- •Engineering Knowledge: An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
- •Problem Analysis: An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- •<u>Design/Development of Solutions:</u> An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations

- •<u>Investigation</u>: An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
- •Modern Tool Usage: An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
- The Engineer and Society: An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the responsibilities relevant to professional engineering practice and solution to complex engineering problems.

- •Environment and Sustainability: An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
- •Individual and Team Work: An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

- •<u>Communication:</u> An ability to communicate effectively, orally as well as in writing, on **complex engineering** activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Project Management: An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.
- •<u>Lifelong Learning</u>: An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

# Sample Solution Case – Example PEOs

- •**PEO-1:** Demonstrate necessary knowledge and skills in Civil Engineering profession.
- •PEO-2: Work and communicate effectively in team.
- •**PEO-3:** Undertake professional practice considering ethical, societal and environmental implications.
- •PEO-4: Be engaged in lifelong learning and continued professional growth.

**Mapping of PLOs and PEOs --- Example Case** 

PLOs	PEO-1	PEO-2	PEO-3	PEO-4
Engineering Knowledge	X			
Problem Analysis	X			
Design/Development of	X			
Solutions				
Investigation	X			
Modern Tool Usage	X			
The Engineer and Society			X	
<b>Environment and</b>			X	
Sustainability				
Ethics			X	
Individual and Team Work		X		
Communication		X		
Project Management		X		
Lifelong Learning				X

# **Domains of Bloom's Taxonomy**

Bloom's Taxonomy employs three distinct domains: the cognitive, the affective, and the psychomotor, which are described as follows:

- •"the cognitive domain ... includes those objectives [that] deal with the recall or recognition of knowledge and the development of intellectual abilities and skills."
- •"the affective domain ... includes objectives [that] describe changes in interest, attitudes, and values ..."
- •the psychomotor domain includes "the manipulative or motor-skill area.

(thinking, knowledge)



# Evaluation

#### Definition:

Judges the value of material for a given purpose.

#### Sample Verbs:

- · assess
- conclude
- · evaluate
- · interpret · justify
- · select
- support

### **Analysis**

#### Definition:

Understands both the content and structure of material.

#### Sample Verbs:

- · analyze
- · categorize · compare
- · contrast
- differentiate

### · outline

#### Sample Verbs:

(higher level of

understanding).

Application

Uses learning in new

and concrete situations

#### • use

### · apply

· carry out

Definition:

- demonstrate
- · illustrate

- · prepare
- · solve

· propose

#### Sample Verbs: · define · identify · label

· list name

Definition:

material.

Remembers

Knowledge

previously learned

 recall state

### Sample Verbs:

(lowest level of

understanding).

Comprehension

Grasps the meaning of

· describe

Definition:

material

- · discuss
- · explain locate
- · paraphrase translate
- · give example

- - discriminate

#### generate · plan

Sample Verbs:

· combine

construct

- design

develop

Synthesis

structures from existing

knowledge and skills.

Definition: Formulates new

Write Learning Outcomes

Based on "Taxonomy of Educational Objectives", B.S. Bloom Editor. 1956

Instructional Job Aid

# **Psychomotor Domain**

#### (doing, skills) Organization Adaption Definition: Creates new patterns for specific Definition: **Complete Overt** situations. Response Adapts skill sets to meet a problem Mechanism situation. Definition: Sample Verbs: Performs designs **Guided Response** Definition: automatically. · originates Performs acts with Sample Verbs: · combines increasing · adapts Set Definition: · composes efficiency, · reorganizes Sample Verbs: constructs Imitates and confidence, and alters Definition: Perception practices skills. · act habitually proficiency. revises Is mentally. often in discrete advance with · changes emotionally, and steps. assurance Definition: physically ready to · control Sample Verbs: Senses cues that direct guide motor activity. · complete with · excel Sample Verbs: confidence guide · copy · conduct Sample Verbs: · maintain efficiency · duplicate Sample Verbs: demonstrate manage · achieve a posture · imitate detect · execute master · assume a body · manipulate with · improve efficiency · hear organize stance guidance · increase speed · listen · perfect · establish a body · operate under make · observe perform position supervision · pace · perceive automatically place hands, arms, · practice recognize produce · proceed · repeat show dexterity · see · position the body · try sense · sit · smell stand taste station · view watch lowerorder Intermediate Higher order 12

# **Affective Domain**

(feeling, attitudes)

### Valuing

#### Definition:

Attaches value or worth to something.

#### Sample Verbs:

- · adopt
- · assume responsibility
- · behave according to
- · choose
- commit

· initiate

prefer

· seek

· show concern

· show continual

· use resources to

desire to

- desire
- · exhibit loyalty
- · express
- comply

- listen
- · notice

Definition

to stimuli.

Sample Verbs:

· be aware

· accept

· pay attention

· acknowledge

Receiving

Selectively attends

tolerate

## Responding

#### Definition:

Responds to stimuli.

#### Sample Verbs:

- · agree to
- · answer freely
- · assist
- · care for
- · communicate
- · conform
- · consent
- contribute
- · cooperate
- follow
- · obey
- participate willingly
- read voluntarily
- respond
- · visit
- · volunteer

# Organization

#### Definition:

Conceptualizes the value and resolves conflict between it and other values.

#### Sample Verbs:

- · adapt
- · adjust
- · arrange
- balance
- · classify
- · conceptualize
- formulate
- · group
- organize
- · rank
- · theorize

### Internalizing

#### Definition:

Integrates the value into a value system that controls behavior.

#### Sample Verbs:

- · act upon
- advocate
- defend
- · exemplify · influence
- · justify behavior
- · maintain
- · serve
- support

Course Learning Outcome (CLO)	Taxonomy Level	Program Learning Outcome (PLO)	Assessment Tool
Apply concept and skills for quantity take off for different civil engineering works.	C-3	Engineering Knowledge	Mid-Term 01 question: Workout no of blocks, and cost of Reinforcement for columns.
Carry out rate analysis, productivity and pricing.	C-3	Problem analysis, Investigation	Mid-Term question 2:s Workout cost of Door and Window Panels.
Discuss concepts related to legal and contractual aspects of cost of construction projects.	C-2	Engineering knowledge, Project management	Quiz 1: What are the contract documents?