

New Graduate Course Proposal

Form Procedure

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Course Title

Course Title:

* Emerging Materials & Technologies

Proposed Banner Abbreviation:

* Emerging Materials & Tech

Banner limit of 30 characters, including punctuation, spaces, and special characters.

Department/Committee Information

The main contact person for the Graduate Curriculum Committee should fill out this form.

Requestor Name:

* Nirajan Mani

Members of the Graduate Curriculum Committee:

Abdel Gabar Mustafa, Hong Yu, Ana Emlinger, Soumitra Basu, Wayne Whitfield, Student Representatives (Mark Izbicki, Miles Ford)

Department / Unit Developing:

* Engineering Technology

Department Chair:

* Dr. Nirajan Mani

* nmani@fitchburgstate.edu

Academic Dean:

Dr. Mahmoud Al-Oden

malodeh@fitchburgstate.edu

Program Chair

The Program Chair for this request is among the people listed above.

- * Yes
 No

Graduate Program

* MS in Construction Management Program

The above program would be responsible for scheduling, staffing & assessing this course.

Course Information

Course Description

* This course centers on innovative materials and advanced technologies used in contemporary building systems. Students investigate evolving technological developments and their effective integration through intelligent materials and construction techniques. Emphasis is placed on the technical performance and aesthetic potential of forward-looking sustainable building systems, including circular economy, and biomimicry-inspired strategies.

Course Objectives

This course aims to equip graduate students with advanced knowledge and critical evaluation skills related to innovative materials and emerging technologies in contemporary building systems. Students will analyze the technical performance, sustainability impact, and practical integration of advanced materials, intelligent systems, renewable energy technologies, and circular design strategies to support resilient, energy-efficient, and future-ready built environments.

Rationale and expected outcomes of offering the Course

*The rapid evolution of building materials, digital technologies, and sustainability requirements is transforming the construction industry. Professionals must evaluate and integrate innovative materials, intelligent systems, and advanced construction technologies to meet growing demands for energy efficiency, resilience, carbon reduction, and circular design. This course addresses the need for graduate-level expertise in assessing emerging materials and technologies, bridging technical performance with environmental responsibility and practical implementation in contemporary building systems.

Expected Outcomes:

1. It prepares students to make informed, evidence-based decisions regarding advanced materials and sustainable technologies.
2. It strengthens students' ability to integrate innovation with performance-driven and environmentally responsible design.
3. It enhances industry readiness by equipping students with skills aligned with evolving sustainability standards and technological advancements.

What are the Learning Outcomes for the Course?

1. Analyze and compare intelligent materials and construction techniques in relation to energy efficiency, environmental performance, and design innovation.
2. Evaluate emerging materials and building technologies based on performance, sustainability, lifecycle impact, and applicability to contemporary architectural and building systems.
3. Introduce advanced environmental building systems, including zero energy buildings, renewable energy technology, and high-performance envelopes into coherent, design-driven building solutions.
4. Apply principles of the circular economy and biomimicry to propose sustainable material and system strategies for the built environment.

Number of Credits: * 3

Discipline Prefix or Prefixes:

* CMGT

Brief rationale if more than one prefix:

Level of Course:

- * 7000
 8000
 9000

Brief rationale for level choice::

* Introductory and elective course

The course will be:

- Requirement
 Elective

Elective or Requirement Note/Special:

Is there a similar undergraduate course?

- * Yes
 No

Does this course affect offerings in any other department or program?

- * Yes
 No

Course Enrollment

Expected Average Enrollment:

* 16

This course is a replacement for:

Course # / Name

Has the course been offered previously as a "Topics" course?

- * Yes
 No

Is this an Extended Campus Course?

- * Yes
 No

Which semester will this course be offered for the first time?:

* Summer 2027

How often thereafter to be offered?:

* Two year rotation

Course Requirements

Prerequisite course(s) if any:

Additional Requirements

Laboratory Hours:

Fieldwork Hours:

Pre-Practicum Hours:

Practicum Hours:

Other Requirements (specify):

Syllabus Upload

New Course Syllabus Upload:

New_course_Emerging_Materials_Technology_Mani.pdf

Signatures

Click on the **Submit Form** button at the bottom of the page after you have signed the form.
You should receive an email confirmation that your signature has been completed.

* ...3635373933
Nirajan Mani 03/13/2026
Requester Signature Date

* ...3537333431
Mahmoud Al-Odeh 03/16/2026
Academic Dean Signature Date

* ...3037303738
Nirajan Mani 03/13/2026
Department Chair Approval Date

*
Becky Cynn Ghy 4/3/26
SGOCE Dean Signature Date

Graduate Council

The Graduate Council Chair Signature indicates that the Council has discussed this proposal and has decided it should move forward.

