  
SUBJECT: College of Engineering Faculty Vote

On Monday, February 15, the proposals for a new Department and PhD program of Chemical, Environmental and Materials Engineering (CEM) was presented before the College of Engineering faculty during a general faculty meeting. A Qualtrics survey was prepared to collect the votes from the faculty. A total of 46 of 73 eligible faculty voted by the time the survey closed on February 16 at 12 noon. The results of the vote as documented in the Qualtrics Survey were:

For a new CEM Department  
44 in favor  
1 against  
1 abstain

For a new PhD Program  
45 in favor  
0 against  
1 abstain

The process of introducing the concept of a new CEM Department began during September 2020 where I had presented a draft of the College of Engineering strategic plan before the College faculty meeting. The CEM Department has been discussed in several forums since then.

It was formally presented during the College Council meeting held February 8. A vote was taken via email. The Chair of the College Council, Dr. Francesco Travascio reported a positive vote in favor on February 14 (see copy of email on following page).

The proposal for a new CEM Department and PhD program has also been discussed at each of the CoE Department Faculty meetings. All five Departments endorse the development of a new CEM Department as documented in the attached letters from the Chairs of each of the five College of Engineering Departments.

I can thus summarize that the plan for a new CEM Department and PhD program has been presented within the College of Engineering and the plan has since received all of the necessary endorsements.

Thank you.

**From:** Travascio, Francesco, Ph.D. <f.travascio@miami.edu>

**Sent:** Sunday, February 14, 2021 2:41 PM

**To:** Parera-Ruggiero, Ailen <apruggero@miami.edu>; Dykstra, Andrew R <adykstra@miami.edu>; Ozdamar, Ozcan <oozdamar@miami.edu>; Suaris, Wimal <wsuaris@miami.edu>; Wang, Gang <g.wang2@miami.edu>; Lee, Seokgi <sgl14@miami.edu>; Yao, John J <jyao@miami.edu>; Guzman, Jorge Alberto <jag536@miami.edu>; Kubat, Miroslav <mkubat@miami.edu>; Negahdaripour, Shahriar <nshahriar@miami.edu>

**Cc:** Biswas, Pratim <pbiswas@miami.edu>; Solo-Gabriele, Helena M <hmsolo@miami.edu>

**Subject:** Results from the survey on new department CEM

Dear All,

I am pleased to announce that **CC members approved** the formation of a new department with name Chemical, Environmental and Materials Engineering (CEM).

This was determined via online voting. The results of the voting are reported below:

In favor	8
Against	1

Sincerely,

Francesco Travascio, PhD

***Associate Professor***

Department of Mechanical and Aerospace Engineering at College of Engineering

Department of Industrial Engineering at College of Engineering

Department of Orthopaedic Surgery at Miller School of Medicine

University of Miami

***Associate Director of Research***

Max Biedermann Institute for Biomechanics

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Record of CAE Faculty Vote for  
Transfer of Environmental Engineering Undergraduate Program to CEM  
plus Vote by CAE Faculty for Name Change

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Antonio Nanni, PhD, PE 1251 Memorial Drive Ph: 305-284-3461  
Professor & Chair MEB Room 325 Fax: 305-284-3492  
Civil, Arch. & Env. Engineering Coral Gables, FL 33146 nanni@miami.edu

DATE: February 25, 2021  
TO: Linda Neider, Chair of the Faculty Senate  
FROM: Antonio Nanni  
SUBJECT: CAE Department Name Change

A handwritten signature in blue ink that reads "Antonio Nanni".

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I am writing this memo in my capacity of CAE Chair.

The College of Engineering is proposing a new Department of Chemical, Environmental, and Materials Engineering (CEM). The undergraduate environmental engineering degree program currently in CAE will transfer to CEM. Specifically, this program transfer includes:

1. The four-year ABET-accredited undergraduate degree in Environmental Engineering (BSEN)
2. Minor in Environmental Engineering
3. Five year BSEN/MSCE corresponding to the BS program in Environmental Engineering. The MS is to remain in Civil Engineering.
4. As a result of this program transfer, the CAE Department's name will change to the Department of Civil and Architectural Engineering. The three letter acronym of the Department (CAE) will remain the same.

On February, 25, 2021, the faculty of CAE voted by secret ballot on the items listed above as follows:

1. Vote for transfer of ENV program to new department: 14 approve, 1 oppose, 0 abstain
2. Vote for transfer of ENV minor to new department: 14 approve, 1 oppose, 0 abstain
3. Vote for 5-year degree program transfer: 14 approve, 0 oppose, 1 abstain
4. Vote for the name change of the CAE Department: 15 approve, 0 oppose, 0 abstain

Best regards.

Letters of Endorsements from all College of Engineering (CoE)  
Departments plus from the Rosenstiel School of Marine and  
Atmospheric Sciences (RSMAS) Atmospheric Sciences Department and  
College of Arts and Sciences (CAS) Department of Chemistry

#### Order of Endorsement Letters

1. BME: Biomedical Engineering, CoE
2. CAE: Civil, Architectural and Environmental Engineering, CoE
3. ECE: Electrical and Computer Engineering, CoE
4. IEN: Industrial Engineering, CoE
5. MAE: Mechanical and Aerospace Engineering, CoE
6. ATM: Atmospheric Sciences, RSMAS
7. CHM: Chemistry, CAS



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**Fabrice Manns, Ph.D.**  
Professor and Chair  
Department of Biomedical Engineering

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Ph: 305-284-2335  
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February 19, 2021

TO: Dr. Linda L. Neider, Professor and Chair of the Faculty Senate

SUBJECT: Letter of Endorsement - Proposed Department of Chemical, Environmental, and Materials Engineering (CEME)

This letter is to endorse the proposal for the creation of a new Department of Chemical, Environmental, and Materials Engineering (CEME) in the College of Engineering.

The Faculty of the Department of Biomedical Engineering unanimously voted in support of the creation of this new department at our faculty meeting on February 19, 2021.

The new department will expand the College's research expertise in areas that will provide opportunities for new collaborations and shared research resources, particularly in the areas of cell and tissue engineering and regenerative medicine. It will also provide opportunities to significantly enhance our undergraduate and graduate student learning experiences through the development of shared instructional wet labs.

The biomedical engineering faculty is looking forward to the collaborative opportunities that the new Department will offer in research and education.

Sincerely,

A handwritten signature in blue ink, consisting of a stylized 'F' and 'M' followed by a long horizontal line.


Fabrice Manns, Ph.D.  
Professor and Chair of Biomedical Engineering  
Professor of Ophthalmology  
University of Miami

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COLLEGE of ENGINEERING

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Antonio Nanni, PhD, PE 1251 Memorial Drive Ph: 305-284-3461  
Professor & Chair MEB Room 325 Fax: 305-284-3492  
Civil, Arch. & Env. Engineering Coral Gables, FL 33146 nanni@miami.edu

DATE: February 21, 2021  
TO: Linda Neider, Chair of the Faculty Senate  
FROM: Antonio Nanni   
SUBJECT: Letter of endorsement for new proposed Department of Chemical,  
Environmental and Materials Engineering (CEM)

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I am writing this memo in my capacity of CAE Chair. This memo is to declare the CAE endorsement for the new proposed Department of Chemical, Environmental, and Materials Engineering (CEM) within the College of Engineering.

The faculty of the CAE Department discussed this proposal during four separate departmental faculty meetings. On Friday, February 19, 2021, with secret ballot, the faculty voted 14 (Y) - 0 (N) - 1(A) in favor of the creation of the new Department.

As a result of the creation of CEM, the current CAE undergraduate degree program will migrate to the new department together with four current faculty members. Accordingly, we envision synergies with CEM in terms of both research and education.

At the same meeting, CAE faculty indicated full support for the creation of PhD program in CEM.

Best regards.

UNIVERSITY OF MIAMI  
COLLEGE of ENGINEERING



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DATE: February 10, 2021

TO: Linda Neider, Chair of the Faculty Senate

SUBJECT: Letter of endorsement for new proposed Department of Chemical, Environmental, and Materials Engineering (CEME)

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This letter is to endorse the new proposed Department of Chemical, Environmental, and Materials Engineering (CEME). The faculty of the Department of Electrical and Computer Engineering (ECE) have discussed the proposal documents and the majority are in favor of the new Department. Within ECE we envision synergies and view this new Department as a resource to establish collaborations in research and education as well as a vital complementing component to further strengthen our existing efforts. Particularly, we are aware of the urgent need to create a chemical engineering program which our college currently lacks. Chemical engineering is a vital foundational component of the cross-disciplinary field of nanotechnology – a strategic area at our Department. Therefore, we envision important synergies of the new chemical engineering program with our ongoing nanotechnology research efforts in ECE. These are the potential contributions and faculty who are currently active in nanotechnology:

- 1) Faculty member Sung Jin Kim has expertise in nanophotonic and optoelectronic materials for renewable energy and sensing applications. His research can contribute towards CEME focus area in Synthetic Biology and Materials Science.
- 2) Faculty member Sakhret Khizroev's laboratory focuses on nanomagnetic/spintronic/multifunctional materials and devices for wireless brain-machine interface (BMI) and next-generation computing. His research can leverage expertise in chemical engineering to build nanotransducers for BMI and neuromorphic computing.

Collectively the ECE Department endorses the proposal for a new CEME Department. We look forward to the collaborative opportunities that this new Department will bring.

Sincerely,

Dr. Mohamed Abdel-Mottaleb,  
Professor and Chairman  
Dept. of Electrical & Computer Engineering



February 14, 2021

TO: Dr. Linda Neider, Chair of the Faculty Senate  
University of Miami

FROM: Vincent Omachonu, Ph.D., P.E.  
Professor and Chair  
Department of Industrial Engineering

Subject: Letter of endorsement for new proposed Department of Chemical, Environmental and Materials Engineering (CEME)

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This letter conveys our support and endorsement for the newly proposed Department of Chemical, Environmental, and Materials Engineering (CEME). The faculty of the Department of Industrial Engineering have discussed the proposal document and the majority are in favor of the new department. We envision potential synergies that could strengthen collaborations involving some of our faculty in the areas of research and education. For example, we anticipate the following synergies:

- 1) Two of our faculty members conduct research in the field of energy and the environment and could potentially collaborate in the areas of materials science, environment, and water quality.
- 2) Two of our faculty members have extensive background in Data Analytics and could potentially be interested in collaborating in the area of water quality and data analytics.

It is therefore with great pleasure that we in the Department of Industrial Engineering endorse the proposal for a new CEME Department. We look forward to the collaborative opportunities that this new department will bring.

UNIVERSITY OF MIAMI  
COLLEGE of ENGINEERING



Department of  
Mechanical & Aerospace  
Engineering

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MEB Room 205  
Coral Gables, FL 33146

Ph: 305-284-2577  
Fax: 305-284-2580

DATE: February 2, 2021

TO: Linda Neider, Chair of the Faculty Senate

FROM: Victoria Coverstone, Chair and Professor of Mechanical and Aerospace Engineering (MAE)

SUBJECT: Letter of endorsement for new proposed Department of Chemical, Environmental, and Materials Engineering (CEME)

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This letter is to endorse the new proposed Department of Chemical, Environmental, and Materials Engineering (CEME). The faculty of the MAE Department have discussed the proposal documents and the majority support the establishment of the new Department. Within MAE we envision synergies and view this new Department as a resource to establish collaborations in research and education. For example, we envision the following synergies:

- 1) Faculty members Celik, Coakley, Po and Yang have expertise in Manufacturing, Materials and Mechanics and can contribute towards CEME focus area in Materials Science.
- 2) Faculty member Zha has expertise in Computational Fluid Dynamics and can contribute towards CEME focus area in Aerosol Sciences.
- 3) Faculty member Coverstone has expertise in space systems and can contribute towards CEME focus area in the remote sensing of Aerosols.

Collectively the MAE Department endorses the proposal for a new CEME Department. We look forward to the collaborative opportunities that this new Department will bring.



Memorandum

To: Linda Neider, Chair of the Faculty Senate  
Cc: Pratim Biswas, Dean of the College of Engineering  
Helena Solo-Gabrielle, Associate Dean for Research, College of Engineering

From: David S. Nolan, Chair, Department of Atmospheric Sciences

Date: March 23rd, 2021

Re: Endorsement for the Proposed Department of Chemical, Environmental, and Materials Engineering (CEME)

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Recently the faculty of ATM learned of the plan to form a new Department of Chemical, Environmental, and Materials Engineering (CEME) in the College of Engineering. Profs. Sharan Majumdar, Cassandra Gaston, and I have reviewed the proposal documents and I can report that we strongly support the new department. In particular, we see the development of a core group of faculty in aerosol research at COE as highly synergistic with the aerosol research already underway in Prof. Gaston's lab, and with plans to develop a new aerosol research laboratory on the RSMAS campus. Water quality is also an area of potential collaboration between COE and RSMAS. We expect students in the new PhD program in CEME to take atmospheric science and atmospheric chemistry classes from our faculty, with mutual benefits to both departments.

At the ATM faculty meeting on March 19<sup>th</sup>, 2021, Dean Biswas described the motivations for forming the new CEME department and its potential collaborations with RSMAS and ATM. After a short discussion, the eligible ATM faculty voted 7-0 in support of CEME.



