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LECTURING UNIT FOR
STEM3109 – Creativity and Technological Innovation

Semester I, Class of 2023, Academic Year 2023-2024

Course Term	:	September, 2023 – January, 2024
Faculty	:	Permata Nur MR, PhD, Hapiz Islamnsyah, S.Sn, M.Ds., Purba Purnama PhD, Sesaria Kikitamara MSc.
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Class	:	FBT23; CSE23; DBT23, PDE23, REE23; BM21
Credit	:	3 credits

COURSE DESCRIPTION

This course introduces students to the concept of creativity and structured approach of innovation in technology-driven context. It combines both analytical and creative thinking aiming at producing new solutions for a wide range of technical and social problems. It exposes students to the essential mental models, mindsets, behaviours, tools and techniques necessary to foster creativity and innovation in individuals and teams. A central theme of this course is that creativity, as an important ingredient to innovation, can be enhanced through learning, imagining, combining ideas, or reframing problems. To be innovative, one should go beyond just creative. He / she must understand the market dynamics and suitable technology as instruments for delivering real value to the society. As such, the course is structured to encourage students exploring various creative approaches and applying them innovatively in responding to real-world challenges. In addition to classroom activities, students will work collaboratively in cross-disciplinary teams to design technologically-viable and economically-sustainable solutions.

LEARNING OBJECTIVES

Upon successful completion of this course, students will be able to:

1. Understand the core aspects and concept of creativity;
2. Improve originality and effectiveness of their thinking:
3. Explain and demonstrate various ways to enhance creativity;
4. Understand the building blocks and whole process of systematic innovation;
5. Develop the paradigms and appropriate behaviors of innovators;
6. Carry out confidently creative initiatives and innovation in technological-intensive environment;

RELATION WITH LEARNING OUTCOMES

This course contributes to fulfil the following program learning outcomes:

1. Demonstrate the spirit of entrepreneurship and persistence (CP-S5)
2. Demonstrate sensitivity to social problems (CP-S6)
3. Ability to apply principles of entrepreneurship, business, innovation, and aspects of health, safety, legality, standardization, sustainability, and social responsibility to specific context (CP-PP3)
4. Ability to work in teams (team work) with multidiscipline groups in accordance with his profession to solve various problems holistically, at the local level, national level, as well as global level (CP-KU1)
5. Ability to become an entrepreneur through the initiation of business ventures / or professional who master the knowledge and practical skills in business, applied social science and applied STEM (CP-KU2)

COURSE DELIVERY

1. General Lecture (LEC)
2. Quiz (QIZ)
3. Homework (HW)
4. Group Project (GP)
5. Guest Lecture (GLEC)

REFERENCES

Textbook:

- Walesh, Stuart G. 2017. **Introduction to Creativity and Innovation for Engineers**. Essex: Pearson. (CREA)
- Gibson, R. 2015. **The 4 Lenses of Innovation**. Wiley. (INNO)
- Lewrick, M.L., P. Link and L. Leifer, 2020, **The Design Thinking Toolbox**. Wiley. (DTP)

Supplemental Readings:

- Arciszewski, T. 2016. **Inventive Engineering: Knowledge and Skills for Creative Engineers.** Boca Raton: Taylor & Francis Group.
- Seelig, T. 2012. **inGenius: A Crash Course on Creativity**. New York: Harper One.
- Verganti, R. 2009. **Design-Driven Innovation: Changing the Rules of Competition by Radically Innovating What Things Mean**. Boston: Harvard Business Press

COURSE EVALUATION

1. Quiz and Howework : 15% (Q+HW)
2. Participation : 10% (PC)
3. Group Project : 25% (GP)

4. Mid-Term Exam : 25% (ME)
5. Final Exam : 25% (FE)

GROUP PROJECT GUIDELINES

Students will collaborate in cross-disciplinary teams to design innovative solution(s) to contemporary real-life challenges. This group assignment involves research on a chosen challenge, its associated environment, and feasible technology-based solution. Each team consists of 3-4 students identifying one grand challenge and then break it down to a workable problem. Gather and synthesize information related to this problem, and formulate a solution based on what you have learned throughout the semester. Prepare a communicative final report to share your innovative solution in class.

The project involves the following activities:

1. Initiating creative initiatives and technological innovation – identifying the problem
2. Acquisitioning the necessary knowledge.
3. Searching for creative solutions
4. Overcoming the obstacles to creativity and innovation
5. Evaluating and selecting an applicable solution
6. Implementing innovative solution
7. Moving for successful commercialization

The final project deliverable should be in two formats:

1. A 4-page written report plus appendixes
2. A 15-minute presentation

The project will be evaluated on the comprehensiveness of the report and the accuracy of the data and calculations. It is due in Session 14.

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SUPPORTING MEDIA

1. Slide Projector
2. Whiteboards Set

OTHER IMPORTANT INFORMATION

This course emphasizes active and experential learning. Students are expected to interact with their peers while learning together in class and doing group assignment. It is expected that students participate actively, since the most important learning take place during these discussions.