*

Graduate Council Chair Signature Date

Notifications

Approval of the President Date

*

SGOCE Dean Initials Date

*

Reviewed by the Registrar: Date



FITCHBURG STATE UNIVERSITY

School of Graduate Online and Continuing Education (SGOCE)

Department of Engineering Technology

SYLLABUS

Summer 2027

Class Information:

Course No: CMGT 7XXX

Course Title: Emerging Materials & Technologies

Credits: 3

Class Modality: Online

Class Start Date: 07/09/2027

Class End Date: 08/27/2027

Instructor Information:

Dr. Nirajan Mani

Office: CNIC 209A

Phone: 978-665-4843

Email: nmani@fitchburgstate.edu

Office Hours: By Appointment

Catalog Description:

This course centers on innovative materials and advanced technologies used in contemporary building systems. Students investigate evolving technological developments and their effective integration through intelligent materials and construction techniques. Emphasis is placed on the technical performance and aesthetic potential of forward-looking sustainable building systems, including energy-efficient design, zero energy buildings, renewable energy technologies, circular economy principles, and biomimicry-inspired strategies for sustainability.

Catalog Objectives:

This course aims to equip graduate students with advanced knowledge and critical evaluation skills related to innovative materials and emerging technologies in contemporary building systems. Students will analyze the technical performance, sustainability impact, and practical integration of advanced materials, intelligent systems, renewable energy technologies, and circular design strategies to support resilient, energy-efficient, and future-ready built environments.

Course Learning Outcomes:

1. Analyze and compare intelligent materials and construction techniques in relation to energy efficiency, environmental performance, and design innovation.
2. Evaluate emerging materials and building technologies based on performance, sustainability, lifecycle impact, and applicability to contemporary architectural and building systems.

3. Introduce advanced environmental building systems, including zero energy buildings, renewable energy technology, and high-performance envelopes into coherent, design-driven building solutions.
4. Apply principles of the circular economy and biomimicry to propose sustainable material and system strategies for the built environment.

Course Assessment:

The following assessment components will be used to measure the course learning outcomes effectively.

1. Class participation and discussion (35%): Students will be encouraged to actively participate in discussions on emerging materials, innovative technology and building systems, and related topics.
2. Assignments (45%): Major assignments are classified into research paper and case study analysis, design and innovation project, and training modules for learning innovative design tools. Students will conduct in-depth investigation of an emerging materials, intelligent system, and sustainable construction technique through case study and research paper analysis.
3. Quizzes (20%): Periodic quizzes testing theoretical knowledge of emerging materials, intelligent systems, and energy-efficient building technologies.

Suggested Books:

Construction Materials, Methods, and Techniques: Building for a Sustainable Future (5th Ed.) (E-book)

Authors: Eva Kultermann, William P. Spence

Publisher: Cengage, Boston 2022

ISBN: 13-9780357709610

Green Construction: An Introduction to a Changing Industry. (Hardcover)

Author: Alison Dykstra

Publisher: Library of Congress Control Number 2015960690, Kirschner Books, San Francisco

ISBN: 978-0-9827034-2-7

Green Building Illustrated (2th Ed.) (E-book)

Author: Francis D. K. Ching, Ian M. Shapiro

Publisher: Wiley, New York 2020

ISBN: 978-1-119-65395-0

Supplementary Materials: Handout materials will be provided by instructor.

Instructor Availability:

Instructor will be available during weekdays to respond your questions or concern via university email. Please contact instructor via university email if you have any questions or concern to avoid spam issue. However, this is an online class, we will use Google Meet for all student requested meetings.

Instructional Strategies:

The course will be conducted in an online format. This class may use lectures, demonstrations, self-guided study, group discussions, collaborative learning groups, and presentations to cover the topics in this course. PowerPoint presentations, computer applications, etc. may be utilized. Some independent learning is expected of the students; they should complete assigned readings prior to each class session and actively engage in discussions and activities to facilitate their understanding of classroom presentations. Every effort will be made to meet the individual needs and various learning styles of the course participants. It is most important that you inform the instructor at the beginning of the semester of any unique needs.

Course Topics:

The following topics will be covered in the course. The following listing is a general indication of the order of their coverage. However, faculty instructor reserves the right to change the order of coverage and the topics to be covered based upon the class's performance and interests.

1. Introduction to Emerging Materials & Building Systems
2. Sustainable and Intelligent Materials
3. Introduction to BIM
4. Project Delivery Methods & BIM
5. BIM Tools for Construction Planning & Management
6. Introduction to Nanomaterials & Nanotechnology
7. Introduction to 3D Printing in Construction
8. 4D Printing: The Next Evolution in Additive Manufacturing
9. Modular Construction
10. Passive Solar Design
11. Introduction to Green Construction
12. Energy Efficient Building
13. Zero Energy House
14. Role of Natural and Artificial Lighting in Energy Efficiency
15. Renewable Energy Systems
16. Circular Economy in AEC Industry
17. Biomimicry Approach for Sustainable Design
18. Life Cycle Assessment

Grading System:

