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EXAM REFORMS

NSAKCET adheres
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Reforms Guidelines

Outline

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Assessment strategy for Outcome Based Education

Improving Structure & Quality of Assessments

Assessing Higher Order abilities & Professional Skills

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Introduction

- Future engineering graduate not only need to be knowledgeable in his/her discipline, but also needs a new set of **soft, professional skills and competencies**
- Essential changes in engineering education in terms of
- **What to teach (content)**
- **How to teach (knowledge delivery)**
- **How to assess (student learning).**
- The digital initiatives of MHRD and AICTE have made available a very large number of Massive **MOOCs through SWAYAM**, that can help the colleges and teachers adopt innovative methodologies in the delivery of course.
- **Outcome based education-** a performance-based approach has emerged as a major reform model in the global engineering education scenario

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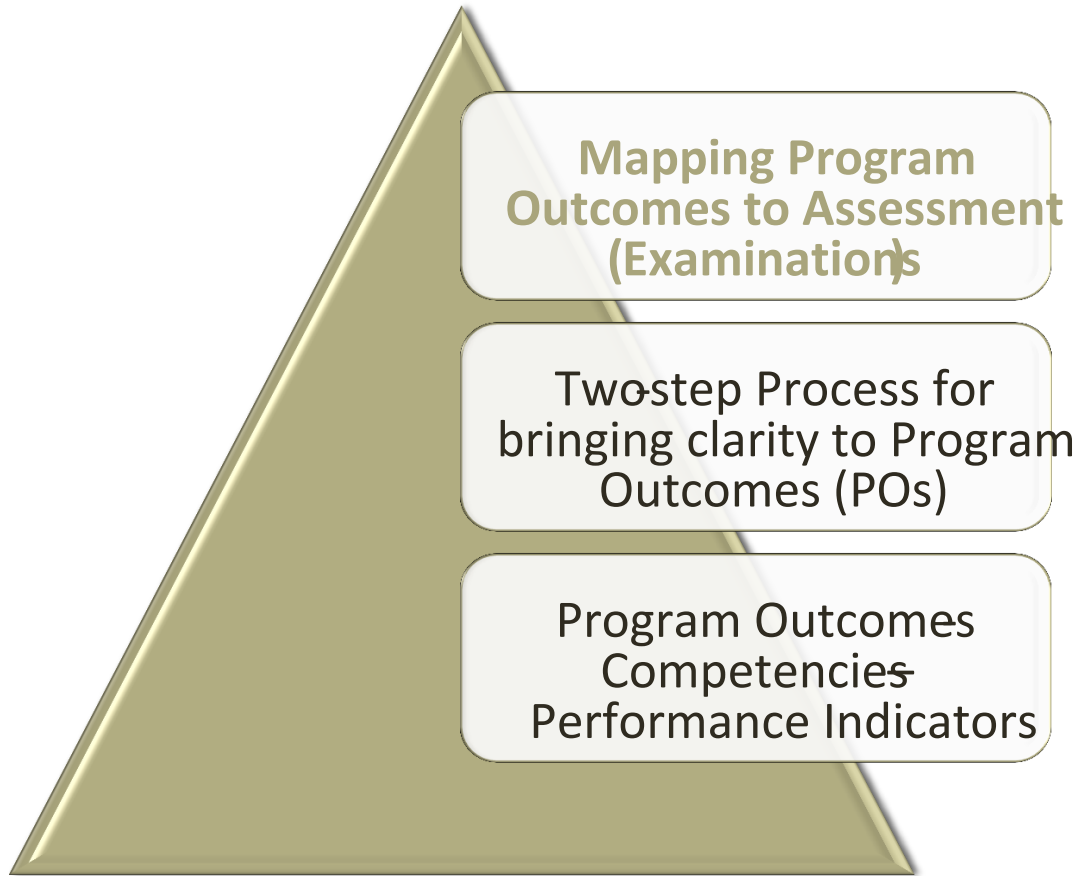
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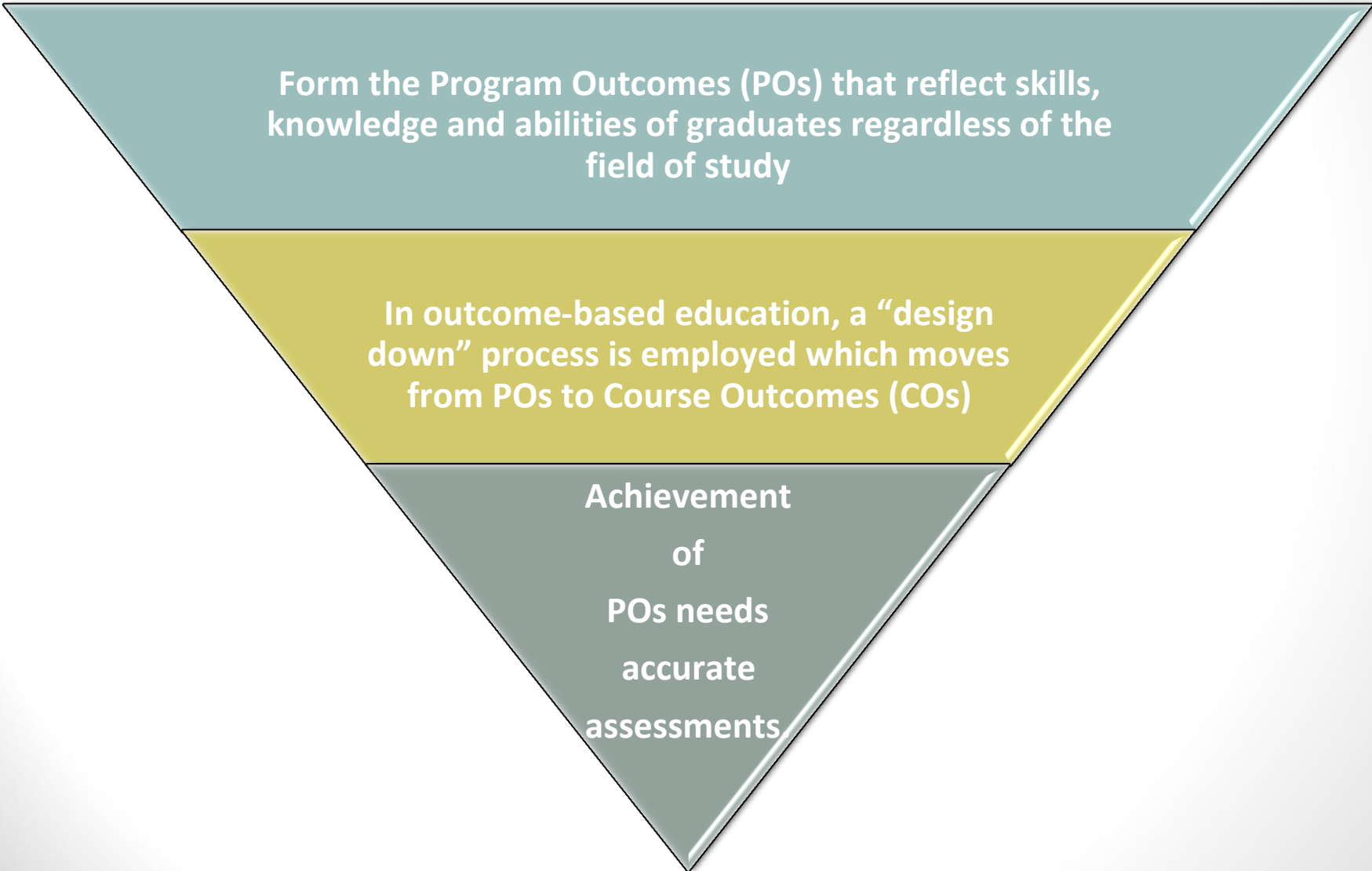
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Assessment strategy for Outcome Based Education



