

THE TWEELEVE PLOS

PROGRAM LEARNING OUTCOMES (PLOS)

Program Learning Outcomes (PLOs)/ Student Outcomes (SO)/ Program Outcome/ Graduate Attributes (GA)/ Washington Accord Graduate Attributes (WA) describe what students are expected to know and be able to do by the time of graduation. In compliance with new manual of accreditation of PEC (Third Edition, 2014), the EE BS program of SBASSE strives to impart following ability and skills in its students.

- **PLO1-Engineering Knowledge** : An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
- **PLO2-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
- **PLO3-Design and Development of Solutions** : 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.

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- **PLO4-Investigation** : 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.
- **PLO5-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.
- **PLO6-The Engineer and Society**: An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.
- **PLO7-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.
- **PLO8-Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice

PROGRAM LEARNING OUTCOMES (PLOS)

- **PLO9-Individual and Team Work:** An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings
- **PLO10-Communication:** 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
- **PLO11-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
- **PLO12- Lifelong Learning:** An ability to recognize the need for, and have the preparation and ability to engage in, independent and life-long learning in the broadest context of technological change.

DESIGN AND ASSESSMENT PRINCIPLES OF CLOS

DESIGN PRINCIPLES OF CLOS

- CLO-PLO relationship in a course:
 - A CLO should fall under a single PLO (and not under multiple PLOs) and under one leaning domain.
 - Multiple CLOs of a course can jointly access a PLO
- A CLO should be defined according to (new) Bloom's Taxonomy (or any other learning taxonomy) and should claim a measurable outcome.

LEARNING DOMAINS OF CLOS

- The three learning domains as per Bloom's Taxonomy
 - Cognitive Domain (Thinking and Knowledge): Theory courses & partly lab activity
 - Psychomotor Domain (Doing and Skills): Labs
 - Affective Domain (Feelings and Attitudes)

ASSESSMENT METHODOLOGY OF CLOS

- **Cognitive Domain:** (Traditional) Exams, Quizzes, Assignments through properly phrased questions; could also be rubric based for activity- based task
- **Psychomotor Domain:** Rubric based
- **Affective Domain:** Rubric based

COGNITIVE DOMAIN CLOS: DESIGN AND ASSESSMENT

COGNITIVE DOMAIN

Thinking , Knowledge

Prof Megat's slide taken from PEC website

Knowledge		Comprehension		Application		Analysis		Synthesis		Evaluation	
<p>Definition: Remembers previously learned material.</p> <p>Sample Verbs:</p> <ul style="list-style-type: none"> .Define .Identify .Label .List .Name .Recall .State 		<p>Definition: Grasps the meaning of material (lowest level of understanding)</p> <p>Sample Verbs:</p> <ul style="list-style-type: none"> .Describe .Discuss .Explain .Locate .Paraphrase .Give example .Translate 		<p>Definition: Uses learning in new and concrete situations (higher level of understanding)</p> <p>Sample Verbs:</p> <ul style="list-style-type: none"> .Apply .Carry out .Demonstrate .Illustrate .Prepare .Solve .Use 		<p>Definition: Understands both the content and structure of material</p> <p>Sample Verbs:</p> <ul style="list-style-type: none"> .Analyze .Categorize .Compare .Contrast .Differentiate .Discriminate .Outline 		<p>Definition: Formulates new structures from existing knowledge and skills</p> <p>Sample Verbs:</p> <ul style="list-style-type: none"> .Combine .Construct .Design .Develop .Generate .Plan .Propose 		<p>Definition: Judges the value of material for a given purpose</p> <p>Sample Verbs:</p> <ul style="list-style-type: none"> .Assess .Conclude .Evaluate .Interpret .Justify .Select .Support 	
Lower Order				Intermediate Order				Higher Order			

