



# OUTCOME BASED EDUCATION (OBE)

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## What do Engineers do?

- Prepare/ Make products/systems (plan, design, develop, manufacture, test, install, operate, maintain)
- Offer technical services
- Solve socially relevant complex technical problems (providing a solution to flash flooding of Warangal )
- All the above activities are to be performed under **well - defined professional and ethical standards**

## Characteristics of Good Engineer considered important by the industries:

- Have **sound knowledge** of engineering sciences and technologies.
- Ability to solve **well defined and ill-defined problems.**
- Have awareness of **customers' needs** and market trends.
- Have an interest and awareness in **all facets of engineering activities.**
- Ability to **work in a team.**
- Ability **to document, plan and communicate** effectively.
- Willingness and ability **to learn** on the job.

## Traditional view of education Vs OBE view:

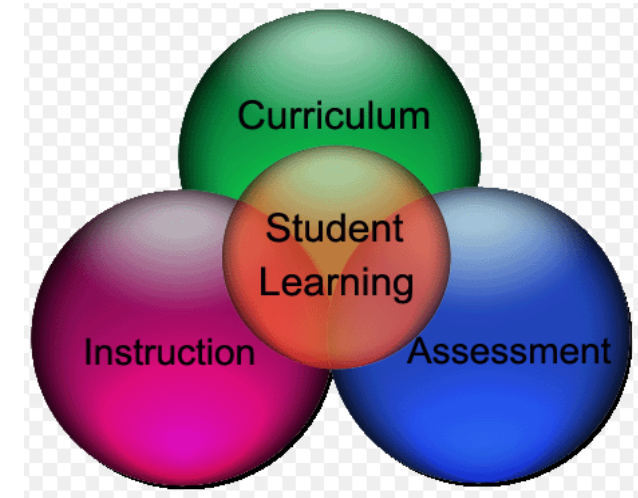
<b>Traditional View</b>	<b>OBE View</b>
<b>Instruction</b>	<b>Learning</b>
<b>Inputs and Resources</b>	<b>Learning Outcomes</b>
<b>Knowledge is transferred by the teacher</b>	<b>Knowledge already exists in the mind of the learners</b>
<b>Teacher dispenses knowledge</b>	<b>Teachers are designers of methods</b>
<b>Teachers and students are independent and in isolation</b>	<b>Teacher and students work in terms.</b>

## Undergraduate Programs (UG)

Undergraduate Engineering Programs are required to impart

- Knowledge (K)
- Skills (S)
- Qualities (Q)

That facilitate the graduates to acquire characteristics of a good engineer.