Assessment strategy for Outcome Based



Form the Program Outcomes (POs) that reflect skills, knowledge and abilities of graduates regardless of the field of study

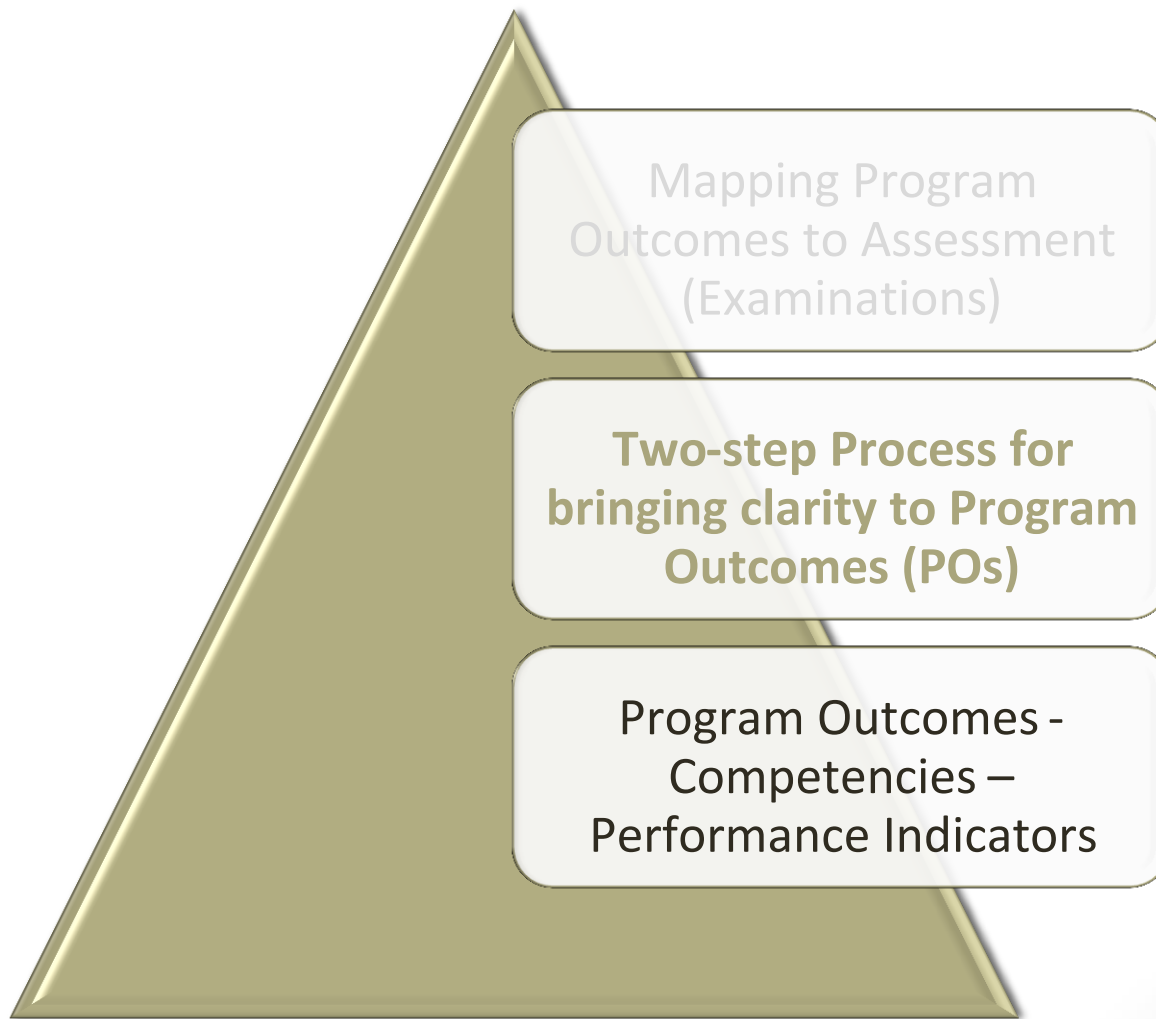
In outcome-based education, a “design down” process is employed which moves from POs to Course Outcomes (COs)

Achievement
of
POs needs
accurate
assessments

Education-

Mapping Program Outcomes to Assessment (Examinations)

Assessment strategy for Outcome Based Education



Assessment strategy for Outcome Based Education-

Two-step Process for bringing clarity to Program Outcomes (POs)

- 1. **Identify *Competencies to be attained***: For each PO define *competencies* -different abilities implied by program outcome statement that would generally require different assessment measures.
- 2. **Define *Performance Indicators***: For each of the *competencies* identified, define Performance Indicators (PIs) that are explicit statements of expectations of the student learning.