March 15, 2021

Dear Dr. Solo-Gabriele,

I have consulted all the Faculty during the week of March 8 to 12'21 regarding the approval of the creation of a new Department in Chemical, Environmental, and Materials Engineering (CEM) and a new Ph.D. program in CEM. I have received a unanimous consensus for a new Department and Ph.D. program in CEM. The Department of Chemistry at UM is willing to collaborate without any reservation at the teaching and research level to the new department and new Ph.D. program. We sincerely wish great success to the new CEM Department/Program which will be an excellent asset to UMiami.

Best Regards,

A handwritten signature in blue ink, appearing to read 'Roger L'.

Roger


R.M. Leblanc  
Professor and Chair



## MEMORANDUM

DATE: March 4, 2021

TO: Pratim Biswas, Dean  
College of Engineering

FROM: Patty Murphy, Associate Provost  
Office of University Accreditation 

RE: Establishing New CEM Department and Renaming CAE Department

The College of Engineering notified me on 03/04/2021 of its intent to make the following changes:

1. Establish a new academic department: Department of Chemical, Environmental, and Materials Engineering
2. Rename the Department of Civil, Architectural and Environmental Engineering (CAE) to the Department of Civil and Architectural Engineering (CAE)
3. Transfer the following programs from the CAE department to the new department:
  - a. Undergraduate minor in Environmental Engineering [ENVR\_MN]
  - b. Bachelor of Science in Environmental Engineering [ENVR\_BSENE]
  - c. The undergraduate component of the BSEE/MS in Civil Engineering dual degree [CENR5\_BSCE]
4. Transfer of four regular faculty lines from the CAE department to the new department:
  - a. Dr. Pratim Biswas (Dean)
  - b. Dr. David Chin (Professor)
  - c. Dr. James Englehardt (Professor)
  - d. Dr. Helena Solo-Gabriele (Professor)

These changes are being made as part of the College's new strategic planning initiatives.

SACSCOC does not require notification or approval related to academic departments or where academic programs or faculty lines are housed.

Please contact me if you have any questions at [pattymurphy@miami.edu](mailto:pattymurphy@miami.edu).

cc: Faculty Senate  
Karen Beckett, University Registrar  
Guillermo Prado, Dean, Graduate School






**MEMORANDUM**

DATE: March 22, 2021

TO: Linda Neider  
Chair, Faculty Senate

FROM: Guillermo (Willy) Prado   
Dean, Graduate School

SUBJECT: Proposed Department of Chemical, Environmental, and Materials Engineering

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The College of Engineering submitted a proposal to create a new Department of Chemical, Environmental, and Materials Engineering. The proposal was discussed at the meeting of the Graduate Council on Tuesday, March 16, 2021. No concerns were expressed by Council members.

CC: Helena Solo-Gabriele, Professor, Civil, Architectural, and Environmental Engineering, College of Engineering  
Pratim Biswas, Dean, College of Engineering  
Tiffany Plantan, Director of Education, Graduate School  
Patty Murphy, Associate Provost for University Accreditation, Office of Assessment and Accreditation



**MEMORANDUM**

**TO:** Pratim Biswas  
Dean, College of Engineering

**FROM:** Jeffrey L. Duerk *Jeffrey L. Duerk*  
Executive Vice President and Provost

**DATE:** March 22, 2021

**RE:** ADPC Vote - establishment of new Department of Chemical,  
Environmental, and Materials Engineering

The Academic Deans Policy Council (ADPC), at its March 3, 2021 meeting, reviewed the proposal for the establishment of a new department in the College of Engineering. The department would be the Department of Chemical, Environmental, and Materials Engineering. ADPC members had also been sent the written proposal in advance of the meeting for review. A vote on the approval of this department was obtained via confidential electronic vote to the Office of the Provost and resulted in unanimous approval by the ADPC.

While this vote is not required as part of the approval process for establishment of this department, it was important to the deans to demonstrate their shared enthusiasm and commitment signaling the significance of STEM education to the Academy as a whole. As such, this memorandum is provided to you as further evidence, not only of the support for creation of this department, but of the need to do so.

## **ADDITIONAL DOCUMENTS**

- 1) CEM Mission Statement
- 2) Market Analysis and Demand
- 3) Library Collections
- 4) Budget (*Submitted Separately*)
- 5) Appendix 1, Vision of CAE Department given the transfer of the environmental engineering program to CEM
- 6) Appendix 2, Draft Strategic Plan for College of Engineering
- 7) Appendix 3, Library Holdings and Expenditures Report

## MISSION

The mission of the Department of Chemical, Environmental, and Materials Engineering is to:

- Provide high-quality undergraduate and graduate education in chemical, environmental, and materials engineering that will prepare graduates for professional careers and a lifetime of learning.
- Conduct high-quality research that will advance the current body of knowledge and engage in new discoveries to improve the quality of human life; and
- Serve the engineering profession and society through active involvement in professional organizations and contribution of professional expertise.

The departmental mission will be accomplished by providing an integrated and multidisciplinary scientific education. Graduates from this department will be involved in the transfer of scientific discoveries to modern technologies and novel products that benefit society and minimize the impact on the environment. They will be trained to address multi-scale aspects of generating clean energy, producing novel and superior materials, and utilizing the biological revolution to manufacture new products. They will be involved in the development and manufacture of consumer products, as well as in design, operation, and control of processes in a variety of industries (e.g. petroleum, petrochemical, chemical, consumer products, semiconductor, environmental technologies, advanced materials, food, feed and pharmaceuticals).

## MARKET ANALYSIS AND DEMAND

The department will graduate engineers who will cover the disciplinary areas of chemical engineering, environmental engineering and materials science and engineering. These are conventional disciplines and there are a variety of sectors that employ such graduates. The new department in CoE at the University of Miami will have the added advantage of providing a holistic and multifaceted education in these sectors, making our graduates more desirable to industry and other sources. The vision for the Department is a focus on first principles in the development of new chemical, environmental and materials engineering approaches. For example, many traditional chemical engineering programs focus on petroleum. The program at the University of Miami will not focus on this traditional area in terms of petroleum exploitation but rather identifying potential alternatives (based upon new chemical, environmental and materials approaches) to petroleum-based energy sources. We see ourselves as filling a unique niche in developing new approaches to meet today's societal needs by synergizing and converging expertise with the three disciplines.

We reiterate that the highly interdisciplinary degree programs that will be established will further enhance the demand for graduates from this new department. It is anticipated that most employment growth in the sector will take place in alternative energies research and the developing fields of nanotechnology and biotechnology. These will be focus areas for the new CEM department. There is also expected to be an imbalance in the number of retiring chemical engineers and the number of new graduates, thus continued demand for experienced individuals will continue providing continued demand for our graduates after they gain experience in the field.

We provide a summary of the recent demand and job prospects for these disciplines. As per the US Bureau of Labor Statistics (<https://www.bls.gov/ooh/architecture-and-engineering/chemical-engineers.htm>), employment of chemical engineers is projected to grow 4 percent from 2019 to 2029, about as fast as the average for all occupations. Demand for chemical engineers' services depends largely on demand for the products of various manufacturing industries. Employment of environmental engineers (<https://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>) is projected to grow 3 percent from 2019 to 2029, about as fast as the average for all occupations. State and local governments' concerns regarding water availability and quality should lead to efforts to increase the efficiency of water use. Finally, for materials scientists and engineers (<https://www.bls.gov/ooh/life-physical-and-social-science/chemists-and-materials-scientists.htm>), employment is projected to grow 5 percent from 2019 to 2029, faster than the average for all occupations. Engineers and materials scientists who have an advanced degree, particularly a Ph.D., are expected to have the best opportunities.

## **LIBRARY COLLECTIONS**

The University of Miami Libraries prepared a Library Holdings and Expenditures Report for the proposed program. The full report is attached as Appendix 3. The College of Engineering endorses the highly recommended list of acquisitions (p. 29 of the library budget document) at a cost of \$22,446:

- Inorganic Crystal Structure Database (ICSC): \$3,775
- Journals: \$18,671
  - Journal of Nanoscience and Nanotechnology
  - Journal of Toxicology and Environmental Health - Part A - Current Issues
  - Nanotoxicology
  - Urban Water Journal

**Appendix 1** - Vision of CAE Department given the transfer of the environmental engineering program to CEM

# Department of Civil and Architectural Engineering (CAE) Vision Draft of 02-17-21

## GUIDING PRINCIPLES

### OVERARCHING STATEMENTS AND GOALS

COE is developing a new strategic plan for the next five years which comprises the following initiatives:

- 1) Obtain critical mass of T/TT faculty (add/create a new department to cover missing areas in comparison to our peer institutions)
- 2) Develop a departmental structure with clusters to promote excellence in college-wide research thrusts; the thrusts should build on the strengths of the current faculty and connect to broader University initiatives
- 3) Promote the initial research thrusts by identifying faculty champions, creating shared facilities and garnering seed funds. A clear outcome is to increase the cohort of PhD students working in these areas to help promote excellence
- 4) Create a Center of Excellence for Teaching & Learning in Engineering Education
- 5) Launch an International Academy to enhance partnerships with leading Universities across the globe in strategic research areas
- 6) Address and improve organizational & operational aspects in the College

COE will pursue a focused set of six research thrusts to address challenge areas of relevance to the region, nation and globe.

- Advanced Materials
- Data Sciences and Engineering:
- Energy and Environment
- Health Care Engineering
- Sustainability and Resilience
- Space Science & Engineering

The thrusts will be supported by a group of faculty from different departments belonging to departmental clusters. In addition, there will be connectivity to other University Schools and Colleges, and support the Roadmap to the next century. These thrusts will connect to and establish connections to other schools at the University, and other organizations including industry and federal agencies.

The Departments will be organized into clusters with distinct groups of tenured/tenure track and educator faculty advancing a research and educational agenda. **Table 1** lists current and new departments and their respective clusters. The various departmental clusters will synergistically work across departments to support various COE Research Thrusts.



In the section of this document devoted to Research, a brief discussion of Thrust and Clusters pertinent to CAE is provided.

Additionally, three strategic initiatives are envisioned:

- A Center of Excellence for Teaching & Learning in Engineering to have an organized platform to advance educational initiatives in COE.
- An International Academy that creates a network with which COE will germinate new ideas and mentor future leaders. This will be done via a partnership model involving groundbreaking research and educational projects, innovation and entrepreneurship; to prepare a cohort of PhD students to be effective leaders in a global community.
- A Committee on Innovation and Entrepreneurship to cultivate a culture or entrepreneurship with other stakeholders at the University.

**Table 1: COE department clusters**

DEPT. CLUSTERS	BME	CAE	ECE	ISE	MAE	CEM
	Neural Engineering	Structures	Cyber-Phys. Systems	Data Analytics	Additive Mfg.	Synthetic Biology
	Regenerative Medicine	Materials	Artificial Intelligence	Energy and Electricity	Aerodyn. & Propulsion	Aerosol Sci. & Technology
	Imaging	Bldg. Env. Systems	Nanotechnol.	Health Care Informatics	Astrodyn. & Control	Water Quality
					Green Energy	Materials Synthesis

**FOCUSED AREA OF EXCELLENCE**

Given the current faculty strengths and departmental clusters, it appears that the area of excellence where CAE can gain national and international visibility is in the topic of Construction Materials with the creation of the UM Center for Infrastructure Materials (UCIM). A one-pager is attached in Appendix B.

## **EDUCATION**

### **MIGRATION OF UNDERGRADATE DEGREE PROGRAM**

As the result of the creation of a new COE Department titled: Chemical, Environmental and Materials Engineering (CEM), the ungraduated degree program in Environmental Engineering currently offered in Department of Civil, Architectural and Environmental Engineering will migrate to the newly formed department.

### **NAME CHANGE**

Since the ungraduated degree program in Environmental Engineering will no longer be offered in the Department of Department of Civil and Architectural Engineering, the department name will be changed to:

- Department of Civil and Architectural Engineering
- The department acronym (CAE) will not change

### **REMAINING UNDERGRADUATE DEGREES**

The new CAE Department will continue offering two ABET-accredited undergraduate degree programs in:

- Civil Engineering
- Architectural Engineering

While no drastic departure from the current programs of study is envisioned, the CAE faculty will revisit course requirements for both programs according to the following principles:

- Meet minimum requirements for ABET accreditation
- Replace to the extent possible required courses with electives to allow CAE students to tailor their own education and become more responsive to the needs of society
- Provide opportunities to CAE students to become more prepared in the disciplinary area of Sustainability and Resilience

### **GRADUATE DEGREES**

The new CAE Department will continue offering the following graduate degree programs:

- MSCE (Civil Engineering)
- MSAE (Architectural Engineering)
- PhD

While no drastic departure from the current programs of study is envisioned, the CAE faculty will revisit both enrolment and course requirements for all programs according to the following principles:

- Meet minimum UM Graduate School requirements
- Allow the maximum possible flexibility in terms of course choice to stimulate interdisciplinarity

## **GRADUATE CERTIFICATES**

The new CAE Department requests permission to develop new resilience focused cross-disciplinary Certificate Programs in collaboration with other COE Departments and UM units as part of the current MS with concentration in Construction Management (offered as an interdisciplinary degree in COE and managed by CAE).