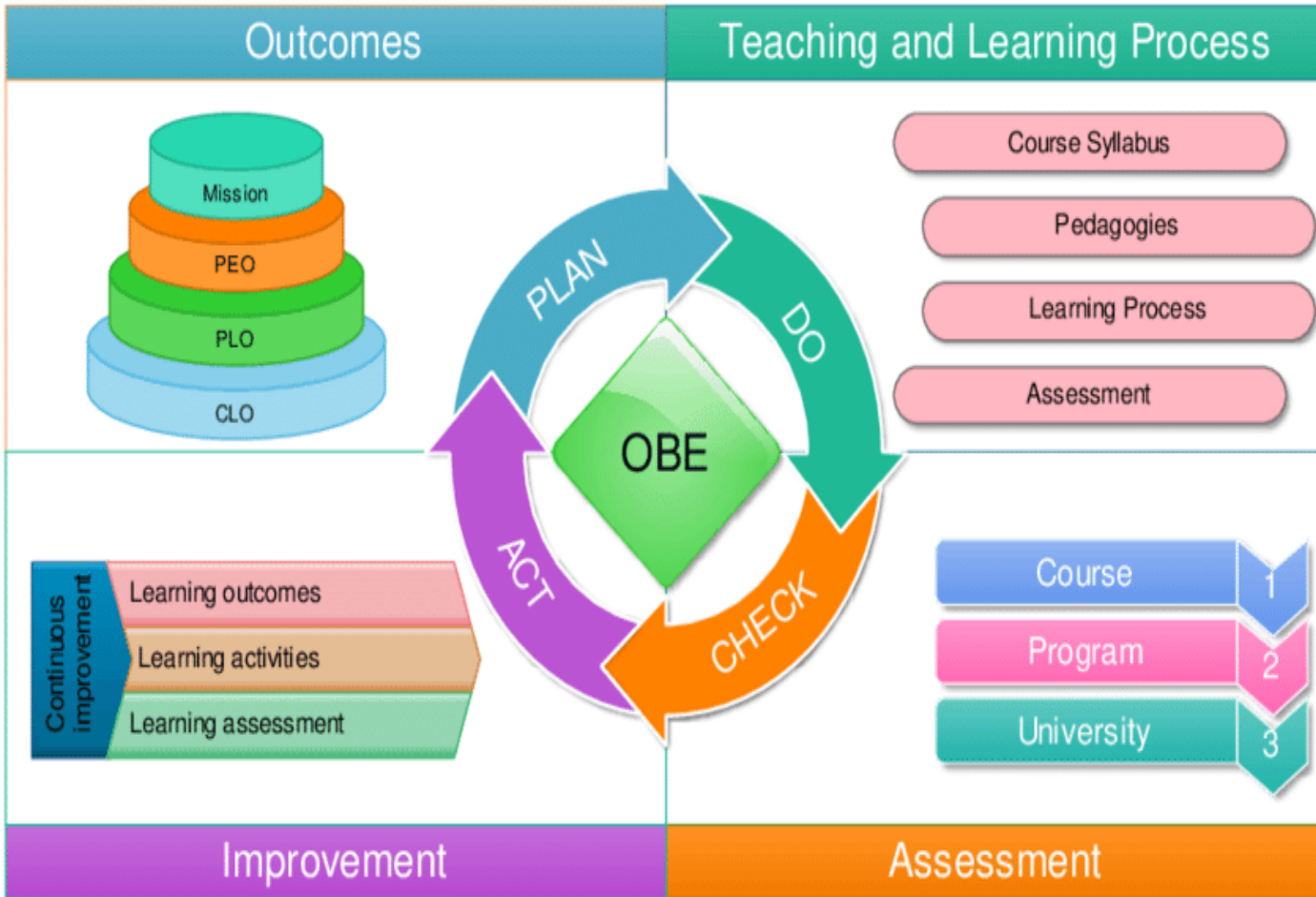
## Outcome based education:

- An outcome is what the learner will be able to do/perform as a result of some learning experience
- An outcome of an education is what the student should be able to do at the end of a program/ course/ instructional unit.
- Outcome-based education is an approach to education in which decisions about the curriculum are driven by the exit learning outcomes that the students should demonstrate at the end of the program/ course.
- In outcome-based education, “product defines process”.

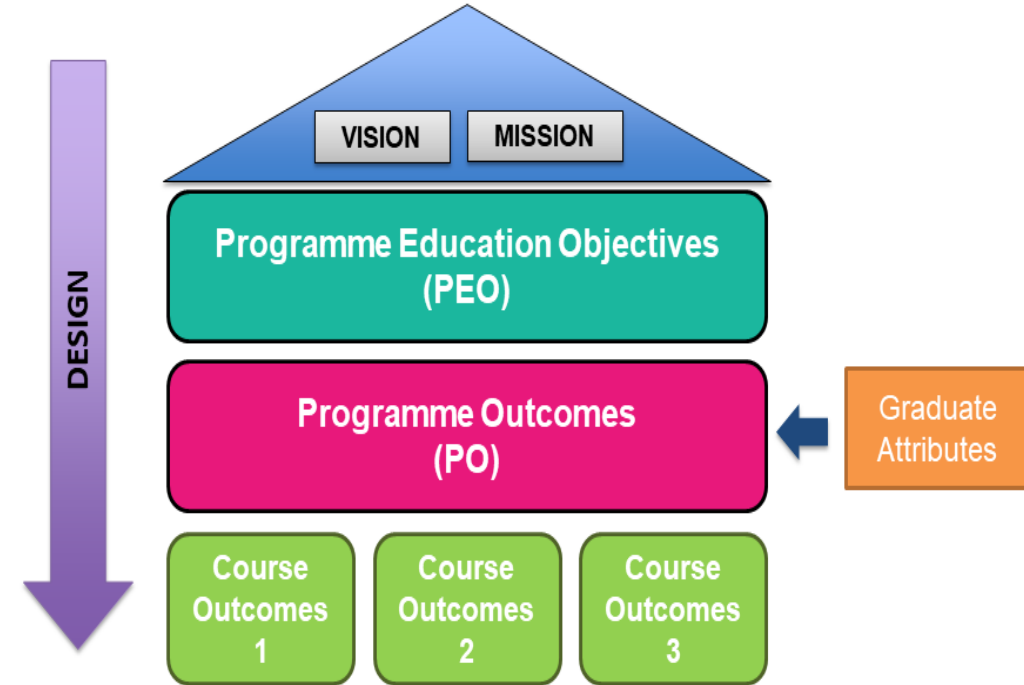
## Levels of Outcomes:

- **Program Educational Objectives:** PEOs are broad statements that describe the career and professional accomplishments in four to five years after graduation that the program is preparing graduates to achieve.
- **Program Outcomes:** POs are statements that describe what the students graduating from engineering programs should be able to do at the time of graduation.
- **Program Specific Outcomes:** PSOs are statements that describe what the graduates of a specific engineering program should be able to do at the time of graduation.
- **Course Outcomes:** COs are statements that describe what students should be able to do at the end of a course.

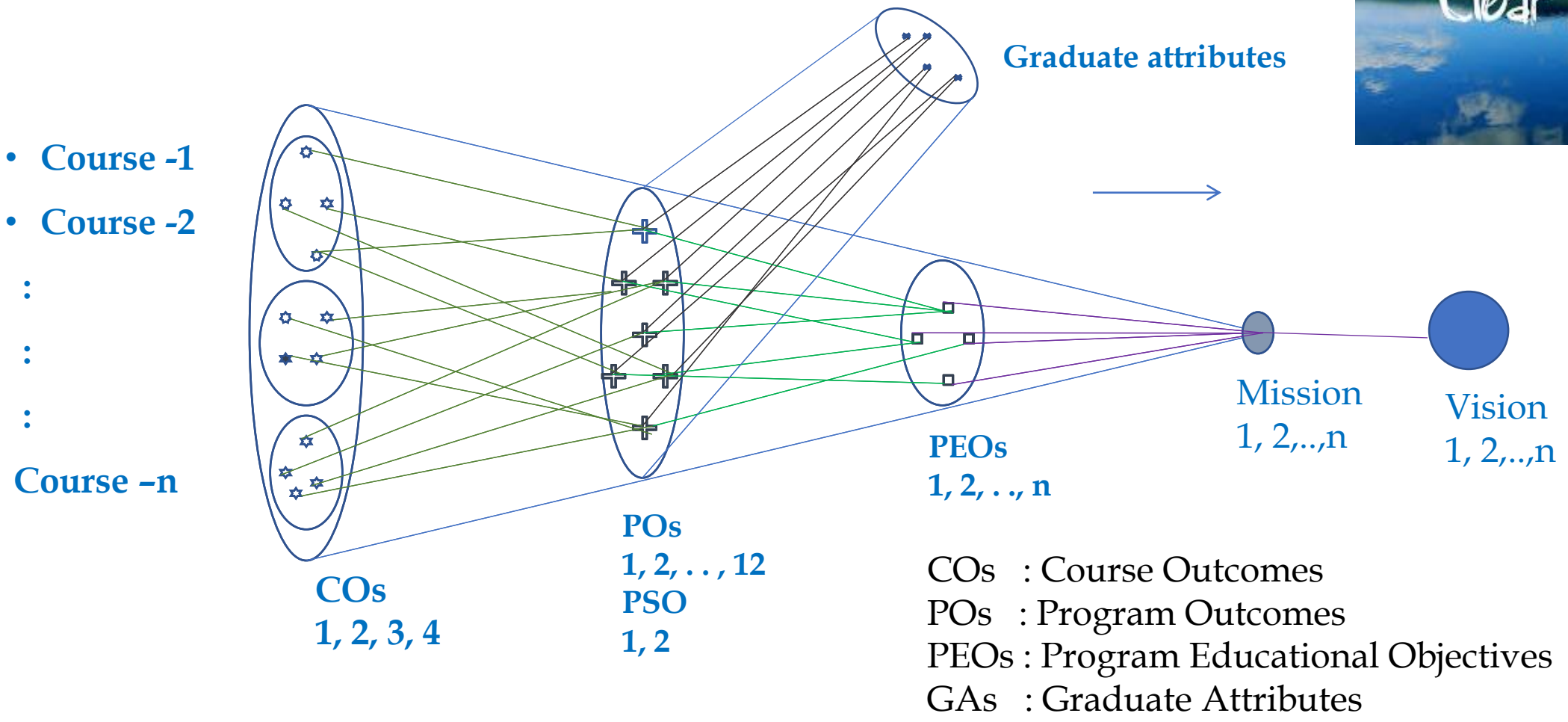
## Process - OBE



## Key Constituents of Outcome-based Education (OBE)



# Correlation : COs, POs, PEOs, GAs and Mission





## Program Educational Objectives (PEOs)

- These statements describe the career and professional accomplishments of the graduates which can be achieved **in four to five years after completion of their graduation.**
- These are program specific.
- These are 3-4 in number for each program