Assessment strategy for Outcome Based Education-

Two-step Process for bringing clarity to Program Outcomes (POs)

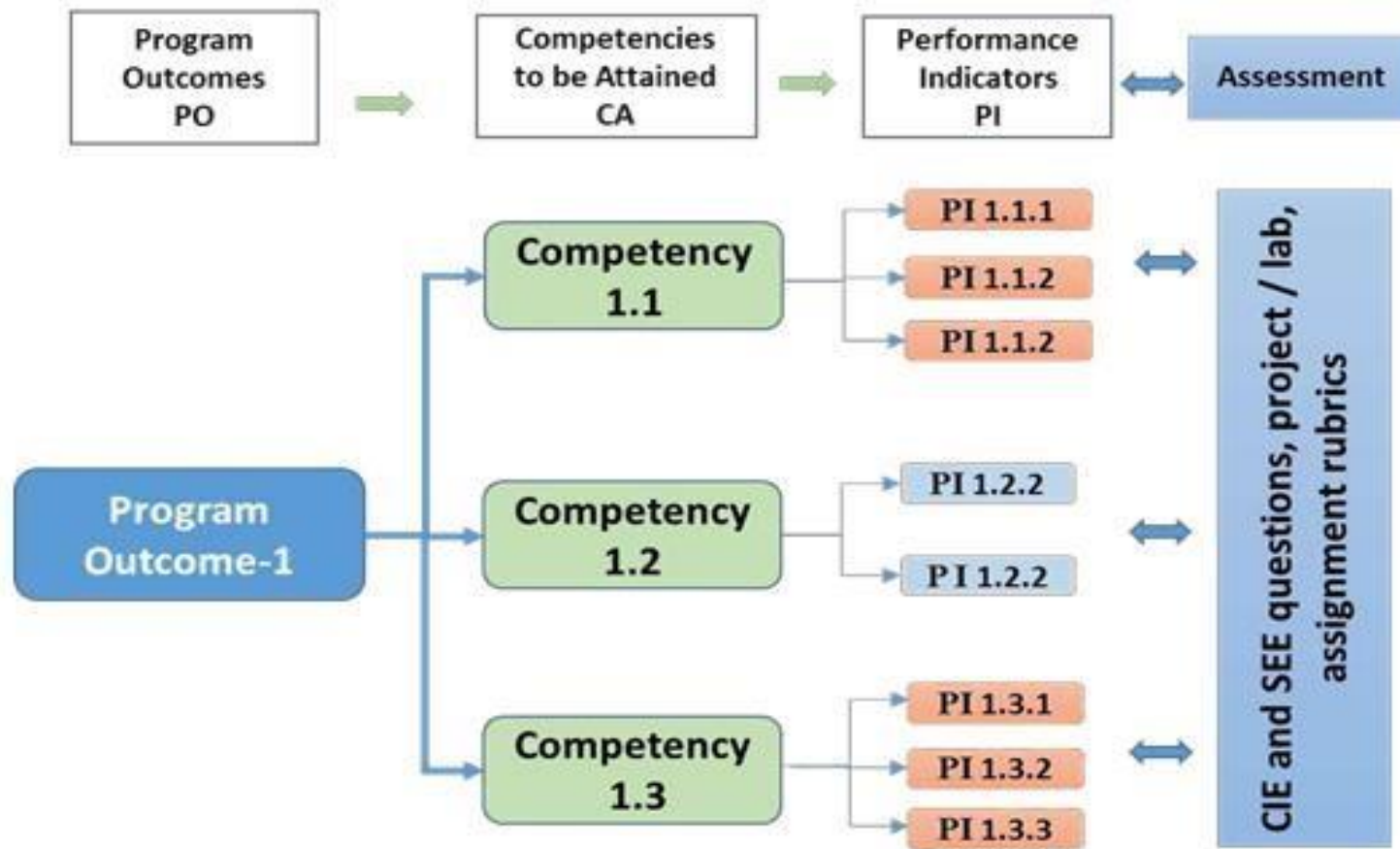
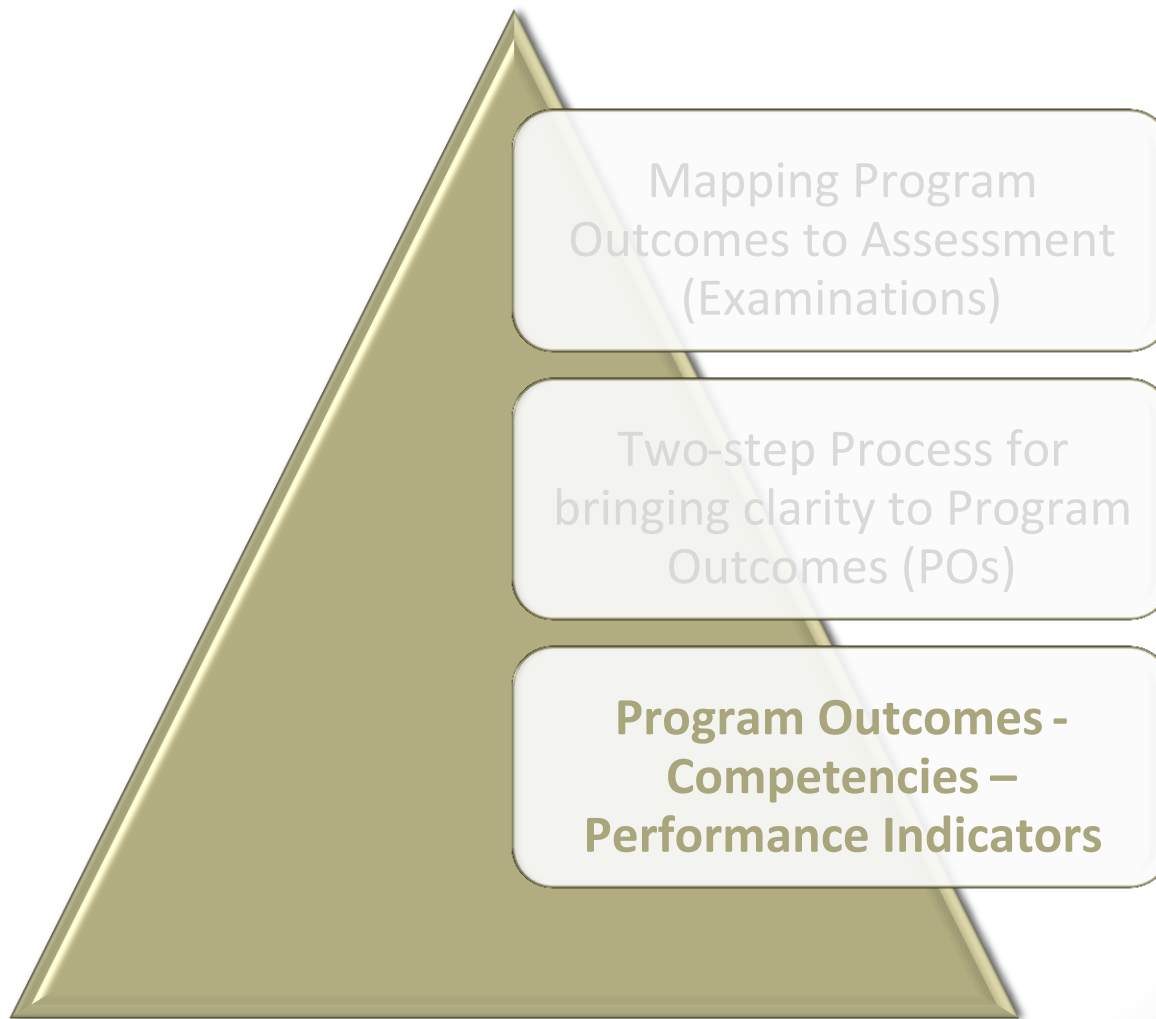