# RESEARCH

## **COE THRUST IN SUSTAINABILITY AND RESILIENCE**

Over 60% of the world population lives in urban areas and consumes most natural resources to maintain and operate its built environment and urban infrastructure. The quality of life is challenged by natural disasters, which have intensified in the last few decades due to climate change. Urban regions and coastal communities' survival requires a holistic approach to sustainability, resilience, and adaptation. It is time to reimagine the fundamental concepts of sustainability and resilience. Given our unique geographic location and susceptibility to natural and climate related impacts, the College of Engineering is well positioned to lead in efforts to develop sustainable and resilient communities.

## **CAE CLUSTERS**

CAE will be reorganized into three clusters with distinct groups of tenured/tenure track faculty advancing a research and educational agenda. They are: Building Environment Systems, Materials and Structures. They all primarily converge into one of the COE Research Thrusts, namely: Sustainability and Resilience.

### **Building Environment Systems Cluster**

The U.S. Energy Information Administration reports that, in coming years, building sector energy consumption will grow faster than that of industry and transportation. Between 2012 and 2030, total building sector energy consumption will increase by 4.74 Quad. Industry will grow by 3.33 Quad and transportation is expected to decrease by 0.37 Quad. Effectively addressing the U.S. and world's energy needs in the near and long-term has important design implications for the building sector. CAE faculty maintains research activity in areas of building envelope optimization in context of energy consumption, environmental comfort, advanced control and water/wastewater system management.

### **Materials Cluster**

A fundamental understanding of the chemistry, materials science, and engineering of infrastructure materials is critical for a sustainable and resilient built environment. For concrete alone, global production is greater than 10 billion tons/year. Due to the volumes used, consumption of natural resources, the resulting carbon emissions, and construction and reconstruction costs associated with such materials are substantial. There is a strong potential for improving the design and performance of such materials, which can then result in a significant improvement in the built infrastructure, but also to the American public. CAE faculty have been working to understand and improve the sustainability and resilience of concrete and composites. Faculty have used both applied and fundamental experimental and modeling approaches, and research has spanned several length and time scales.

### **Structures Cluster**

According to UN estimations, approximately 55% of the world's population lives in cities and urban areas. This massive urbanization has been exerting significant pressure on natural resources, with the building environment currently accounting for approximately 40% of the annual global energy and contributing indirectly to the increasing concentration of atmospheric carbon. Moreover, many urban areas are in regions susceptible to natural disasters that have been occurring with an increasing frequency due to climate change. CAE Faculty have been addressing structure and infrastructure resilience in a holistic way. For example, faculty have been working on developing efficient and cost-effective shoreline protection systems with adaptive features that provide a hospitable environment for marine life. Faculty have also been working on community resilience aspects, such as building adaptation against flooding.

## **APPENDIX B: FOCUSED AREA OF EXCELLENCE**

### **UM Center for Infrastructure Materials (UCIM)**

A fundamental understanding of the chemistry, materials science, and engineering of infrastructure materials is essential for the built environment to be **Sustainable and Resilient**. The proposed Area of Excellence merges a cross-disciplinary group of faculty, scientists, and students capable of simultaneously addressing basic science and engineering challenges at multiple time and length scales in the areas of concrete, composites and other **Infrastructure Materials** that evolve around a circular economy. The aim of UCIM is to find solutions through synergistic integration of lab-based research with **data-driven and physical** modeling approaches. The unique hemispheric location of Miami will serve as a testbed to deploy research outcomes to make a substantial and long-lasting contribution to coastal infrastructure resilience. Due to the significant volumes of materials used, improvements in their sustainability and durability will also have long-term positive impacts on **Energy and Environment**. UCIM will be composed of faculty, students and staff from the Dept. of Civil and Architectural Engineering and other College of Engineering units, who will collaborate strategically with peers in the Rosenstiel School of Marine and Atmospheric Science, School of Architecture, and College of Arts and Sciences. Moreover, UCIM will work closely with several federal and state-level partners (FHWA, DOTs), local government, industry (including through the NSF I/U CRC Center for Integration of Composites in Infrastructure), and national and international researchers. **UCIM** will involve heavy use of shared instrumentation facilities and will help to trigger collaborative research among different UM schools revolving around materials, sustainability and resilience. Furthermore, the mission of UCIM seamlessly aligns with other major university initiatives such as the Resilience Academy. UCIM will place a strong focus on lasting education, including industry, through collaborative teaching, certificates, seminars, lunch-and-learn, and networking events.

#### **Initial areas to be covered:**

Infrastructure Resilience; Coastal Infrastructure; Concrete Materials Science; Composites for Infrastructure; Molecular Dynamics; Machine Learning; Built Environment; Repair

#### **University/College of Engineering Thrusts Supported:**

*Data Sciences and Engineering, Energy and Environment, Sustainability and Resilience; Resilience Academy; Frost Institute of Chemical and Molecular Science; Institute for Data Science and Computing*

#### **Faculty Participants:**

*UCIM Researchers: Antonio Nanni, Ali Ghahremaninezhad, Luis Ruiz Pestana, Francisco de Caso, Prannoy Suraneni, Landolf Rhode-Barbarigos, and Esber Andiroglu (CAE); James Coakley and Giacomo Po (MAE); Brian Haus, Diego Lirman, Andrew Baker, and Chris Langdon (RSMAS); Sonia Chao and Christopher Meyer (SoA), Marc Knecht (Chemistry); Kathleen Sealey (Biology).*

#### **Why can this be an area of eminence:**

There is a presence of Senior faculty (selected list) who are well known in the field: Antonio Nanni (composites for infrastructure, H index: 52), Andrew Baker (coral reefs, marine conservation, H index: 34) together with excellent Mid/Early career faculty: Ali Ghahremaninezhad (bio-inspired materials, CAREER Award winner, H index 14), Prannoy Suraneni (RILEM Gustavo Colonnetti Medal winner, H index 14)

Strategic hiring of faculty in Engineering/RSMAS/A&S to plug in certain missing expertise (including in life-cycle analysis) will establish UM as one the best in the world in this area and bring significant recognition to the University.

**Appendix 2 – Draft Strategic Plan for College of Engineering**





COLLEGE OF ENGINEERING (COE)

STRATEGIC INITIATIVES

*Enhancing lives through Education, Research, Innovation & Service*

**“ENGINEERING MIAMI FOR THE FUTURE”**

The College of Engineering (COE) is focused on educating the next generation of engineers to prepare societal leaders with strong scientific and technical skills combined with an ethical and moral outlook to impact academia, business, government and/or the non-profit sector. Through discovery of new knowledge and its application, we tackle global challenge problems, and create opportunities through innovation and entrepreneurship. We do this with a deep commitment to excellence, demonstrated meritocracy, transparency, inclusiveness, and diversity.

The fusion of knowledge creation and knowledge translation is crucial during this time of exponential growth in industry and technology, including the Internet of Things, artificial intelligence, robotic process automation, machine learning, developing advanced materials, health engineering, environmentally benign energy production and use, exploration and inhabitation of outer space, and more. By creating and strengthening programs in various disciplines and areas of strategic importance, we aspire to make a positive impact in South Florida, the nation, globe—and even in our endeavors and rendezvous with outer space. The COE has identified the following strategic initiatives to pursue in the next 5 years:

**I) Creating a new Department of Chemical, Environmental and Materials Engineering**

The College of Engineering (COE) is a 74-year-old college and has changed over the years adding new departments over time. It currently has 5 departments – Biomedical Engineering (BME), Civil, Architectural and Environmental Engineering (CAE), Electrical and Computer Engineering (ECE), Industrial Engineering (IEN), and Mechanical and Aerospace Engineering (MAE). A notable absence is a Chemical Engineering department that is present in most Engineering Schools. Chemical engineering is a discipline influencing numerous areas of science and technology. In broad terms, chemical engineers conceive and design processes to produce, transform, and transport materials — beginning with experimentation in the laboratory followed by the implementation of the technology in full-scale production. More importantly, to meet the aspirations and address challenging issues, it is a notable absence that precludes not only the College, but also the University holistically address and work on challenging issues. The University of Miami has a great opportunity to create this much needed department in the College of Engineering with a new outlook that will be impactful. The goal is to consolidate Environmental and Materials

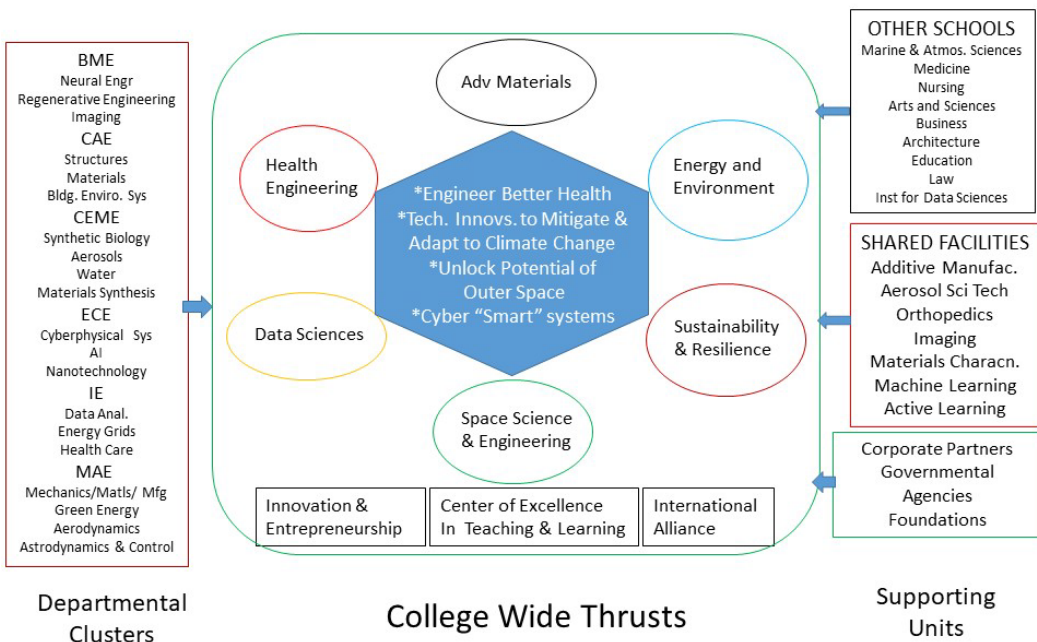
Science and Engineering aspects of the College into a new department – Chemical, Environmental and Materials Engineering (CEM).

The following is a summary of the reasons:

- 1) Areas of CEM research and education are needed to advance the Strategic Research Initiatives (see Appendix I) of COE and are absent amongst current departments.
- 2) The absence hampers visibility and recognition as a holistic College of Engineering, recruiting, rankings, and more.
- 3) The new department would be synergistic with Frost Institute of Chemical & Molecular Sciences
- 4) Provides an opportunity to consolidate synergistic areas of Environmental Engineering and provide a base for Materials efforts. Environmental engineering currently relies on multiscale studies ranging from molecular to the continuum scale, a disciplinary aspect covered well in chemical engineering. A similar approach is relevant for advanced materials synthesis – a current gap in COE.
- 5) The potential to enhance our visibility by drawing attention to COE and U of Miami in areas such as Aerosol Science and Technology (jointly with RSMAS) and in Water Quality.
- 6) Hiring in two additional cluster areas of synthetic biology and materials synthesis would synergize and promote holistic groups in several of the strategic thrusts adopted by CoE and the University.

In addition, we are proposing a structure for the COE that establishes “clusters” within the Department, and these clusters working synergistically to advance “college-wide thrusts”. *An overall layout of strategic initiatives for the College of Engineering is provided in the figure below; with the Table identifying the various “clusters” in each Department.*

### University of Miami College of Engineering Strategic Initiatives



### College of Engineering Research Thrusts

	Health Engineering (HE)	Advanced Materials (AM)	Energy and Environment (EE)	Data Sciences Engineering (DSE)	Sustain. & Resilience (SR)	Space Sciences & Engineering (SSE)
<b>BME</b>						
Neural Engineering	•	•		•		
Regenerative Medicine	•	•				
Imaging	•			•		
<b>CAE</b>						
Structures					•	
Materials		•	•		•	
Building Env Systems			•	•	•	
<b>CEME</b>						
Aerosols	•	•	•		•	•
Water			•	•	•	
Synthetic Biology	•		•			
Materials Synthesis		•		•		•
<b>ECE</b>						
Artificial Intelligence	•			•	•	
Cyberphysical Systems				•	•	
Nanotechnology	•	•		•		
<b>IEN</b>						
Data Analytics				•	•	
Energy & Electricity			•	•	•	
Healthcare Informatics	•					
<b>MAE</b>						
Mechanics, Materials & Manufacturing	•	•	•		•	•
Aerodynamics & Propulsion	•		•	•	•	•
Aerodynamics & Control	•					•
Green Energy		•	•		•	•

## II) COE Research Thrusts

The College of Engineering will pursue a focused set of research thrusts to address challenge areas of relevance to the region, nation and globe. The thrusts will be supported by a group of faculty from different departments belonging to departmental clusters. In addition, there will be connectivity to other University Schools and Colleges, and support the Roadmap to the next century.