PSYCHOMOTOR DOMAIN

Doing , Skills

Prof Megat's slide taken from PEC website

Perception		Set	Guided Response	Mechanism	Complete overt Response	Adaption	Organization
<p>Definition: Senses cues that guide motor activity.</p> <p>Sample Verbs: Detect, Hear, Listen, Observe, Perceive, Recognize, See, Sense, Smell, Taste, View, Watch</p>		<p>Definition: Is mentally, emotionally and physically ready to act.</p> <p>Sample Verbs: Achieve a posture, Assume a body stance, Establish a body position, Place hands ,arms, etc., Position the body, Sit, Stand, Station</p>	<p>Definition: Imitates and practices skills, often in discrete steps.</p> <p>Sample Verbs: Copy, Duplicate, Imitate, Manipulate with guidance, Operate under supervision, Practice, Repeat, Try .</p>	<p>Definition: Performs acts with increasing efficiency, confidence, and proficiency.</p> <p>Sample Verbs: Complete with confidence, Conduct, Demonstrate, Execute, Improve efficiency, Increase speed, Make, Pace, Produce, Show dexterity</p>	<p>Definition: Performs automatically.</p> <p>Sample Verbs: Act habitually, Advance with assurance, Control, Direct, Excel, Guide, Maintain efficiency, Manage, Master, Organize, Perfect, Perform automatically, Proceed</p>	<p>Definition: Adapts skill sets to meet a problem situation.</p> <p>Sample Verbs: .Adapts .Recognizes .Alters .Revises .Changes</p>	<p>Definition: Create new patterns for specific situations.</p> <p>Sample Verbs: .Designs .Originates .Combines .Composes .Constructs</p>
Lower Order			Intermediate Order		Higher Order		

AFFECTIVE DOMAIN

Feeling , Attitudes

Prof Megat's slide taken from PEC website

				Internalizing
			Organization	<p><i>Definition:</i> Integrates the value in to a value system the controls behavior.</p> <p><i>Sample Verbs:</i></p> <ul style="list-style-type: none"> .Act upon .Advocate .Defend .Exemplify .Influence .Justify behavior .Maintain .Serve .Support
	Responding	Valuing		
Receiving	<p><i>Definition:</i> Responds to stimuli.</p> <p><i>Sample Verbs:</i></p> <ul style="list-style-type: none"> Agree to, Answer freely, Assist, Care for, Communicate, Comply, Conform, Consent, Contribute, Cooperate, Follow, Obey, Participate willingly, Read voluntarily, Respond, Visit, Volunteer 	<p><i>Definition:</i> Attaches value or worth to something.</p> <p><i>Sample Verbs:</i></p> <ul style="list-style-type: none"> Adopt, Assume responsibility, Behave according to , Choose, Commit, Desire, Exhibit loyalty, Express, Initiate, Prefer, Seek, Show concern, Show continual desire to, Use resources to 	<p><i>Definition:</i> Conceptualizes the value and resolves conflict between it and other values.</p> <p><i>Sample Verbs:</i></p> <ul style="list-style-type: none"> .Adapt .Adjust .Arrange .Balance .Classify .Conceptualize .Formulate .Group .Organize .Rank .Theorize 	
<p><i>Definition:</i> Selectively attends to stimuli.</p> <p><i>Sample Verbs:</i></p> <ul style="list-style-type: none"> .Accept .Acknowledge .Be aware .Listen .Notice .Pay attention .Tolerate 				

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

RECOMMENDED MAPPING OF PLOS ON CORE COURSES

- CS 100 Computational Problem Sol: PLO1, PLO3, PLO5
- CS 200/EE 201 Intro. To Programming: PLO1, PLO2, PLO3, PLO5
- CS/EE 202 Data Structures: PLO1, PLO2, PLO3
- BIO 100 Biology Laboratory: PLO1, PLO9 & PLO10
- BIO 101 Introductory Biology: PLO1 & PLO3
- CHEM 100 Exp. Chemistry Lab.: PLO1 & PLO10
- CHEM 101 Principles of Chemistry: PLO1
- PHY 100 Exp. Physics Lab: PLO1, PLO2, PLO4 & PLO5
- PHY 101 Mechanics : PLO1
- PHY 104 Modern Physics: PLO1 & PLO2

RECOMMENDED MAPPING OF PLOS ON CORE COURSES

- PHY 204 Electricity & Magnetism: PLO1 & PLO2
- MATH 101 Calculus-I: PLO1 & PLO2
- MATH 102 Calculus-II: PLO1
- MATH 120 LA and Differential eqns: PLO1
- MATH 230 Probability : PLO1
- EE 100 Engineering Lab: PLO1 & PLO5