Fig.1 Connecting POs to Assessment

Assessment strategy for Outcome Based Education



Assessment strategy for Outcome Based Education-

Program Outcomes -Competencies – Performance Indicators

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

Competency	Indicators
1.2 Demonstrate competence in mathematical modelling	<p>1.2.1 Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems</p> <p>1.2.2 Apply the concepts of probability, statistics and queuing theory in modeling of computer based system, data and network protocols.</p>
1.5 Demonstrate competence in basic sciences	1.5.1 Apply laws of natural science to an engineering problem
1.6 Demonstrate competence in engineering fundamentals	1.6.1 Apply engineering fundamentals
1.7 Demonstrate competence in specialized engineering knowledge to the program	1.7.1 Apply theory and principles of computer science engineering to solve an engineering problem

Assessment strategy for Outcome Based Education-

Program Outcomes -Competencies – Performance Indicators

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Competency	Indicators	
5.4 Demonstrate an ability to identify / create modern engineering tools, techniques and resources	5.4.1	Identify modern engineering tools, techniques and resources for engineering activities
	5.4.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
5.5 Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.5.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
	5.5.2	Demonstrate proficiency in using discipline specific tools
5.6 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.6.1	Discuss limitations and validate tools, techniques and resources
	5.6.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

Assessment strategy for Outcome Based Education-

Program Outcomes -Competencies – Performance Indicators

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Competency	Indicators
6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level
6.2 Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public

Some Examples of Suggestive list of competencies and PI for Computer SC

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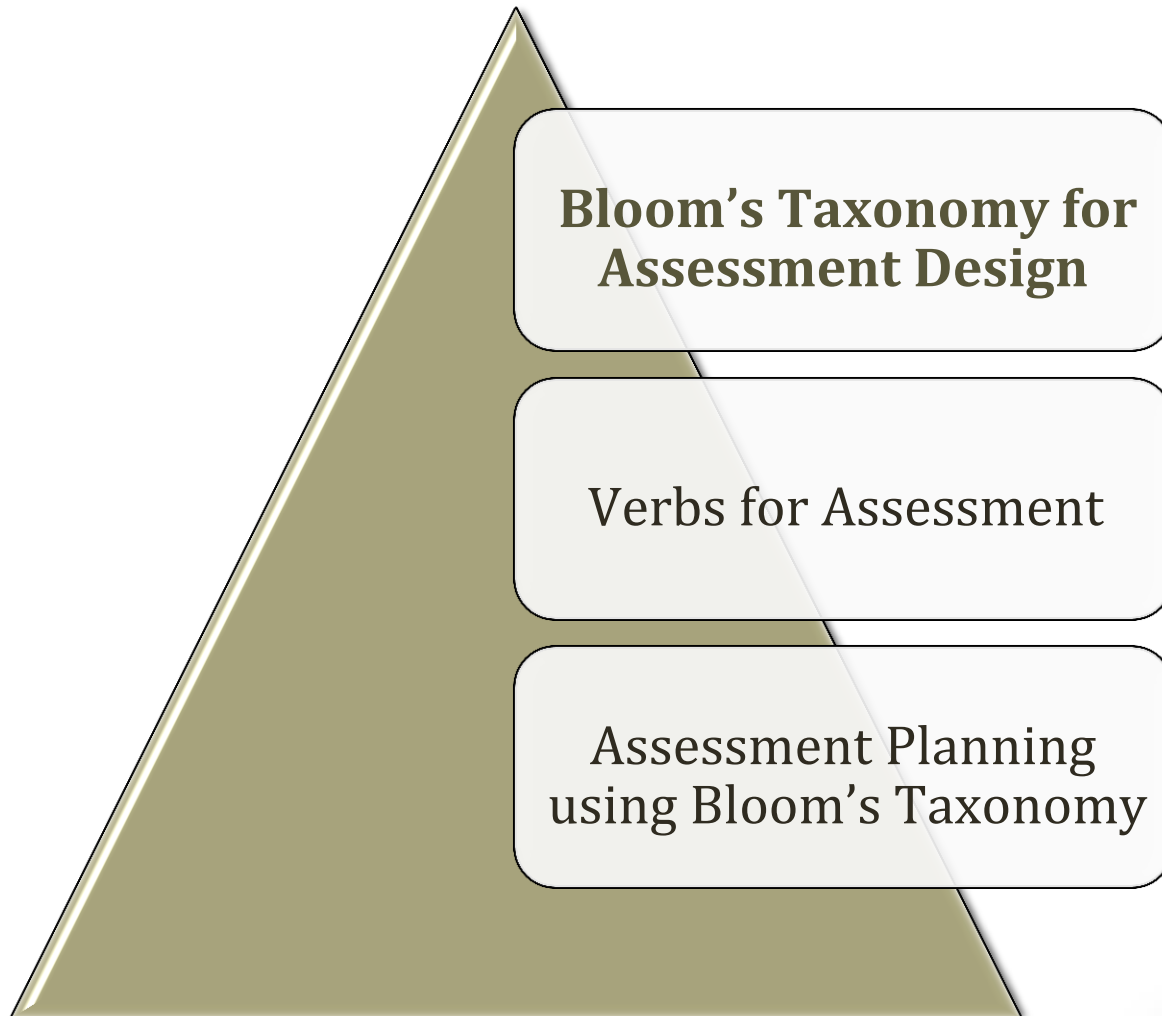
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Improving Structure & Quality of Assessments