While several challenging problems will be addressed, an initial set of key questions that will be addressed collectively include:

- Engineering better health
- Technological innovations to mitigate and adapt to challenges due to climate change
- Unlock the potential of outer space
- Design and implement various cyber-physical “smart” systems

The following are the six RESEARCH THRUSTS that will be advanced by the College of Engineering:

- 1) Advanced Materials:** Materials are an enabler for many societal advances. The emphasis of this group would be multi-scalar: from the synthesis of nanomaterials to building of devices and large-scale structures. Concepts of knowledge based synthesis, design and additive manufacturing will be developed and utilized.
- 2) Data Sciences and Engineering:** The field of data sciences and engineering encompasses areas ranging from data generation, collection, measurement and analytics. Areas include artificial intelligence, machine learning, informatics and others. The group focuses on practical applications of data collection and analysis in areas ranging from medicine, materials, climate change, and environment.
- 3) Energy and Environment:** Energy is an important global challenge and concerns about human's environmental footprint, such as that due to carbon dioxide, and concerns about security and rapid global development, have recently brought this field to the forefront. Environmental issues related to aerosols, air quality and water quality will be under the purview of this thrust.
- 4) Health Engineering:** Healthcare is of continually growing importance as one of the world's largest and fastest-growing sectors of the economy. All disciplines of engineering will help in the advancement through creating, developing, and implementing cutting-edge devices, systems, and procedures to support medical advances. Technology will play a significant role in addressing challenges related to the aging population, management of common diseases and pandemics, and other innovations in medicine.
- 5) Space Sciences and Engineering:** As human kind begins to explore and inhabit outer space; there will be a need for the most advanced technologies to ensure that life is sustainable. There is also an opportunity to gain knowledge from the space based infrastructure to be set up to improve our condition on earth. The areas of emphasis include: propulsion, aerodynamics and astrodynamics, advanced environmental technologies for space applications; advanced satellite imaging, and materials and resource production in space.
- 6) Sustainability and Resilience:** As a large fraction of the population globally lives in urban areas, a large amount of resources are utilized for developing the infrastructure, in its operation and sustenance. Furthermore, there are natural disasters that have often to be overcome. The College of Engineering is therefore leading in an effort to research sustainable and resilient urban systems.

These thrusts will establish connections to other schools at the University, and other organizations including industry and federal agencies. Collaborating Schools and College at the University include Miller School of Medicine, Rosenstiel School of Marine and Atmospheric Sciences, College of Arts and Sciences, Miami Herbert Business School, School of Architecture, and School of Communication and others.

In addition to the research programs, plans are in progress to establish state of the art shared facilities. The following are examples of some of the shared facilities:

**Additive Manufacturing Facility:** this includes state of the art 3-D printing and manufacturing facilities established with support of Johnson and Johnson; we plan to create a maker space and be a manufacturing resource for the University and neighboring community

**Chemical and Materials Characterization Facility:** this facility would include instrumentation such as mass spectroscopy, chemical ion mass spectroscopy, surface area analysis, ICP\_MS, liquid chromatography, and other tools for chemical and materials characterization. Initial discussions are underway with instrument suppliers

**Aerosol Science and Technology Instrumentation:** A world renowned Center for Aerosol Science Technology (CAST) has been envisioned with participants from Engineering, Marine and Atmospheric Sciences and Medicine. This group will work on the enabling features of the discipline and addresses challenges in climate change, environment, advanced materials, medicine, public health (such as the recent pandemic), atmospheric sciences, air quality, smart agriculture and others.

**Orthopedics / Biomaterials and Neurosensory Shared Facility:** this will help create a cohesive research group to meet the needs of orthopedic and biomechanics research. It will help consolidate the neurosensory researchers efforts focused on auditory perception. Other collaborators include Sports Medicine, Arts and Sciences, and Medicine.

**Imaging Facility:** The Gables campus has distributed imaging facilities, and creation of this facility will enable integration of the various scanning electron and transmission electron microscopy facilities. In addition, resources will be used to obtain cryo-electron microscopy and other imaging instrumentation. Both materials and medical applications will be the focus of this facility.

**Machine Learning and Advanced Computing Facility:** This will be developed to support the efforts of the various computational researchers in engineering and other schools. The unit will be closely integrated with the Institute of Data Sciences.

### **III) Center of Excellence for Teaching & Learning in Engineering**

Engineering has a major role to play in society, and even in the University community. With technological innovations so impactful, it is important to have all students get some exposure to basics of engineering. Engineering education has realized the importance of exposure to social and other issues through required components in the humanities and social sciences. Similarly, it is important that the broader general education of all students have an understanding of the impact and contributions of engineering and technology. The overall goal is to create a Center of Excellence for Teaching & Learning in Engineering to have an organized platform to advance educational initiatives in the College. The following are some of the elements that will be addressed:

- 1) Active Learning in the College (build on programs started in 2016)  
Continue building on successes (classroom infrastructure and technology, enhance faculty training through Workshops, Annual Showcase)
- 2) Help promote retention of UGs, UG research experience, integrating across degree programs, become a regional and national hub; Outreach
- 3) Set up General Studies Program through new innovative 1<sup>st</sup> Year Classes  
Examples include Introduction to Innovation, Introduction to Engineering; Create a general studies class on how Engineering and Technology addresses Global Challenges (for majors and non-majors)
- 4) Launch and Scale Up Innovative Programs (e.g. Masters in Construction Management, others in conjunction with other Schools, etc)
- 5) Community Building/Culture of Belonging  
Internal resources to promote interactions (students-faculty-staff) – lounge;  
Internationalization of programs (see International Academy)  
Outreach programs for Alumni and local Engineering community

#### **IV) International Alliance in Engineering**

Consistent with the University's Roadmap to our New Century, and our distinct geographic location that positions us as a connector between institutions, individuals, and ideas across the Americas and throughout the world; engineering and technology has a major role to play in globalization of research and education.

We plan to create an International Alliance that creates a network with which the College of Engineering @ U Miami will germinate new ideas and mentor future leaders. This will be done via a partnership model involving groundbreaking research and educational projects, innovation and entrepreneurship; to prepare a cohort of PhD students to be effective leaders in a global community. Other programs include faculty and student exchanges, and study abroad programs.

Partnerships will include selected leading Universities across the globe and corporate entities and agencies with a global interest. Our entire effort will be collaborative in format with our partners.

*The initial task will be to set up a cohort group of PhD students in various departments in the College of Engineering coming from partner Universities; and funded via 5 year Fellowships.*

#### **V) Innovation and Entrepreneurship**

Our goal in the College is promote creativity, innovation, and entrepreneurship by working with the students and faculty, the brightest minds who are thought leaders and change agents in promoting solutions to the most challenging problems. We aim to meet local

and regional needs through innovation and entrepreneurship by bringing together multidisciplinary talent.

We will develop training programs to provide the basics and strategies to create roadmap of ideas to build successful ventures. We will partner with local industry, start-up company and venture capital leaders to assist in the creation of successful enterprises.

Like the most successful engineering schools, we will work closely with partners in business, industry, and across the profession to translate research discoveries into real-world technological innovation. The CoE will seek to strengthen and expand our collaborations across the University and South Florida region to facilitate industry and startup company support for student capstone projects, and support the Florida Intercollegiate Competition on Technological Innovation, hosted by the CoE at eMerge Americas.

We will also seek private support so that CoE administrators, faculty, and students have the opportunities to attend conferences and events such as SYNAPSE, eMerge Americas, the Institute of Industrial and Systems Engineers Annual Conference and Expo, Cuba Infrastructure Scholarship Competition, Society of Hispanic Professional Engineers, and other academic conferences, pitch competitions, and others.

## **VI) Efficient Organizational and Operational Enterprise**

There are several efficiencies that have to be realized in the operations of the College of Engineering. This will be done by establishing a robust organizational structure that will assist the faculty, staff and students realize their goals. The following are the various areas that will be evaluated and improved:

- Establishing an efficient staff structure to better assist faculty and students
- Infrastructure improvements to support education and research needs,
- Governance issues, faculty task assignments, policies
- Review of space usage and allocation based on need,
- Shared Instrumentation Facilities
- Communication
  - Improved and functional website
  - Publicity of activities through targeted newsletters to enhance visibility,
- Efficient and impactful operations (graduate admissions, others)
- Hiring of faculty and mentoring for growth and success,
- Clearly identified metrics for faculty performance and resource allocation (increase PhD Student counts, Research Funding levels, Scholarly output and impact)
- Outreach to alumni and other stakeholders
- Modification of plans based on continual feedback

## Summary

As the College of Engineering approaches its 75<sup>th</sup> year, and the University its centennial, the execution of the strategic initiatives will give us the foundation to help lead the world in solving pressing problems at the convergence of the physical, chemical, biological and digital worlds: in health engineering, information security, sustainability and resilience, advanced materials and fabrication, energy and environment, outer space exploration and habitation

As a small, private, nonprofit, engineering college, we have more flexibility than state colleges or larger engineering programs. We can move quickly to form industry partnerships, create new courses and establish new programs. And, our existing interdisciplinary partnerships with other University of Miami schools, colleges and units ideally position us to address problems with societal impacts.

The pace of learning, discovery, innovation, and change are accelerating at unprecedented rates. It is clear that the CoE must act quickly and act now to rise to the challenges and take advantage of the opportunities that this presents. Through the confluence of industry partnership, specialized research, and a thriving South Florida entrepreneurial ecosystem, the CoE is well positioned to drive innovation in South Florida and in the hemisphere, collaborate with industry to solve real-world problems in South Florida and around the world, and to educate the next generation of engineers to solve existing and as-yet-unimagined problems.

Details of the Research Thrusts and Faculty involved in each effort are available on the website – [coe.miami.edu](http://coe.miami.edu)




**Appendix 3 – Library Holdings and Expenditure Report**

## LIBRARY HOLDINGS AND EXPENDITURES REPORT

prepared by:

Steven Alexander, Manager of Continuing Resources  
Kineret Ben-Knaan, Research & Assessment Librarian  
Elizabeth Fish, Associate Dean for Collection Strategies  
Micaela Huber-Thacker, Manager of Monographic Resources  
Dan Roose, Head of Acquisitions  
James Sobczak, STEM Librarian

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## [UM Libraries & Collection Overview](#)

The University of Miami Libraries rank among the top 50 research libraries in North America, providing facilities, services, and information resources to support the University's mission and community.

The University of Miami Libraries include the Otto G. Richter Library and libraries in the architecture, business, law, medical, music, and marine schools, providing access to more than 4 million volumes, 136,917 current serials titles, 135,902 electronic journals, 1,279,872 electronic books, over 4 million microforms, and 205,287 audio, film, video, and cartographic materials. The libraries' digital collections feature 1,418,622 images and document pages. The institutional scholarly repository, known as Scholarship@Miami, is managed by the libraries and hosts 16,805 theses, dissertations, article preprints, and datasets.

### *Library Leadership*

Guidance and leadership of the UM Libraries is provided by Charles Eckman, Dean of Libraries. Associate deans include: Glen Wiley (Access and Discovery Services), Elizabeth Fish (Collection Strategies), Elizabeth Gushee (Digital Strategies), Kelly Miller (Learning & Research Services), and Cheryl Gowing (Library Information Systems and Facilities).

### *Library Liaison Support*

The College of Engineering is directly supported by a subject specialist librarian, known as the STEM librarian, who provides face-to-face, phone, e-mail, chat, and telecommunication reference support. This liaison librarian also provides course-specific and general workshops on engineering information resources, library services, citation management, and publication metrics. Other duties include tracking down and purchasing difficult-to-obtain resources, facilitating digital access, and advocating for engineering interests within the library. The current STEM librarian is James Sobczak.

## [Chemical, Environmental, & Materials Engineering Collection by LC Classification](#)

The libraries' collections include about 135,000 monograph titles related to the area of Chemical, Environmental, and Materials Engineering (CEME) research, with more than 54,800 book titles available electronically. For the purposes of this report, CEME include subjects covered by the Library of Congress (LC) classifications listed Table 1. Note that this estimated count does not include collections on CEME topics outside of the listed LC call number ranges.

In addition, the libraries subscribe and provide online access to about 12,000 of CEME related journal titles accessible and discoverable through a variety of full-text journal collections and databases. Approximately 3,900 additional related journal titles are available in print.

In FY 2020, the expenditures for books in *CEME* subject areas were \$56,876 (585 titles). In FY 2020, the libraries' collections expenditures for *CEME* research also included \$837,060 for related databases and \$862,487 for individual journal subscriptions (603 titles). For more information about the available *CEME* databases and resources, please see Table 4, 7, and 8.