Range	Letter Grade	Quality Points
95 - 100	A	4.0
92 - 94	A-	3.7
89 - 91	A- / B+	3.5
86 - 88	B+	3.3
83 - 85	B	3.0
80 - 82	B-	2.7
77 - 79	B- / C+	2.5
74 - 76	C+	2.3
71 - 73	C	2.0
0 - 70	C-	0
Withdrawn		W
Incomplete		IN
In-Progress		IP
Audit		AU
Satisfactory		S
Unsatisfactory		U

** Grades that fall between intervals will be rounded to the higher number.*

Evaluation Criteria:

Participation and Discussion	35%
Quizzes	20%
Assignments	45%

** The instructor reserves the right and the responsibility for adjusting these items and their weights as necessary to meet specific situations as they may arise.*

Student Responsibilities and Class Requirements:

Each student is responsible for completing all course requirements and for keeping up with all activities of the course. Students are required to complete all assigned participation and discussion, quizzes, and assignments by the given deadline.

Policy on Assignments:

All assignments must be turned in on the blackboard as per the documented dates in the syllabus. Feedback to your submissions will be posted on the blackboard after the weekly submission due date and time. It means that if you chose to submit your assignment early, it will be graded at the scheduled time and not before. Work submitted after due date will receive a grade of zero. All assignments must conform to APA writing style and include a reference list (not a work cited or bibliography). Students with extenuating circumstances, such as a medical emergency or other emergencies must provide written proof of such event and report such events within 24 hours and make arrangement to complete assignments in a timely manner. Failure to do so will result in a penalty up to 50%. Make up examinations (if part of course) will only be offered at the discretion of the instructor.

Technology Initiatives:

Users of the Fitchburg State University computer systems are subject to all applicable federal, state, and international computer laws. Questions regarding regulations may be directed to the office of Information Technology Systems.

Students will utilize technology as:

- A research tool; (a means of discovering current trends and substantive research articles in education)
- A communication method
- An enhancement tool for the design of PowerPoint presentations (for recorded presentations-individual/group)

Fitchburg State University Library Online Services:

The Fitchburg State University Library online services may be accessed through the Fitchburg State University Homepage <https://library.fitchburgstate.edu/>. Students may access any of several full-text online databases. Passwords are available to students by calling 978.665.3063. Students may access the Fitchburg State University Career Service and Counseling Services Center via the college's homepage at <https://www.fitchburgstate.edu/student-support/career-support/career-resources>.

Disabilities Accommodation:

Students requiring course alterations or accommodations due to a disability or emergency medical condition, should inform instructor as soon as possible. You should also work with the Disability Services Office (978-665-4020). They will provide you with the forms needed to determine the accommodations that your situation merits.

University Academic Dishonesty Policy:

Fitchburg State University's policy on Academic Dishonesty will be enforced in this course. Please refer to the university catalog on this policy. Plagiarism and cheating are inexcusable. Any instance of plagiarism or cheating will result in lowered grade and possible failing the course.

Course Calendar:

Week	Weekly Activity	Assignments and Due dates
Week 1	Reading: Topic 1: Introduction to Emerging Materials & Building systems Topic 2: Sustainable and Intelligent Materials	<i>Introduction post:</i> Due: TBD <i>Discussion Participation:</i> Due: TBD <i>Quiz 1:</i> Due: TBD
Week 2	Reading: Topic 3: Introduction to BIM Topic 4: Project Delivery Methods & BIM Topic 5: BIM Tools for Construction Planning & Management	<i>Participation & Discussion:</i> TBD <i>Assignment 1:</i> Due: TBD <i>Quiz 2:</i> Due: TBD
Week 3	Reading: Topic 6: Introduction to Nano-materials & Nano-Technology Topic 7: Introduction to 3D Printing in Construction	<i>Participation & Discussion:</i> Due: TBD <i>Quiz 3:</i> Due: TBD
Week 4	Reading: Topic 8: 4D Printing: The Next Evolution in Additive Manufacturing Topic 9: Modular Construction	<i>Participation & Discussion:</i> Due: TBD <i>Assignment 2:</i> Due: TBD <i>Quiz 4:</i> Due: TBD
Week 5	Reading: Topic 10: Passive Solar Design Topic 11: Introduction to Green Construction Topic 12: Energy Efficient Building	<i>Participation & Discussion:</i> Due; TBD <i>Quiz 5:</i> Due: TBD
Week 6	Reading: Topic 13: Zero Energy House (ZEH) Topic 14: Role of Natural and Artificial Lighting in Energy Efficiency Topic 15: Renewable Energy Systems	<i>Participation & Discussion:</i> Due: TBD <i>Quiz 6:</i> Due: TBD
Week 7	Topic 16: Circular Economy in AEC Industry Topic 17: Biomimicry Approach for Sustainable Design Topic 18: Life Cycle Assessment	<i>Assignment 3:</i> Due: TBD

Note: The instructor reserves the right to modify this syllabus and schedule.