Department of Civil Engineering

Course Name:

Creativity and Problem Solving in Engineering

Course Number: 20-024	**Credit:** 3
Program: Undergraduate/Graduate	**Course Type:** Technical required
Prerequisite: **4th year BS**	**Corequisite:**

Course Description (Objectives):
This course covers the fundamentals of critical thinking, problem solving and creativity in engineering through engineering applications. It attempts to sharpen problem-solving skills of students and help them reach a higher level of talent to efficiently handle problems in engineering projects. The topics covered include problem definition, idea generation techniques, and critical thinking methodology. The course provides a systematic framework for improving problem solving skills and creativity.

Course Content (outline):

- Chapter 1: Intelligence and Creativity, Types of problems, Benefits of Efficient Problem Solving, Problem Prioritization Scheme
- Chapter 2: Cognitive Frames, Creative and Habitual Ways of Thinking, Language and Frames, Metaphors, Paradigms, Writing as Thinking
- Chapter 3: Critical Thinking, Structured Critical Reasoning, Fallacies in Logic, Types of Biases, Socratic Questioning, Types of Conceptual Blocks, Causes of Mental Blocks, Emotional Intelligence, Divergent Thinking, Visualization, Risk Taking,
- Chapter 4: Preliminary Steps in Problem Solving, Knowledge, Resources, Modeling, Psychological Engagement
- Chapter 5: Techniques for Problem Reframing, Dunker's Diagram Method, Multiple Why's Method, Statement-Restatement Technique
- Chapter 6: Root-cause Analysis, Kepner-Tregoe Problem Analysis
- Chapter 7: Idea Generation Techniques, Vertical Thinking, Lateral Thinking, Brainstorming, SCAMPER Method, Futuring, Analogy, Cross-Pollination, TRIZ Principles and Methodology
- Chapter 8: Kepner-Tregoe Decision Analysis, Kepner-Tregoe Potential Problem Analysis

References:

- Fogler, H., Leblanc, S., and Rizzo, B. (2014), Strategies for Creative Problem Solving, 3rd edition, Prentice-Hall.
- Ness, M. (2012) Innovation Generation, Oxford University Press.
- Michalko, M. (2001), Cracking Creativity, the Secrets of Creative Genius, Ten Speed Press.
- Kepner, H and Tregoe, B. (1981) New Rational Manager, Kepner-Tregoe, Inc.
- Altshuller, G. et al (2005) 40 Principles: TRIZ Keys to Technical Innovation, Technical Innovation Center.