*Table 1: Selected LC Classification*

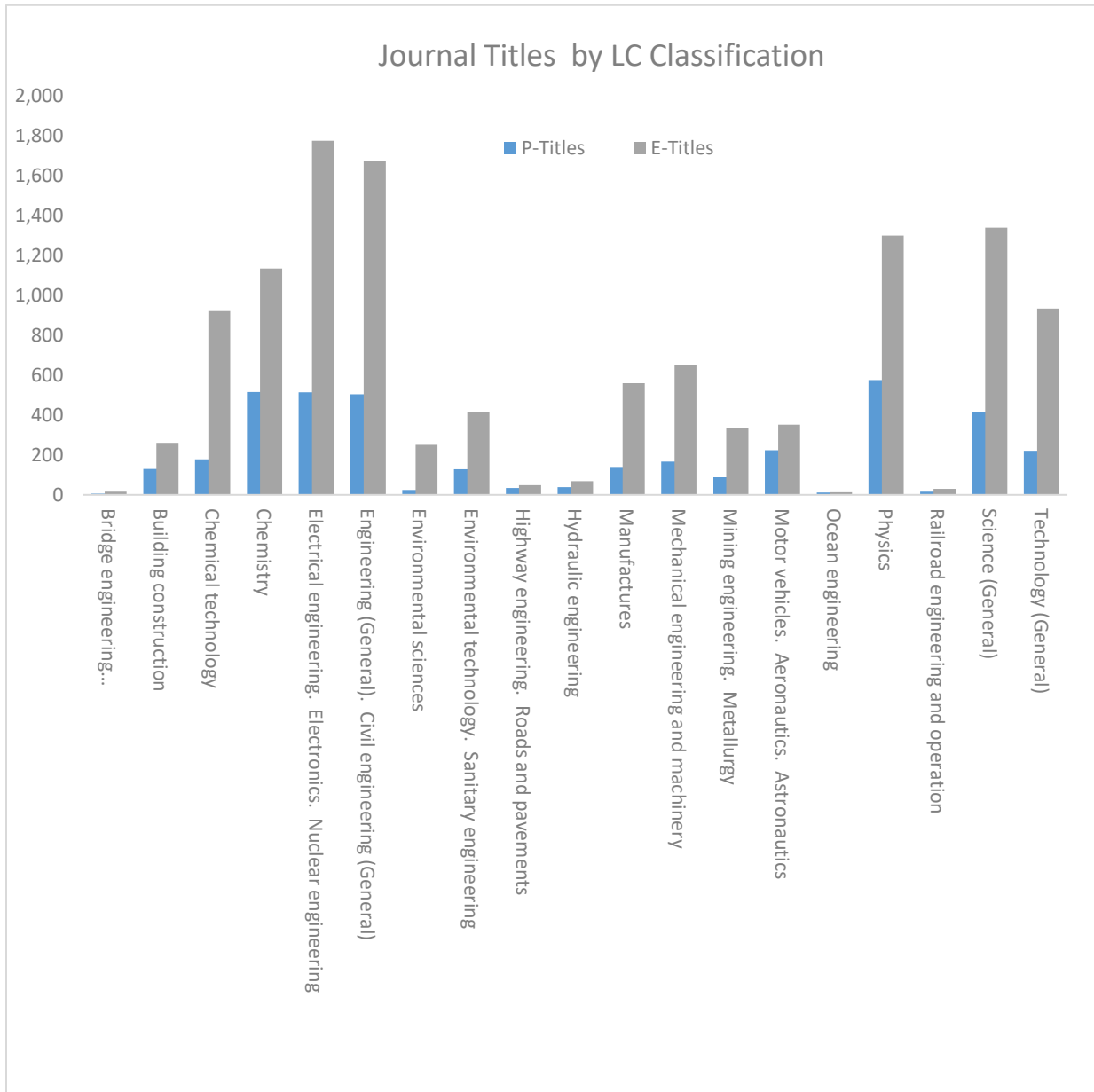
LC Classification	LC Subject Areas
GE 1-350	Environmental sciences
Q 1-390	Science (General)
QC1-999	Physics
QD 1-999	Chemistry
T 1-995	Technology (General)
TA 1-2040	Engineering (General). Civil engineering (General)
TC 1501-1800	Ocean engineering
TC 1-978	Hydraulic engineering
TD 1-1066	Environmental technology. Sanitary engineering
TE 1-450	Highway engineering. Roads and pavements
TF 1-1620	Railroad engineering and operation
TG 1-470	Bridge engineering
TH 1-9745	Building construction
TJ 1-1570	Mechanical engineering and machinery
TK 1-9971	Electrical engineering. Electronics. Nuclear engineering
TL 1-4050	Motor vehicles. Aeronautics. Astronautics
TN 1-997	Mining engineering. Metallurgy
TP 1-1185	Chemical technology
TS 1- 1935	Manufactures

CEME Collections

Journals & E-Journals

- Titles with Physical Items (P-Titles): **3,926**
- Titles with Electronic Portfolios (E-Titles): **12,075**
- **Total Journal Titles: 16,001**

Figure 1: Journal Title Count by the selected LC Classification



*Table 2: Journal Title Count by the Selected LC Classification*

LC Classification	LC Subject Areas	Journals	E-Journals	Total
<b>GE 1-350</b>	Environmental sciences	25	251	276
<b>Q 1-390</b>	Science (General)	417	1,339	1,756
<b>QC1-999</b>	Physics	575	1,300	1,875
<b>QD 1-999</b>	Chemistry	516	1,134	1,650
<b>T 1-995</b>	Technology (General)	221	933	1,154
<b>TA 1-2040</b>	Engineering (General). Civil engineering (General)	504	1,672	2,176
<b>TC 1501-1800</b>	Ocean engineering	12	13	25
<b>TC 1-978</b>	Hydraulic engineering	38	69	107
<b>TD 1-1066</b>	Environmental technology. Sanitary engineering	128	414	542
<b>TE 1-450</b>	Highway engineering. Roads and pavements	35	49	84
<b>TF 1-1620</b>	Railroad engineering and operation	16	30	46
<b>TG 1-470</b>	Bridge engineering	6	16	22
<b>TH 1-9745</b>	Building construction	130	261	391
<b>TJ 1-1570</b>	Mechanical engineering and machinery	166	650	816
<b>TK 1-9971</b>	Electrical engineering. Electronics. Nuclear engineering	514	1,775	2,289
<b>TL 1-4050</b>	Motor vehicles. Aeronautics. Astronautics	223	352	575
<b>TN 1-997</b>	Mining engineering. Metallurgy	87	336	423
<b>TP 1-1185</b>	Chemical technology	178	921	1,099
<b>TS 1- 1935</b>	Manufactures	135	560	695
<b>Grand Total</b>		<b>3,926</b>	<b>12,075</b>	<b>16,001</b>

Books / Monographs:

- Titles with Physical Items (P-Titles): **80,155**  
Titles with Electronic Portfolios (E-Titles): **54,831\***
- **Total Book Titles: 134,986**

**\*7,750** (12%) out of the total **54,831** electronic book titles are Demand-Driven Acquisition [DDA] titles. Those titles are available to patrons through the library discovery system.

Figure 2 : Book Title Count by the Selected LC Classification

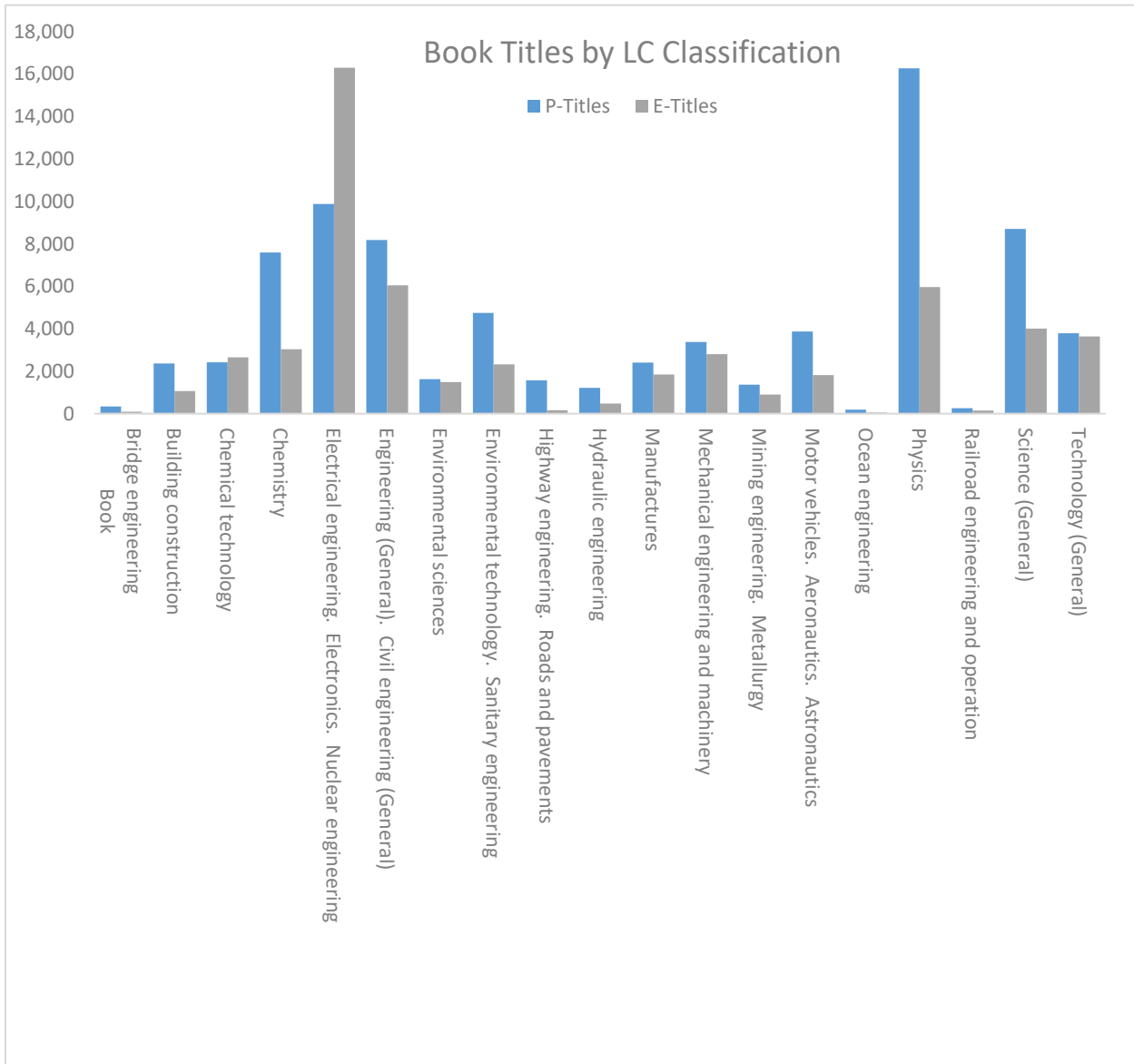


Table 3: Book Title Count by the Selected LC Classification

LC Classification	LC Subject Area	Book	E-Book	Total
<b>GE 1-350</b>	Environmental sciences	1,626	1,489	3,115
<b>Q 1-390</b>	Science (General)	8,697	4,005	12,702
<b>QC1-999</b>	Physics	16,267	5,971	22,238
<b>QD 1-999</b>	Chemistry	7,593	3,030	10,623
<b>T 1-995</b>	Technology (General)	3,790	3,639	7,429
<b>TA 1-2040</b>	Engineering (General). Civil engineering (General)	8,177	6,049	14,226
<b>TC 1501-1800</b>	Ocean engineering	191	58	249
<b>TC 1-978</b>	Hydraulic engineering	1,219	477	1,696
<b>TD 1-1066</b>	Environmental technology. Sanitary engineering	4,742	2,321	7,063
<b>TE 1-450</b>	Highway engineering. Roads and pavements	1,571	166	1,737
<b>TF 1-1620</b>	Railroad engineering and operation	250	141	391
<b>TG 1-470</b>	Bridge engineering	344	95	439
<b>TH 1-9745</b>	Building construction	2,370	1,067	3,437
<b>TJ 1-1570</b>	Mechanical engineering and machinery	3,372	2,806	6,178
<b>TK 1-9971</b>	Electrical engineering. Electronics. Nuclear engineering	9,874	16,297	26,171
<b>TL 1-4050</b>	Motor vehicles. Aeronautics. Astronautics	3,866	1,816	5,682
<b>TN 1-997</b>	Mining engineering. Metallurgy	1,372	906	2,278
<b>TP 1-1185</b>	Chemical technology	2,426	2,657	5,083
<b>TS 1- 1935</b>	Manufactures	2,408	1,841	4,249
<b>Grand Total</b>		<b>80,155</b>	<b>54,831</b>	<b>134,986</b>



Table 4: Top 20 Access Interface and their e-title holdings by the Selected LC Classification

E-Interface Name	E-Book	Digital Files	E-Journal	Visuals	Total
<b>Ebook Central</b>	22,443	1			22,444
<b>DDA Discovery</b>	7,749	1			7,750
<b>IEEE Xplore</b>	6,782		947		7,729
<b>O'Reilly Media, Inc</b>	7,435			96	7,531
<b>Individual E-book purchases (various Interfaces)</b>	4,329	5	22		4,356
<b>Knovel</b>	2,721				2,721
<b>ProQuest</b>	17		1,754		1,771
<b>Galegroup</b>	33		1,474		1,507
<b>DOAJ Directory of Open Access Journals</b>			1,481		1,481
<b>Free E- Journals</b>			1,300		1,300
<b>EBSCOhost</b>	119		892		1,011
<b>Springer Link</b>	31		716		747
<b>National Academies Press</b>	721				721
<b>Oxford Scholarship Online</b>	640				640
<b>Elsevier ScienceDirect</b>			550		550
<b>Wiley Online Library</b>	4		526		530
<b>Elsevier SD Backfiles</b>			501		501
<b>DOAB Directory of Open Access Books</b>	452				452
<b>Morgan &amp; Claypool Synthesis Digital Library</b>	408				408
<b>ProQuest New Platform</b>	371				371
<b>Grand Total</b>	<b>54,255</b>	<b>7</b>	<b>10,163</b>	<b>96</b>	<b>64,521</b>

Table 5: Physical Title Count by Library Name and LC Classification

Library Name	Book	Digital File	Journal	Map	Mixed material	Music	Visuals	Grand Total
Richter Library	66,920	4	3,215	5	1	8	181	70,334
Marine Library	6,579	5	175	1			7	6,767
Off-Site Storage	4,120		339				18	4,477
Architecture Research Center	893		38					931
Special Collections	768		77				2	847
Law Library	604		23				11	638
Cuban Heritage Collection	255		56	1				312
Music Library	12		2					14
University Archives	4		1					5
<b>Grand Total</b>	<b>80,155</b>	<b>9</b>	<b>3,926</b>	<b>7</b>	<b>1</b>	<b>8</b>	<b>219</b>	<b>84,325</b>

## CEME Expenditures

### Monographs

- The total amount spent on monographs for CEME in FY20 was **\$56,875.64**.
- 585 titles were purchased: 390 print titles, 193 e-books, 1 DVD. 297 titles were firm ordered, and 288 were received on approval.