Improving Structure & Quality of Assessments-

Bloom's Taxonomy for Assessment Design

Level	Descriptor	Level of attainment
1	Remembering	Recalling from memory of previously learned material
2	Understanding	Explaining ideas or concepts
3	Applying	Using information in another familiar situation
4	Analysing	Breaking information into part to explore understandings and relationships
5	Evaluating	Justifying a decision or course of action
6	Creating	Generating new ideas, products or new ways of viewing things

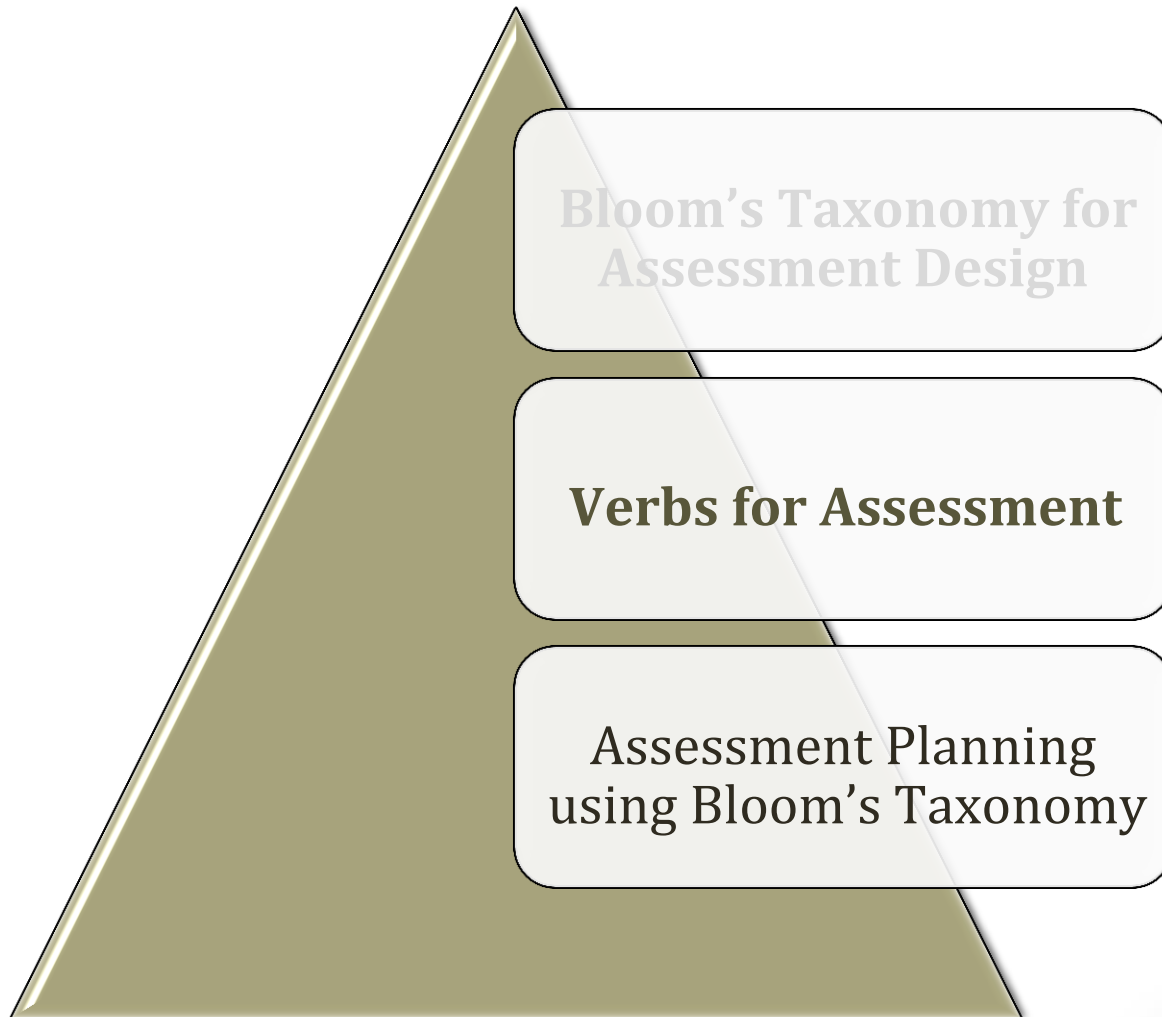
Improving Structure & Quality of Assessments-

Bloom's Taxonomy for Assessment Design



Fig. 2, Revised Bloom's Taxonomy

Improving Structure & Quality of Assessments



Improving Structure & Quality of Assessments-

Level	Skill Demonstrated	Question Ques / Verbs for tests
1. Remember	<ul style="list-style-type: none">• Ability to recall of information like, facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria• ability to recall methodology and procedures, abstractions, principles, and theories in the field• knowledge of dates, events, places• mastery of subject matter	list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when, where, etc.
2. Understand	<ul style="list-style-type: none">• understanding information• grasp meaning• translate knowledge into new context• interpret facts, compare, contrast• order, group, infer causes• predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss

Improving Structure & Quality of Assessments-

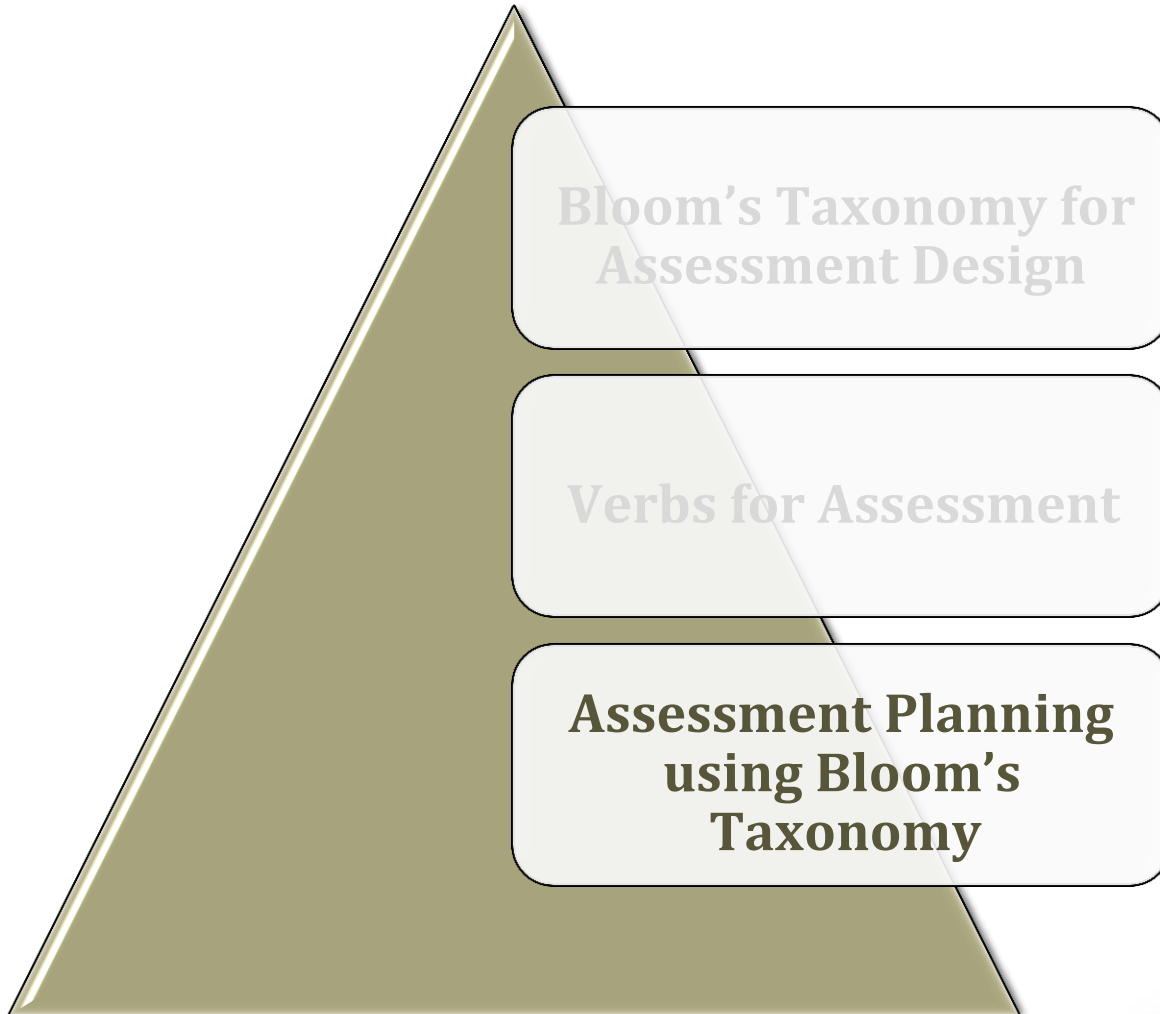
Action Verbs for Assessment

Level	Skill Demonstrated	Question Ques / Verbs for tests
3. Apply	<ul style="list-style-type: none">• use information• use methods, concepts, laws, theories in new situations• solve problems using required skills or knowledge• Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify
4. Analyse	<ul style="list-style-type: none">• break down a complex problem into parts. Identify the relationships and interaction between the different parts of complex problem.• identify the missing information, sometimes the redundant information and the contradictory information, if any.	classify, outline, break down, categorize, analyze, diagram, illustrate, infer, select

Improving Structure & Quality of Assessments-

Level	Skill Demonstrated	Question Ques / Verbs for tests
5. Evaluate	<ul style="list-style-type: none">• compare and discriminate between ideas• assess value of theories, presentations make• choices based on reasoned argument verify value of evidence recognize subjectivity use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate
6. Create	<ul style="list-style-type: none">• use old ideas to create new ones• combine parts to make (new) whole,• generalize from given facts relate knowledge from several areas predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

Improving Structure & Quality of Assessments



Improving Structure & Quality of Assessments-

Assessment Planning using Bloom's Taxonomy

- While using Bloom's taxonomy framework in planning and designing of assessment of student learning, following points need to be considered:
- Normally the **first three learning levels**; remembering, understanding and applying and to some extent fourth level analysing are **assessed in the Continuous Internal Evaluation (CIE) and semester End Examinations (SEE)**, where students are given limited amount of time.

- And **last three learning levels** abilities; analysis, evaluation and creation can be assessed in extended course works or in variety of student works like **course projects, mini / minor projects, internship experience and final year projects.**