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LECTURING OUTLINE

Week	General Topic	LO	Week's Learning Objectives By the end of each session, students will be able to:	Chapter Reference	Course Delivery	Course Evaluation	Supporting Media
(1)	**Course Overview** **Creativity, Innovation and Entrepreneurship in Engineering**	1	1. Explain the basic process of creativity and Innovation 2. Differentiate and describe the connection between creativity, technological innovation and entrepreneurship 3. Illustrate six reasons engineers / scientists need to be creative and innovative 4. Illustrate characteristics of creative/ innovative individuals 5. Identify ones readiness for creativity and innovation	CREA, Ch. 1 & 6	LEC	PC, Q	1,2
(2)	**Drivers of Creativity and Innovation**	1, 2	1. Demonstrate the special capabilities of the brain's left and right hemispheres 2. Explain lifelong learning and creative potential as a result of the brain's neuroplasticity 3. Discuss the dominance of habits and explain how to change them to enhance creativity 4. Explain how to care for more effective use of brain for creativity and innovation 5. Explain how a certain thinking methods enable intentional creativity and innovation	CREA, Ch. 2 & 3	LEC	PC, GP	1,2
(3) Sept. 21th, 2022 Online (Hapiz)	**Basic Cognitive Modelling and Advanced Tools for Enhancing Creativity**	2	1. Identify ways for releasing creativity 2. Demonstrate understanding of the various methods of creativity and their wide applicability 3. Explain basic, quickly learned, and rapidly applied tools and discuss the importance of appropriate method selection 4. Discuss the advantages and disadvantages features of each basic tool	CREA, Ch. 4 & 7	GLEC	PC, Q	1,2

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Week	General Topic	LO	Week's Learning Objectives By the end of each session, students will be able to:	Chapter Reference	Course Delivery	Course Evaluation	Supporting Media
			5. Explain advanced tools for creativity and innovation efforts 6. Demonstrate understanding and use of more advanced creativity tools when working on a project 7. Illustrate the applicability of some creativity tools to technical and nontechnical challenges 8. Discuss further the positive and negative features of each advanced tool				
(4)	**Difficulties & Barriers to Creativity and Innovation – with Case Study**	2,3	1. Describe the potential obstacles to individual and team creativity 2. Illustrate the possible remedy for each obstacle 3. Evaluate oneself or associated team difficulties more thoroughly in applying creative thinking 4. Identify the damaging impacts of those barriers to creative idea and find ways to proactively move forward	CREA, Ch. 5	LEC	PC	1,2
(5)	**Implementation of Creative and Innovative Ideas**	3	1. Employ suitable approaches for implementing creative idea for an improved or new solution 2. Demonstrate the knowledge and skill to be more creative and innovative Explain issues related to bringing new ideas to the market	CREA, Ch. 8,9	LEC QIZ	PC	1,2
(6)	**The Technological Innovation and Source of Innovation**		1. Understand Technology evolution, innovation and strategy 2. Understand the four lenses of innovation 3. Understand the locus of innovation 4. Understand the forms of innovation	INNO, Part 1	LEC	PC	1,2
(7)	**Group Project Launching**						

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Week	General Topic	LO	Week's Learning Objectives By the end of each session, students will be able to:	Chapter Reference	Course Delivery	Course Evaluation	Supporting Media
(8)	**Midterm Exam** (Creativity Project Presentation)						
(9)	**Design Thinking – Fundamentals**	**4**	1. Understand the basics of Design Thinking 2. Transform organization for creative design thinkers to work 3. Design the future	DTP, Ch 1-3	**GLEC**	**PC**	
(10)	**Design Thinking – Practice**	4	1. Implement and practice design thinking for a case study 2. Self-reflection from the completed design thinking task	DTP, Ch 1-3	LEC	PC	1,2
(11)	**Technology-based Business Model**	4,5	1. Understand the technology-based Business model 2. Implications of business models		LEC	PC, HW	1,2
(12)	**Technology Adoption and Difussion**	5,6	1. Understand technology adoption and diffusion 2. Distribution of adopters 3. Crossing the chasm		LEC	PC	1,2
(13)	**Capturing Values from Innovation**	4,5	1. Understand capturing values from innovation 2. Understand the Teece Model 3. Differentiate innovators from imitators		LEC	PC	1,2
(14)	**Group Project work**						

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Week	General Topic	LO	Week's Learning Objectives By the end of each session, students will be able to:	Chapter Reference	Course Delivery	Course Evaluation	Supporting Media
(15)	**Group Project Work**						
(16)	**Final Exam (Innofair exhibition)**						

Prepared by, **Approved by Head of Departments,**

PNM **Adinda IP Ihsan Iswaldi Agung Alfiansyah Permata NMR Zaki Saldi**