*Table 6: Monographs Expenditures*

LC Classification	LC Subject Area	Transaction [\$]	# of Orders
<b>GE 1-350</b>	Environmental sciences	\$3,058	34
<b>Q 1-390</b>	Science (General)	\$3,372	36
<b>QC1-999</b>	Physics	\$5,706	72
<b>QD 1-999</b>	Chemistry	\$5,516	35
<b>T 1-995</b>	Technology (General)	\$2,414	44
<b>TA 1-2040</b>	Engineering (General). Civil engineering (General)	\$6,906	67
<b>TC 1-978</b>	Hydraulic engineering	\$2,442	9
<b>TD 1-1066</b>	Environmental technology. Sanitary engineering	\$6,619	71
<b>TG 1-470</b>	Bridge engineering	\$360	5
<b>TH 1-9745</b>	Building construction	\$2,568	26
<b>TJ 1-1570</b>	Mechanical engineering and machinery	\$5,203	53
<b>TK 1-9971</b>	Electrical engineering. Electronics. Nuclear engineering	\$10,355	98
<b>TL 1-4050</b>	Motor vehicles. Aeronautics. Astronautics	\$400	10
<b>TN 1-997</b>	Mining engineering. Metallurgy	\$431	5
<b>TP 1-1185</b>	Chemical technology	\$222	4
<b>TS 1- 1935</b>	Manufactures	\$1,304	16
<b>Grand Total</b>		<b>\$56,876</b>	<b>585</b>

### Continuing Resources:

The Libraries subscribe to more than ten thousand CEME-related journals. The exact number and total cost of these publications is far more difficult to determine than was possible in the past. This is due to the manner in which access is purchased. UM Libraries buy perpetual access to all the journals published by Springer, Wiley, Sage, and many more publishers. Moreover, the cost of databases and e-journal packages is shared with several libraries. The portion of each library varies based on the resource's content and its usage.

### Databases:

- In FY 2020 the total amount spent on databases that are focused on CEME and supporting sciences was **\$ 837,060**.

Table 7: Database Expenditures

Database	FY20 Price	Notes
AccessScience	\$6,114	
ACM Digital Library		Content Platform
Advanced Technologies & Aerospace (ProQuest)	\$5,492	
AES Electronic Library	\$1,800	
American Chemical Society Web Editions	\$118,276	
Annual Reviews	\$25,510	
ASCE Research Library		Content Platform
ASTM Compass	\$11,100	
BioMed Central		Content Platform
Chemical & Engineering News		Via ACS
Chemoreception Abstracts		Subset of ProQuest Biological Science Collection \$20,648
Compendex	\$33,568	
Conference Proceedings Citation Index- Science	\$18,706	
CRC Handbook of Chemistry and Physics	\$2,290	
Encyclopedia of Biological Chemistry		Owned
Engineering Village		Content Platform
Environmental Engineering Abstracts		Subset of ProQuest Agricultural and Environmental Science \$15,025
Essential Science Indicators		Subset of Clarivate Journal & Highly Cited Metrics Package \$35846
Gale In Context: Science		Subset of Gale Access Program \$38228
Gale OneFile: Science		Available via Florida Electronic Library
General Science Full Text (H.W. Wilson)		Subset of EBSCO Omnifile Full Text Mega \$21034
IEEE Xplore Digital Library	\$198,490	
IET Digital Library		Content Platform
INSPEC Archive 1898-1968	\$1,152	
International Nuclear Information System Database (INIS)		Content Platform

Knovel Library	\$26,450	
NTIS	\$10,746	
Plant Science		Subset of ProQuest Agricultural and Environmental Science \$15,025
Pollution Abstracts		Subset of ProQuest Agricultural and Environmental Science \$15,025
Risk Abstracts		Subset of ProQuest Agricultural and Environmental Science \$15,025
Royal Society of Chemistry Journals		Content Platform
Science Citation Index Expanded	\$190,839	
ScienceDirect		Content Platform
SciFinder	\$108,695	
Scitation		Content Platform
SCOPUS	\$72,743	
Springer Link		Content Platform
STEM Database (ProQuest)	\$889	
Synthesis		Owned
Toxicology Abstracts		Subset of ProQuest Agricultural and Environmental Science \$15,025
Toxline		Subset of ProQuest Agricultural and Environmental Science \$15,025
Treatise on Geochemistry		Owned
Web of Science Citation Indexes		Content Platform
WebCSD/CCDC	\$4,200	
<b>Grand Total</b>	<b>\$837,060</b>	

*Serial Expenditures:*

- The total amount spent on electronic individual/package subscriptions for CEME and supporting sciences in FY20 was **\$857,493** for 603 titles.

*Table 8: Serial Expenditures*

Title	Material Type	FY20 Price
Environment and society.	Journal	\$189
International journal of environment and pollution.	Journal	\$1,630
EcoAméricas.	Journal	\$240
Journal of the Audio Engineering Society.	Journal	\$580
Isis.	Journal	\$1,075
Osiris : A Research Journal Devoted to the History of Science & Its Cultural Influences		
Journal of laser applications.	Journal	\$1,139
The American journal of science.	Journal	\$255
Discover.	Periodical	\$34
New scientist.	Periodical	\$161
Philosophy of science	Journal	\$561
Journal of the Elisha Mitchell Scientific Society, for the year ...	Journal	\$110
Daedalus.	Journal	\$181
Proceedings of the American Philosophical Society held at Philadelphia for promoting useful knowledge.	Periodical	\$100
Proceedings of the National Academy of Sciences of the United States of America.	Journal	\$3,060
Early science and medicine.	Journal	\$462
Antarctic science	Journal	\$1,238
International journal of bifurcation and chaos in applied sciences and engineering.	Journal	\$6,399
HOPOS.	Journal	\$238
International studies in the philosophy of science.	Journal	\$1,772
Science in context	Journal	\$490
Zeitschrift für Naturforschung.	Journal	\$1,072
International journal of pattern recognition and artificial intelligence	Journal	\$2,999
Mathematical proceedings of the Cambridge Philosophical Society.	Journal	\$1,066
Philosophical transactions.	Journal	\$5,052
Proceedings of the Royal Society of Edinburgh.	Journal	\$1,083
Historical records of Australian science.	Journal	\$110
AIP conference proceedings	Journal	\$7,098
Canadian journal of physics = Revue canadienne de physique.	Journal	\$1,170
Journal of the Physical Society of Japan	Journal	\$810
The European physical journal.	Journal	\$2,662
Zeitschrift für Naturforschung.	Journal	\$1,272
Molecular physics	Journal	\$12,859

International journal of modern physics.	Journal	\$6,899
Modern physics letters.	Journal	\$4,950
Philosophical magazine.	Journal	\$11,404
Open systems & information dynamics.	Journal	\$692
Solid state physics.	None	\$248
International journal of geometric methods in modern physics.	Journal	\$1,585
Reviews in mathematical physics.	Journal	\$2,559
The Journal of the Acoustical Society of America.	Journal	\$3,268
Journal of non-equilibrium thermodynamics	Journal	\$1,890
Numerical heat transfer. Part A,	Journal	\$11,456
Heat transfer research.	Journal	\$3,832
Journal of modern optics	Journal	\$11,697
Waves in random and complex media.	Journal	\$1,194
Journal of plasma physics	Journal	\$2,926
Modern physics letters A.	Journal	\$5,799
International journal of modern physics.	Journal	\$8,699
Radiocarbon.	Journal	\$422
Geomagnetically induced currents from the sun to the power grid /	Series	\$200
Climate research.	Journal	\$916
Journal of applied meteorology and climatology.	Journal	\$835
Journal of atmospheric and oceanic technology.	Journal	\$700
Journal of climate.	Journal	\$1,270
Journal of the atmospheric sciences.	Journal	\$1,165
気象集誌. 第2輯 [[キシヨウシュウシ.ダイ2シュウ]]	Journal	\$117
Monthly weather review.	Journal	\$1,260
Weather and forecasting.	Journal	\$430
Australian journal of chemistry	Journal	\$2,211
Bulletin of the Chemical Society of Japan.	Journal	\$1,285
Canadian journal of chemistry = Revue canadienne de chimie.	Journal	\$1,910
Chemistry letters.	Journal	\$889
Pure and applied chemistry.	Journal	\$2,417
Zeitschrift für physikalische Chemie.	Journal	\$3,232
Fortschritte der Chemie organischer Naturstoffe. : Progress in the chemistry of organic natural products.	None	\$306
Synthesis	Journal	\$4,996
Organic preparations and procedures international	Journal	\$666
Synlett	Journal	\$3,382
Synthetic communications	Journal	\$6,126
Supramolecular chemistry	Journal	\$3,994
Advances in quantum chemistry.	None	\$221
Journal of coordination chemistry	Journal	\$15,335

Journal of electrochemical energy conversion and storage.	Journal	\$549
Analytical letters	Journal	\$8,354
International journal of technology management = Journal international de la gestion technologique.	Journal	\$2,200
Popular mechanics.	Periodical	\$31
Technical communication (Washington)	Journal	\$276
Harris Florida manufacturers directory.	None	\$314
Research technology management	Journal	\$387
IISE transactions.	Journal	\$1,558
INFOR : Information systems and operational research	Journal	\$440
MIS quarterly management information systems.	Journal	\$1,000
Information systems management	Journal	\$357
Information resources management journal.	Journal	\$800
Journal of global information management.	Journal	\$800
Applied mechanics reviews /	Journal	\$698
Civil engineering.	Periodical	\$330
Journal of applied mechanics	Journal	\$916
Journal of engineering materials and technology	Journal	\$549
Journal of heat transfer.	Journal	\$916
Journal of manufacturing science and engineering	Journal	\$916
Foundations and trends in computer graphics and vision.	Journal	\$561
Ergonomics.	Journal	\$6,284
International journal of performability engineering.	Journal	\$1,815
The Engineering economist.	Journal	\$257
International journal of applied mechanics.	Journal	\$1,394
Corrosion.	Journal	\$800
Eureka.	Periodical	\$240
Materials science and technology	Journal	\$3,672
Shale subsurface science and engineering /	Series	\$200
BuildingGreen.com.	Journal	\$1,010
Journal of materials research	Journal	\$2,146
The Journal of strain analysis for engineering design /	Journal	\$3,578
Survey review.	Journal	\$906
Surveying and land information science /	Journal	\$154
Magazine of concrete research.	Journal	\$1,600
Canadian geotechnical journal = Revue canadienne de géotechnique.	Journal	\$1,090
Journal of offshore mechanics and Arctic engineering	Journal	\$698
Environmental conservation.	Journal	\$1,025
Environmental chemistry.	Journal	\$467
Journal of the International Association for Shell and Spatial Structures.	Journal	\$149
Journal of building performance simulation	Journal	\$1,078

Fine homebuilding.	Periodical	\$43
ASHRAE handbook.	None	\$199
ASHRAE journal	Journal	\$301
ASHRAE transactions.	None	\$619
Journal of green building.	Journal	\$739
Journal of engineering for gas turbines and power.	Journal	\$916
Journal of mechanical design	Journal	\$916
Journal of tribology.	Journal	\$916
Journal of energy resources technology	Journal	\$916
MRS energy & sustainability : a review journal.	Journal	\$827
Robotica	Journal	\$2,444
Journal of dynamic systems, measurement, and control.	Journal	\$916
Journal of turbomachinery	Journal	\$916
Journal of solar energy engineering	Journal	\$698
Engineering & technology.	Journal	\$1,729
Wired.	Periodical	\$30
Broadcasting & cable.	Periodical	\$249
World radio TV handbook.	None	\$56
IBM journal of research and development	Journal	\$1,515
Journal of electronic packaging.	Journal	\$549
Sound & vision.	Periodical	\$25
Hi-fi news.	Periodical	\$104
AIAA journal	Journal	\$995
Aviation week & space technology.	Periodical	\$129
Journal of aircraft	Journal	\$1,410
SAE International journal of aerospace.	Periodical	\$654
The international journal of aerospace psychology.	Journal	\$1,064
Journal of guidance, control, and dynamics	Journal	\$1,430
Journal of propulsion and power	Journal	\$1,550
Ad astra.	Periodical	\$67
Journal of spacecraft and rockets	Journal	\$1,340
Journal of thermophysics and heat transfer	Journal	\$1,130
Ore deposits : origin, exploration, and exploitation /	Series	\$200
Exploration geophysics : the bulletin of the Australian Society of Exploration Geophysicists.	Journal	\$907
The leading edge	Journal	\$230
Ceramics monthly.	Periodical	\$48
Ceramic review.	Periodical	\$92
International journal of production research	Journal	\$14,111
International journal of manufacturing technology and management.	Journal	\$1,170
Journal of quality technology.	Journal	\$1,197