## PEOs

### Mechanical Engineering:

- Provide comprehensive knowledge in basic sciences, mechanical engineering and multi disciplinary areas.
- Apply modern tools and techniques to design, analyze, interpret and solve mechanical and allied engineering problems and communicate them effectively.
- Impart responsibility towards socio-technical, economical, environmental and energy related issues
- Inculcate professionalism, ethical attitude, team spirit and lifelong learning to achieve career goals.

## Program Outcomes (POs)

- POs are what graduates of any engineering program should demonstrate at the time of graduation.
- Specifications of the abilities that a fresh engineering graduate must possess
- POs relate to KNOWLEDGE, SKILLS and QUALITIES (KSQs) that the student is expected to acquire through the programme
- Only five of twelve POs are dominantly disciplinary outcomes, and the remaining seven are professional outcomes also known as generic or transferable (skills) outcomes.

## Complex Engineering Problems - Examples

- **GLOBAL WARMING / POLLUTION / TRAFFIC PROBLEMS / TRANSPORTATION**
- Plan for supplying water for irrigation and drinking to a group of villages in an arid zone.
- Design an instrumentation system for managing available water and its utilization in a river basin.
- Design a machine tool for a given specific requirements.
- Evaluate alternate solutions to control pollution.

## PROGRAM OUTCOMES (Pos)

- The first 5 POs are directly related to engineering skills ( i.e., Domain dependent) and are emphasized in curriculum and teaching-learning process

**PO1: Engineering knowledge**

**PO2: Problem analysis**

**PO3: Design/development of solutions**

**PO4: Conduct investigations of complex problems**

**PO5: Modern tool usage**

- These 5 POs lay the foundation of engineering education
- They are vital to engineering profession and are of utmost importance



# Outcome Based Education - OBE

## Engineering Skill related -5 POs

Number	Domain	Explanation
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/ development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage	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.

# Non-Engineering related - 7 POs

The remaining 7 POs (PO6-PO12) are primarily non-engineering skills (i.e., Domain independent) deal with the concern, soft skills, life skills, life-long learning and managerial skills Should be addressed through proper TLP

**PO6: The engineer and society**

**PO7: Environment and sustainability**

**PO8: Ethics**

**PO9: Individual and team work**

**PO10: Communication**

**PO11: Project management and finance**

**PO12: Life-long learning**

Create comparisons



Number	Domain	Explanation
PO6	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.
PO7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and teamwork	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicate effectively 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.
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning	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.

Non -Engineering Skill related - POs



## Course Outcomes (COs)

- These statements indicate the knowledge, skills and qualities(KSQs) which the students are expected to know and demonstrate as a result of learning at the end of the course.
- **Each course has four units of contents**
  - Each unit of contents is identified with a CO
  - 4 COs for each course of the program
- **All the COs are**
  - made observable and measurable
  - written at higher order cognitive level as per Bloom's Revised Taxonomy