Improving Structure & Quality of Assessments-

Assessment Planning using Bloom's Taxonomy

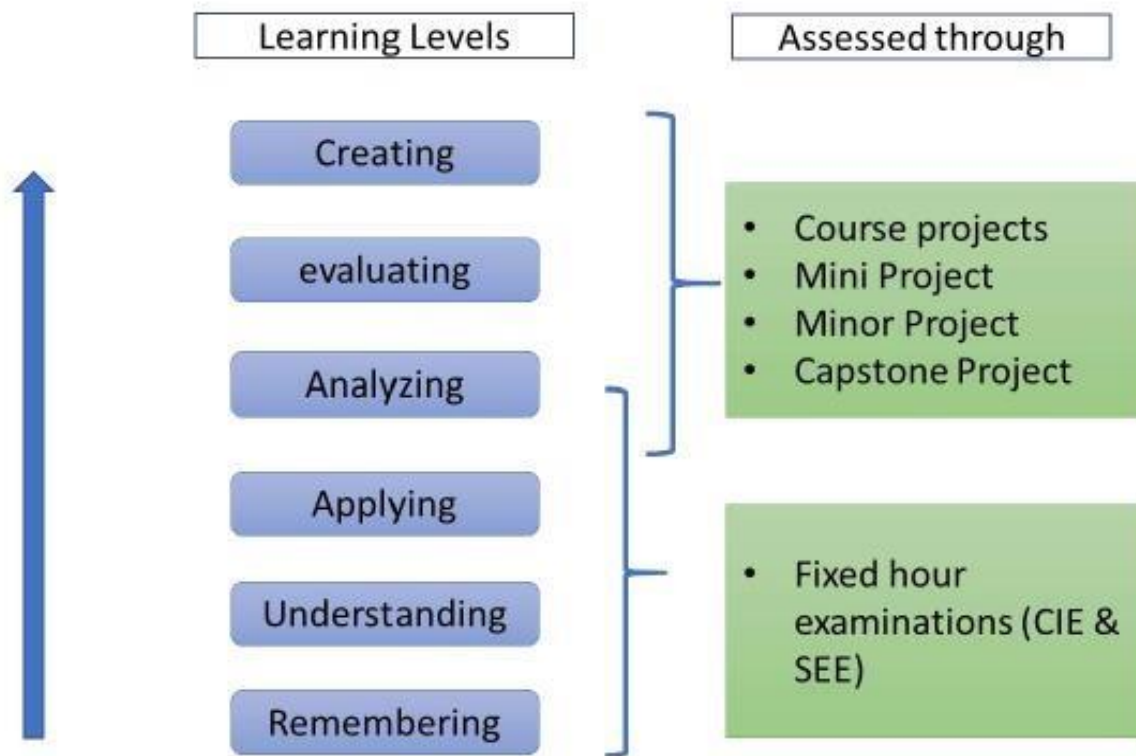


Fig. 3 Assessment methods for different Bloom's cognitive levels

Improving Structure & Quality of Assessments-

Assessment Planning using Bloom's Taxonomy

- Before adopting this framework for reforms in examination system of a University/Institution, it is worthwhile to study the present pattern of assessment in each of the course in the program to gain insight about:
 - a) Alignment of assessment questions with course learning outcomes
 - b) Whether all the learning outcomes are tested; sometimes some learning outcomes are over tested at the expense of others which may be not tested at all.

Improving Structure & Quality of Assessments-

- c) Overall weightage in the assessment, to each of the Bloom's learning levels
- d) Assessment methods used to adequately assess the content and desired learning outcomes

Assessment Planning using Bloom's Taxonomy

- Examination paper must consist of various difficulty levels to accommodate the different capabilities of students.
- Bloom's taxonomy framework helps the faculty to set examination papers that are well balanced, testing the different cognitive skills without a tilt towards a tough or easy paper perception.

Improving Structure & Quality of Assessments-

- It is recommended that at institution/ University level, upper limit need to be arrived for lower order skills (for example, no more than 40% weightage for knowledge-oriented questions).
- **Examples of typical questions for each of the Bloom's cognitive level are given in Appendix-B Model question Papers are given in Appendix- C**

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APPENDIX-Assessing Higher Order abilities & Professional Skills