Quality engineering.	Journal	\$1,679
Quality progress.	Periodical	\$237
Quality.	Periodical	\$232
Journal of pressure vessel technology	Journal	\$698
Industry week.	Periodical	\$73
Journal of the Operational Research Society Pack (COMBINATION SUBSCRIPTION).	Journal	\$3,103
- Journal of Simulation		
- Journal of the Operational Research Society		
- Knowledge Management Research & Practice		
Association for the Advancement of Artificial Intelligence Membership [Payment].	Periodical	\$300
Communications in Statistics Pack - Online [PAYMENTS].	Journal	\$19,790
- Communications in Statistics : Simulation and computation		
- Communications in Statistics : Theory and Methods		
Consortium for mathematics and its applications membership [PAYMENTS].	Periodical	\$355
- Consortium		
- UMAP Journal		
Digital Library Core Package (PAYMENTS).	Journal	\$9,390
- ACM Computing Surveys		
- ACM Journal on Data and Information Quality		
- ACM Journal on Emerging Technologies in Computing Systems		
- ACM Transactions on Algorithms		
- ACM Transactions on Applied Perception		
- ACM Transactions on Architecture and Code Optimization		
- ACM Transactions on Asian and Low-Resource Language Information Processing		
- ACM Transactions on Autonomous and Adaptive Systems		
- ACM Transactions on Computation Theory		
- ACM Transactions on Computational Logic		
- ACM Transactions on Computer Systems		
- ACM Transactions on Computer-Human Interaction		
- ACM Transactions on Computing Education		
- ACM Transactions on Cyber-Physical Systems		
- ACM Transactions on Database Systems		
- ACM Transactions on Design Automation of Electronic Systems		
- ACM Transactions on Economics and Computation - TEAC		
- ACM Transactions on Embedded Computing Systems		
- ACM Transactions on Graphics		

- ACM Transactions on Information Systems		
- ACM Transactions on Intelligent Systems and Technology		
- ACM Transactions on Interactive Intelligent Systems - TIIS		
- ACM Transactions on Internet Technology		
- ACM Transactions on Knowledge Discovery from Data		
- ACM Transactions on Management Information Systems		
- ACM Transactions on Mathematical Software		
- ACM Transactions on Modeling & Computer Simulation		
- ACM Transactions on Multimedia Computing Communications and Applications		
- ACM Transactions on Parallel Computing		
- ACM Transactions on Privacy and Security - TOPS		
- ACM Transactions on Programming Languages and Systems		
- ACM Transactions on Reconfigurable Technology & Systems		
- ACM Transactions on Sensor Networks		
- ACM Transactions on Social Computing		
- ACM Transactions on Software Engineering & Methodology		
- ACM Transactions on Spatial Algorithms and Systems		
- ACM Transactions on Storage		
- ACM Transactions on the Web		
- Communications of the ACM		
- IEEE ACM Transactions on Computational Biology and Bioinformatics		
- IEEE-ACM Transactions on Audio Speech & Language Processing		
- IEEE-ACM Transactions on Networking		
- Interactions		
- Journal of Experimental Algorithmics		
- Journal of the ACM		
- Journal on Computing and Cultural Heritage		
- VLDB Journal		
Digital Library Master ACM SIG Package (PAYMENTS).	Journal	\$8,325
- Accessibility and Computing - SIGACCESS		
- ACM Conference Proceedings		
- ACM Inroads		
- ACM SIGPLAN Notices		
- ADA Letters - SIGADA		
- Applied Computing Review - SIGAPP		
- Communications in Computer Algebra - SIGSAM		
- Computer Architecture News - SIGARCH		
- Computer Communication Review - SIGCOMM		

- Computers & Society - SIGCAS		
- Digital Library Master Sig Package		
- Genetic and Evolutionary Computation - SIGEVO		
- GetMobile : Mobile Computing and Communications - SIGMOBILE		
- Information Technology Education - SIGITE		
- Operating Systems Review - SIGOPS		
- Performance Evaluation Review - SIGMETRICS		
- Proceedings ACM SIGUCCS User Services Conference		
- Proceedings of the ACM on Human-Computer Interaction		
- Proceedings of the ACM on Measurement and Analysis of Computing Systems		
- Proceedings of the Annual International Symposium on Microarchitecture - SIGMICRO		
- SIGACT News		
- SIGAI - Artificial Intelligence Proceedings		
- SIGBED Newsletters		
- SIGCHI Bulletin		
- SIGDOC Newsletter		
- SIGecom Exchanges - Electronic Commerce		
- SIGKDD Explorations		
- SIGMIS - Management Information Systems - Database for Advances in Information Systems		
- SIGMM - Multimedia		
- SIGMOD - Management of Data		
- SIGSAC - Security Audit & Control Proceedings		
- SIGSIM - Simulation and Modeling Proceedings		
- SIGSPATIAL - Spatial Information		
- SIGWEB - Hypertext Hypermedia & Web		
- Software Engineering Notes - SIGSOFT		
Discrete and continuous dynamical systems Series A - Online {Payments}.	Journal	\$5,115
- Discrete and Continuous Dynamical Systems - Series A		
- Discrete and Continuous Dynamical Systems - Series B		
- Discrete and Continuous Dynamical Systems - Series S		
EUCLID PRIME JOURNALS PACKAGE - ONLINE (COMBINATION SUBSCRIPTION).	Journal	\$4,523
- Abstract & Applied Analysis		
- Advanced Studies in Pure Mathematics		
- Advances in Operator Theory - Archive		
- Advances in Theoretical and Mathematical Physics - Archive		

- African Diaspora Journal of Mathematics		
- African Journal of Applied Statistics		
- Afrika Statistika		
- Annals of Functional Analysis - Archive		
- Asian Journal of Mathematics - Archive		
- Banach Journal of Mathematical Analysis - Archive		
- Bulletin of the Belgian Mathematical Society Simon Stevin - Incls Supplement		
- Communications in Information and Systems - Archive		
- Communications in Mathematical Analysis		
- Communications in Mathematical Sciences - Archive		
- Current Developments in Mathematics - Archive		
- Experimental Mathematics - Archive		
- Functiones et Approximatio Commentarii Mathematici		
- Hokkaido Mathematical Journal		
- Homology Homotopy and Applications - Archive		
- Illinois Journal of Mathematics		
- International Journal of Differential Equations		
- Internet Mathematics - Archive		
- Japan Journal of Industrial and Applied Mathematics - Archives		
- Journal of Applied Mathematics		
- Journal of Commutative Algebra		
- Journal of Generalized Lie Theory and Applications - Archive		
- Journal of Geometry & Symmetry in Physics		
- Journal of Integral Equations and Applications		
- Journal of Physical Mathematics		
- Journal of Symplectic Geometry - Archive		
- Kodai Mathematical Journal		
- Kyoto Journal of Mathematics		
- Methods and Applications of Analysis - Archive		
- Missouri Journal of Mathematical Sciences		
- MSJ Memoirs		
- Nihonkai Mathematical Journal		
- Notre Dame Journal of Formal Logic		
- Proceedings of Annual International Conferences on Geometry Integrability & Quantization		
- Publicacions Matemàtiques		
- Real Analysis Exchange		
- Review of Modern Logic - Archive		

-	Revista Matematica Iberoamericana - Archive		
-	Rocky Mountain Journal of Mathematics		
-	Tbilisi Mathematical Journal		
-	Tohoku Mathematical Journal		
-	Tokyo Journal of Mathematics		
-	Topological Methods in Nonlinear Analysis		
-	Tsukuba Journal of Mathematics		
	Graduate studies in mathematics.	Book	\$100
	IAS/Park City mathematics series.	Book	\$109
	Journal of Differential Geometry - inclS Surveys in Differential Geometry Supplement [PAYMENTS].	Journal	\$1,313
-	Journal of Differential Geometry - inclS Surveys in Differential Geometry Supplement		
-	Surveys in Differential Geometry		
	Society for Industrial & Applied Mathematics Academic Membership Option D {PAYMENTS}.	Journal	\$10,380
-	Multiscale Modeling & Simulation		
-	SIAM Journal on Applied Algebra and Geometry		
-	SIAM Journal on Applied Dynamical Systems		
-	SIAM Journal on Applied Mathematics		
-	SIAM Journal on Computing		
-	SIAM Journal on Control & Optimization		
-	SIAM Journal on Discrete Mathematics		
-	SIAM Journal on Financial Mathematics		
-	SIAM Journal on Imaging Sciences		
-	SIAM Journal on Mathematical Analysis		
-	SIAM Journal on Matrix Analysis and Applications		
-	SIAM Journal on Numerical Analysis		
-	SIAM Journal on Optimization		
-	SIAM Journal on Scientific Computing		
-	SIAM News		
-	SIAM Review		
-	SIAM-ASA Journal on Uncertainty Quantification		
-	Theory of Probability & its Applications		
	CBMS-NSF regional conference series in applied mathematics.	None	\$69
	Canadian Mathematical Society Package - ONLINE (COMBINATION SUBSCRIPTION) {PAYMENTS}	Journal	\$1,246
-	Canadian Journal of Mathematics		
-	Canadian Mathematical Bulletin		
	History of mathematics.	Periodical	\$125
	Progress in nonlinear differential equations and their applications.	Book	\$108
	AIP Select.	Journal	\$36,884

- Applied Physics Letters		
- Chaos		
- Journal of Applied Physics		
- Journal of Chemical Physics		
- Journal of Mathematical Physics		
- Physics of Fluids		
- Physics of Plasmas		
- Physics Today		
- Review of Scientific Instruments		
APS ALL - ONLINE (COMBINATION SUBSCRIPTION) [PAYMENTS].	Journal	\$28,640
- Physical Review A		
- Physical Review Accelerators and Beams		
- Physical Review Applied		
- Physical Review B		
- Physical Review C		
- Physical Review D		
- Physical Review E		
- Physical Review Fluids		
- Physical Review Letters		
- Physical Review Materials		
- Physical Review Physics Education Research		
- Physical Review Research		
- Physical Review X		
- Physics		
- PROLA		
- Reviews of Modern Physics		
IOPscience extra - Online {PAYMENTS}	Journal	\$157,785
- 2D Materials		
- Advances in Natural Sciences : Nanoscience and Nanotechnology		
- Applied Physics Express		
- Astronomical Journal		
- Astrophysical Journal - Option 3		
- Astrophysical Journal - Supplement Series		
- Astrophysical Journal Letters		
- Biofabrication		
- Bioinspiration & Biomimetics		
- Biomedical Materials - Bristol		
- Biomedical Physics & Engineering Express		
- Chinese Journal of Chemical Physics - Archive - IOP		

- Chinese Physics B		
- Chinese Physics C		
- Chinese Physics Letters		
- Classical and Quantum Gravity		
- Communications in Theoretical Physics		
- Computational Science & Discovery		
- Distributed Systems Engineering - Archive		
- Electronic Structure		
- Environmental Research Letters		
- EPL		
- European Journal of Physics		
- Flexible and Printed Electronics		
- Fluid Dynamics Research		
- Inverse Problems		
- IOP Conference Series - Materials Science and Engineering		
- IOP Conference Series : Earth & Environment Science		
- Izvestiya : Mathematics		
- Japanese Journal of Applied Physics - England		
- Journal of Breath Research		
- Journal of Cosmology and Astroparticle Physics		
- Journal of High Energy Physics - Archive - IOP		
- Journal of Instrumentation		
- Journal of Micromechanics & Microengineering		
- Journal of Neural Engineering		
- Journal of Optics - England		
- Journal of Physics : A Mathematical & Theoretical		
- Journal of Physics : B Atomic Molecular & Optical Physics		
- Journal of Physics : Condensed Matter		
- Journal of Physics : Conference Series		
- Journal of Physics : D Applied Physics		
- Journal of Physics : G Nuclear & Particle Physics		
- Journal of Physics Communications		
- Journal of Radiological Protection		
- Journal of Semiconductors		
- Journal of Statistical Mechanics : Theory and Experiment		
- Laser Physics		
- Laser Physics Letters		
- Materials Research Express		
- Measurement Science & Technology		