## Course Outcomes (COs) COs

### Ex. U18ME503 THEORY OF METAL CUTTING

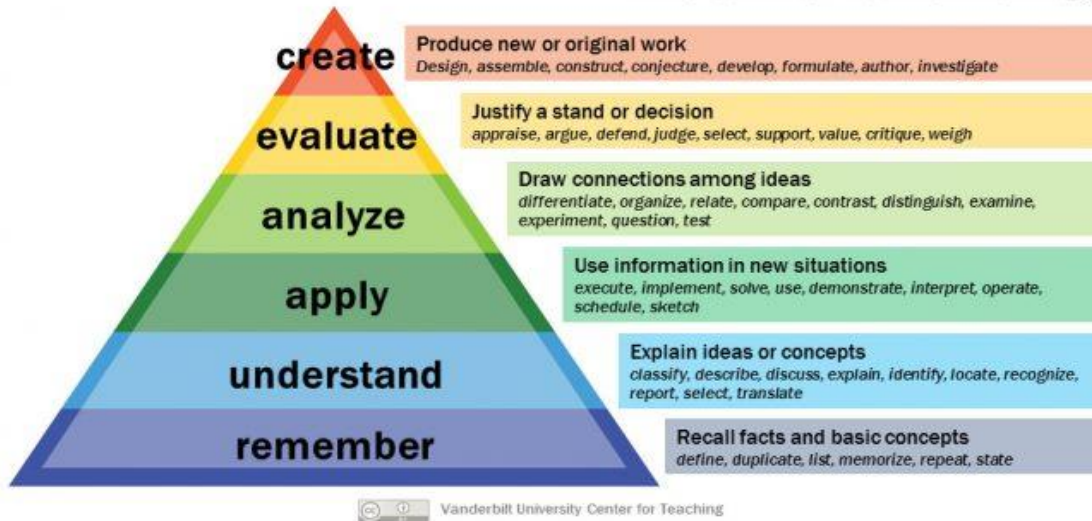
On completion of the course, the students will be able to...

#### Course Learning Outcomes (COs):

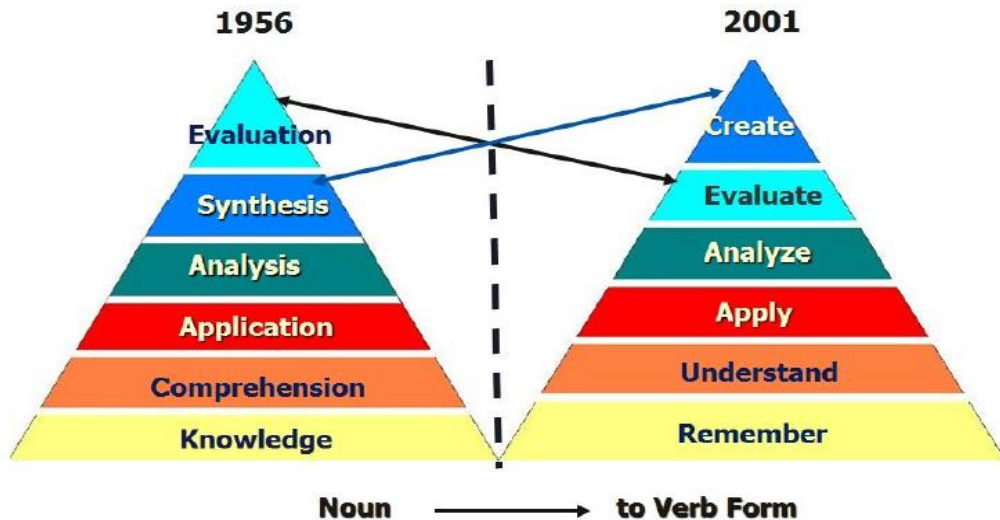
On completion of this course, students will be able to...

- CO1: categorize tool materials, draw tool geometry in various reference systems and interpret chip formation process*
- CO2: analyze Merchant's circle and measure various cutting forces & temperature*
- CO3: determine tool wear, tool life, machinability & optimum cutting speed for maximum production rate & minimum cost criteria*
- CO4: distinguish principles & applications of various modern machining processes*