**Innovative Educational
experiences to teach and
Assess**

Using Scoring Rubrics as
Assessment tool

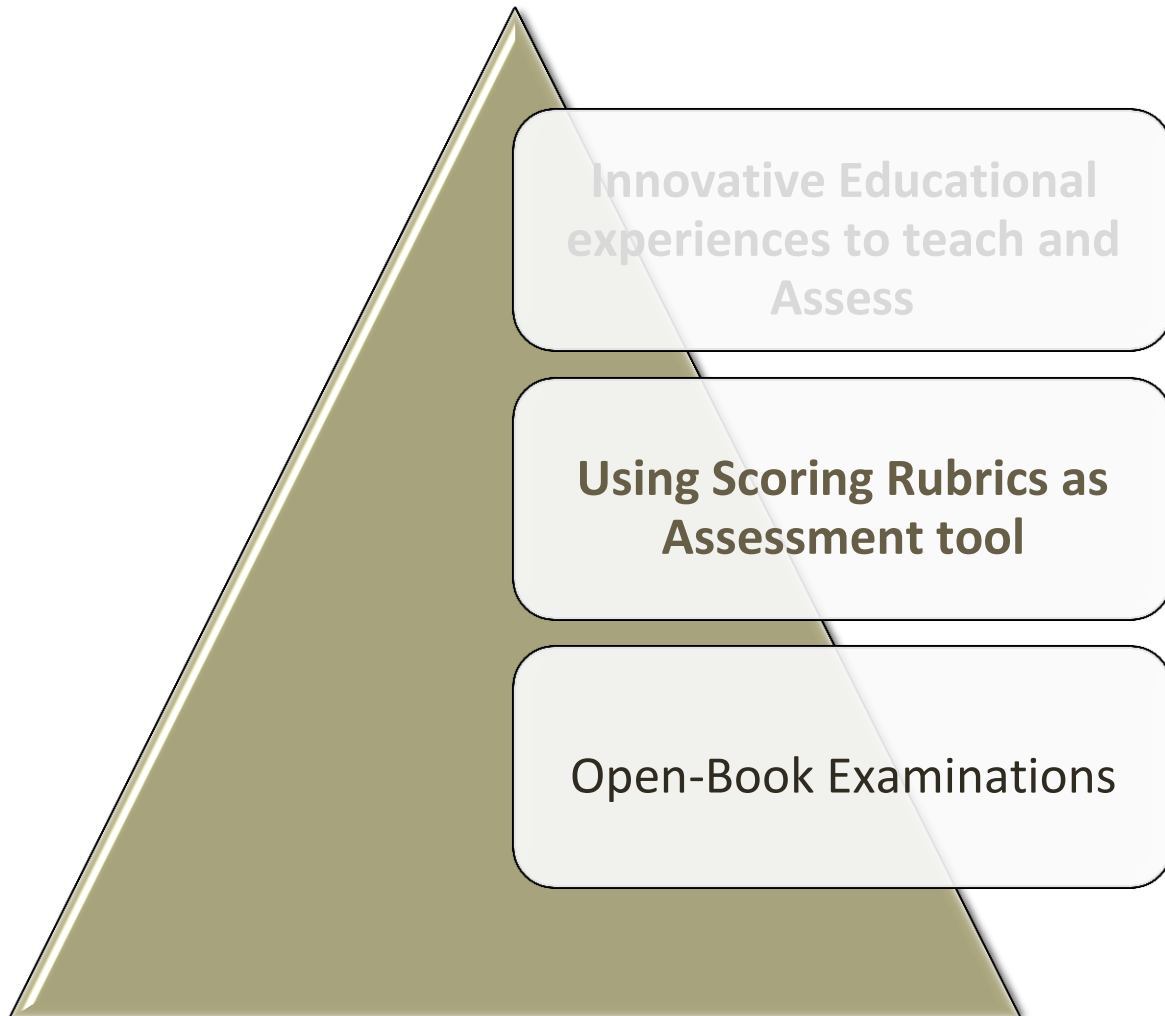
Open-Book Examinations

Assessing Higher Order abilities & Professional Skills

Innovative Educational experiences to teach and Assess

- Following are the few educational experiences that are recommended to teach and assess professional outcomes and higher order cognitive abilities:
- Course projects
- Project-based learning modules
- MOOCS
- Co-Curricular experiences
- Mini / Minor projects
- Final year projects
- Internship experiences

Assessing Higher Order abilities & Professional Skills



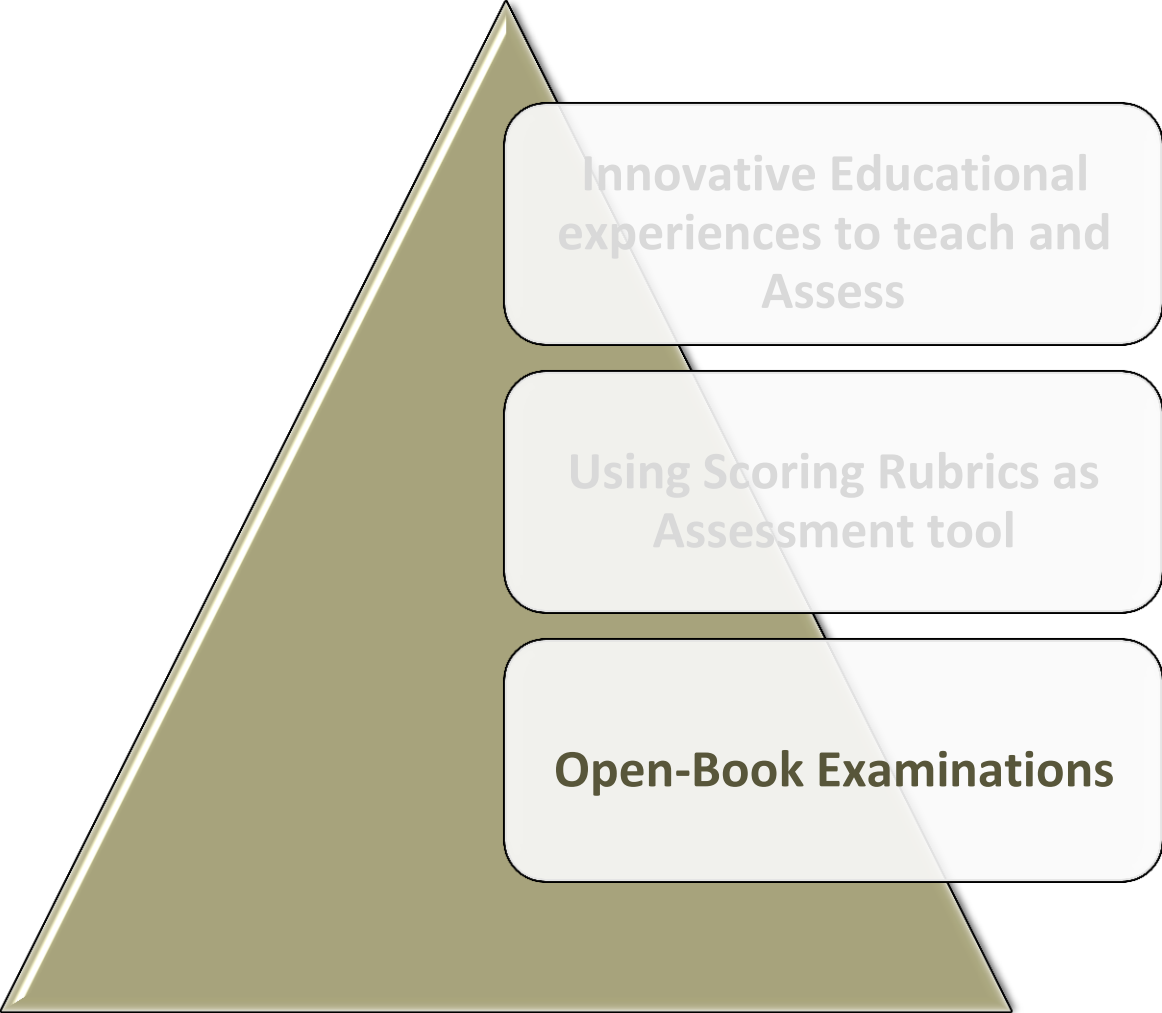
Assessing Higher Order abilities & Professional Skills

Using Scoring Rubrics as Assessment tool

- **Rubrics** provide a powerful tool for assessment and grading of student work.
- There are **three components within rubrics** namely
 - (i) **criteria / performance Indicator**: the aspects of performance that will be assessed
 - (ii) **descriptors**: characteristics that are associated with each dimension
 - (iii) **scale/level of performance**: a rating scale that defines students' level of mastery within each criterion.

Examples of Rubrics (Accessed from Rogers (2010))

Communication Skills				
	Unsatisfactory 1	Developing 2	Satisfactory 3	Exemplary 4
Performance criteria	<div>Scales</div>			
Performance criteria				
Performance criteria				
Performance criteria				
<div>Dimensions</div>		<div>Descriptors</div>		



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- <https://www.aicteindia.org/sites/default/files/ExaminationReforms.pdf>