-	Methods and Applications in Fluorescence		
-	Metrologia		
-	Modelling and Simulation in Materials Science and Engineering		
-	Multifunctional Materials		
-	Nano Futures		
-	Nanotechnology		
-	New Journal of Physics		
-	Nonlinearity		
-	Nuclear Fusion = Fusion Nucleaire		
-	Physica Scripta		
-	Physica Scripta - Supplement		
-	Physical Biology		
-	Physics Education		
-	Physics in Medicine & Biology		
-	Physics World Archive		
-	Physics-USpekhi		
-	Physiological Measurement		
-	Plasma Physics & Controlled Fusion		
-	Plasma Research Express		
-	Plasma Science and Technology		
-	Plasma Sources Science & Technology		
-	Publications of the Astronomical Society of the Pacific		
-	Quantum Electronics		
-	Quantum Science and Technology		
-	Reports on Progress in Physics		
-	Research in Astronomy and Astrophysics		
-	Russian Chemical Reviews		
-	Russian Mathematical Surveys		
-	Sbornik : Mathematics		
-	Semiconductor Science and Technology		
-	Smart Materials & Structures		
-	Superconductor Science & Technology		
-	Surface Topography : Metrology and Properties		
-	Translational Materials Research		
	OPTICAL SOCIETY OF AMERICA E-COMBINATION 1 [PAYMENTS].	Journal	\$14,575
-	Advances in Optics and Photonics		
-	Applied Optics		
-	Journal of Optical Communications and Networking		



-	Journal of the Optical Society of America - Part A Optics Image Science & Vision		
-	Journal of the Optical Society of America - Part B Optical Physics		
-	Optics and Photonics News		
-	Optics Letters		
	SCOAP3 [PAYMENTS].	Journal	\$13,854
	American journal of physics	Journal	\$1,300
	American Chemical Society Web Editions {PAYMENTS}.	Journal	\$89,771
	American Chemical Society Web Editions {PAYMENTS}.	Journal	\$13,602
-	Accounts of Chemical Research		
-	Accounts of Materials Research		
-	ACS Agricultural Science & Technology		
-	ACS Applied Bio Materials		
-	ACS Applied Electronic Materials		
-	ACS Applied Energy Materials		
-	ACS Applied Materials & Interfaces		
-	ACS Applied Nano Materials		
-	ACS Applied Polymer Materials		
-	ACS Biomaterials Science & Engineering		
-	ACS Catalysis		
-	ACS Chemical Biology		
-	ACS Chemical Health & Safety		
-	ACS Chemical Health & Safety		
-	ACS Chemical Neuroscience		
-	ACS Combinatorial Science		
-	ACS Earth & Space Chemistry		
-	ACS Energy Letters		
-	ACS ES&T Engineering		
-	ACS ES&T Water		
-	ACS Food Science & Technology		
-	ACS Infectious Diseases		
-	ACS Macro Letters		
-	ACS Materials Letters		
-	ACS Medicinal Chemistry Letters		
-	ACS Nano		
-	ACS Pharmacology & Translational Science		
-	ACS Photonics		
-	ACS Sensors		
-	ACS Sustainable Chemistry & Engineering		

- ACS Synthetic Biology		
- Analytical Chemistry		
- Biochemistry		
- Bioconjugate Chemistry		
- Biomacromolecules		
- Chemical & Engineering News Global Enterprise		
- Chemical Research in Toxicology		
- Chemical Reviews		
- Chemistry of Materials		
- Crystal Growth & Design		
- Energy & Fuels		
- Environmental Science & Technology		
- Environmental Science & Technology Letters		
- Industrial & Engineering Chemistry Research		
- Inorganic Chemistry		
- Journal of Agricultural and Food Chemistry		
- Journal of Chemical & Engineering Data		
- Journal of Chemical Education - ACS		
- Journal of Chemical Information and Modeling		
- Journal of Chemical Theory and Computation		
- Journal of Medicinal Chemistry		
- Journal of Natural Products		
- Journal of Organic Chemistry		
- Journal of Physical Chemistry A		
- Journal of Physical Chemistry A c-w Journal of Physical Chemistry B /&/ Journal of Physical Chemistry C		
- Journal of Physical Chemistry B		
- Journal of Physical Chemistry C		
- Journal of Physical Chemistry Letters		
- Journal of Proteome Research		
- Journal of the American Chemical Society		
- Journal of the American Society for Mass Spectrometry		
- Langmuir		
- Macromolecules		
- Molecular Pharmaceutics		
- Nano Letters		
- Organic Letters		
- Organic Process Research & Development		
- Organometallics		
ECS Digital Library [PAYMENTS].	Journal	\$6,302

- ECS Journal of Solid State Science & Technology		
- ECS Transactions		
- Journal of the Electrochemical Society		
RSC GOLD PACKAGE.	Journal	\$83,400
- Analyst - Royal Society of Chemistry		
- Analytical Abstracts		
- Analytical Methods		
- Biomaterials Science		
- Catalysis Science and Technology		
- Chemical Communications		
- Chemical Hazards in Industry		
- Chemical Society Reviews		
- CrystEngComm		
- Dalton Transactions		
- Energy & Environmental Science		
- Environmental Science - Nano		
- Environmental Science - Processes and Impacts		
- Environmental Science - Water Research and Technology		
- Faraday Discussions		
- Food and Function		
- Green Chemistry		
- Inorganic Chemistry Frontiers		
- Journal of Analytical Atomic Spectrometry		
- Journal of Materials Chemistry - A		
- Journal of Materials Chemistry - B		
- Journal of Materials Chemistry - C		
- Journal of Materials Chemistry Collection		
- Lab on a Chip		
- Laboratory Hazards Bulletin		
- Materials Chemistry Frontiers		
- Materials Horizons		
- Molecular Omics		
- Molecular Systems Design and Engineering		
- Nanoscale		
- Nanoscale Horizons		
- Natural Product Reports		
- Natural Product Updates		
- New Journal of Chemistry		
- Organic & Biomolecular Chemistry		
- Organic Chemistry Frontiers		

-	Physical Chemistry Chemical Physics PCCP		
-	Polymer Chemistry		
-	Reaction Chemistry and Engineering		
-	RSC Medicinal Chemistry		
-	Soft Matter		
-	Sustainable Energy and Fuels		
-	Synthetic Reaction Updates		
ICE Specialist Engineering Journals Collection [PAYMENTS].		Journal	\$7,774
-	Proceedings of the Institution of Civil Engineers - Civil Engineering		
-	Proceedings of the Institution of Civil Engineers - Engineering & Computational Mechanics		
-	Proceedings of the Institution of Civil Engineers - Geotechnical Engineering		
-	Proceedings of the Institution of Civil Engineers - Ground Improvement		
-	Proceedings of the Institution of Civil Engineers - Maritime Engineering		
-	Proceedings of the Institution of Civil Engineers - Municipal Engineer		
-	Proceedings of the Institution of Civil Engineers - Structures & Buildings		
-	Proceedings of the Institution of Civil Engineers - Transport		
-	Proceedings of the Institution of Civil Engineers - Urban Design and Planning		
-	Proceedings of the Institution of Civil Engineers - Water Management		
-	Proceedings of the Institution of Civil Engineers : Bridge Engineering		
-	Proceedings of the Institution of Civil Engineers : Construction Materials		
-	Proceedings of the Institution of Civil Engineers : Energy		
-	Proceedings of the Institution of Civil Engineers : Engineering History and Heritage		
-	Proceedings of the Institution of Civil Engineers : Engineering Sustainability		
-	Proceedings of the Institution of Civil Engineers : Forensic Engineering		
-	Proceedings of the Institution of Civil Engineers : Management Procurement and Law		

-	Proceedings of the Institution of Civil Engineers : Waste and Resource Management		
	ENR (PAYMENT).	Periodical	\$87
	Laser focus world [PAYMENTS].	Periodical	\$156
-	Laser Focus World		
-	LFBG		
	Journal of fluids engineering.	Journal	\$916
	American Shore and Beach Preservation Association Membership [payment].	Periodical	\$115
	Journal of hydraulic research pack - Online {COMBINATION SUBSCRIPTION PAYMENTS}.	Journal	\$1,232
-	International Journal of River Basin Management		
-	Journal of Applied Water Engineering & Research		
-	Journal of Ecohydraulics		
	Bauwelt. (PAYMENT).	Periodical	\$331
	Progress in astronautics and aeronautics.	None	\$120
	Proceedings of the Institution of Mechanical Engineers Parts A-P [PAYMENTS].	Journal	\$48,968
-	Proceedings of the Institute of Mechanical Engineers - Pt N - Journal of Nanomaterials Nanoengineering and Nano		
-	Proceedings of the Institution of Mechanical Engineers - Part B - Journal of Engineering Manufacture		
-	Proceedings of the Institution of Mechanical Engineers - Part C - Journal of Mechanical Engineering Science		
-	Proceedings of the Institution of Mechanical Engineers - Part D - Journal of Automobile Engineering		
-	Proceedings of the Institution of Mechanical Engineers - Part E - Journal of Process Mechanical Engineering		
-	Proceedings of the Institution of Mechanical Engineers - Part F - Journal of Rail & Rapid Transit		
-	Proceedings of the Institution of Mechanical Engineers - Part G - Journal of Aerospace Engineering		
-	Proceedings of the Institution of Mechanical Engineers - Part H - Journal of Engineering in Medicine		
-	Proceedings of the Institution of Mechanical Engineers - Part I - Journal of Systems & Control Engineering		
-	Proceedings of the Institution of Mechanical Engineers - Part J - Journal of Engineering Tribology		
-	Proceedings of the Institution of Mechanical Engineers - Part K - Journal of Multibody Dynamics		
-	Proceedings of the Institution of Mechanical Engineers - Part P - Journal of Sports Engineering & Technology		

-	Proceedings of the Institution of Mechanical Engineers : Part O - Journal of Risk & Reliability		
-	Proceedings of the Institution of Mechanical Engineers Part A - Journal of Power & Energy		
-	Proceedings of the Institution of Mechanical Engineers -Part L- Journal Materials : Design & Application		
-	Proceedings of the Institution of Mechanical Engineers -Pt M - Journal of Engineering of the Maritime Environment		
<b>Grand Total</b>			<b>\$857,493</b>

### CEME Recommended Acquisitions

Acquisition of the items below are not feasible given current Richter Library budgets for continuing resources. An endorsement by the College of Engineering in their own budget request for a new CEME department would be needed to help secure additional University funding for these resources. Lists could be subject to additional revision with additional input from College of Engineering administrators and departmental faculty.

#### Highly Recommended

To support CEME research, the UML would highly recommend subscribing to or purchasing the following resources:

##### *Database Acquisitions:*

- Inorganic Crystal Structure Database (ICSD) at **\$775** for a yearly single department license. This would have to be paid by the College of Engineering. A library subscription for campus-wide access would cost approximately **\$3,000**.

##### *Serial Acquisitions:*

- Serial e-titles totaling approximately **\$18,671** (4 titles), please see Table 9.

*Table 9: Highly Recommended Serial Acquisitions*

Title	Yearly Subscription
Journal Of Nanoscience And Nanotechnology	\$5,780
Journal Of Toxicology And Environmental Health - Part A - Current Issues	\$7,417
Nanotoxicology	\$3,941
Urban Water Journal	\$1,533
<b>Grand Total</b>	<b>\$18,671</b>

Additional Recommendations

To more fully support CEME research, the UML would also recommend subscribing to or purchasing the following resources:

*eBook and Reference Acquisitions:*

- Knovel Environment & Environmental Engineering package, yearly subscription at approximately **\$3000**
- CHEMLIBnetBASE, SCI-TECHnetBASE, ENVIROnetBASE, MATERIALSnetBASE, and WATERnetBASE eBook collections from Taylor & Francis (**exact pricing TBD**)

*Database Acquisitions:*

- Reaxys Web Platform at approximately **\$26,000** for a yearly campus-wide license

*Serial Acquisitions:*

- several additional serial e-titles totaling approximately **\$105,454** (38 titles), please see Table 10.

Table 10: Recommended Serial Acquisitions

Title	Purchase Price
3D Printing and Additive Manufacturing	\$2,982
Advances in Cement Research	\$1,119
Advances In Nano Research	\$655
Catalysis Reviews-Science And Engineering	\$2,730
Corrosion Reviews	\$913
Crystallography Reviews	\$2,102
Current Pharmaceutical Design	\$12,000
European Journal of Wood and Wood Products	\$3,257
Expert Opinion On Therapeutic Patents	\$13,521
Fullerenes Nanotubes and Carbon Nanostructures	\$6,974
Functional Materials Letters	\$661
Fusion Science And Technology	\$3,056
International Materials Reviews	\$2,517
International Review Of Aerospace Engineering	\$1,193
ISH Journal Of Hydraulic Engineering	\$490
Journal Of Biomedical Nanotechnology	\$4,400
Journal Of Nanofluids	\$2,540
Journal of Natural Fibers	\$1,840
Journal Of Porous Media	\$1,736
Journal Of Rheology	\$745

Journal Of Structural Integrity And Maintenance	\$529
Journal Of The Textile Institute	\$2,063
Journal Of Thermal Science And Engineering Applications	\$1,000
Journal of Wood Chemistry and Technology	\$3,536
Liquid Crystals	\$11,065
Liquid Crystals Reviews	\$929
Materials Technology	\$1,807
Molecular Simulation	\$9,545
MRS Communications	\$1,004
Nanoscale and Microscale Thermophysical Engineering	\$1,481
Reviews In Chemical Engineering	\$1,016
Steel And Composite Structures	\$1,290
Textile Progress	\$656
Tribology - Materials, Surfaces And Interfaces	\$1,266
Vestnik Udmurtskogo Universiteta: Matematika, Mekhanika, Komp'Yuternye Nauki	\$400
Virtual And Physical Prototyping	\$1,334
Wood And Fiber Science	\$505
Wood Material Science and Engineering	\$597
<b>Grand Total</b>	<b>\$105,454</b>