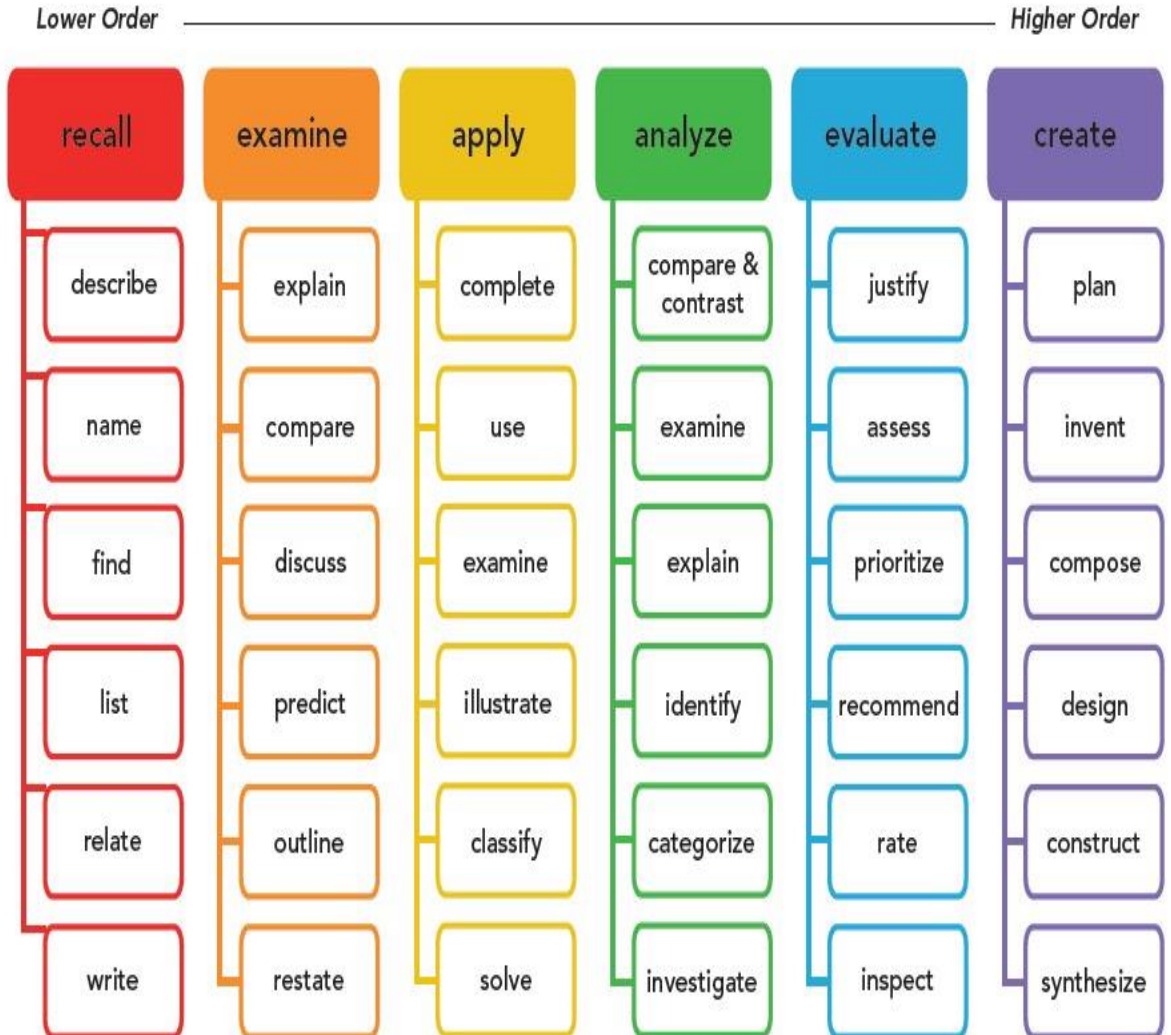
## Bloom's Taxonomy



## Blooms Cognitive Domain Revisions



## Generating LOs using Bloom's Cognitive Taxonomy (adapted 2019)



Retrieved from <http://maasd.edublogs.org/2012/26/linking-ipads-blooms-taxonomy/>

## Implementation of OBE at KITSW



## Implementation of OBE - Teaching –Learning Process (TLP)

Through effective course teaching-learning activities, the faculty at KITSW,

- Interact with industry experts
- Identify the industry relevant knowledge, skills and Qualities (KSQs)
- facilitate active learning
- Make course students ready for industry imparting relevant KSQs
- Ensure that the identified KSQs are demonstrated by course students through a valid and reliable assessment

### Course Web Portal

- Students are given access to CourseWeb portal
- Faculty updates the course portal with relevant information supporting the TLP

### Essential components of TLP

- Course introduction video
- ATLP assignments: Assignment based teaching learning
  - Lecture wise assignment
  - To test whether student achieved the lecture outcomes
- Tutorial classes
  - Tutorial sheets

- **Essential components of TLP *contd...***
  - Assignments – CODING BASED
  - Self-learning topics
  - Special Assignments
    - Course Research Papers (CRPs) – summarizing CRPs related to course
    - Course Patents (CPs) - summarizing CPs related to course
  - Course Projects
- **Essential components of TLP *contd...***
  - Table of Specifications (ToS)
    - Question paper Mapping COs and Cognitive domain learning level
    - Assessment templates
  - Assessments
    - Assignments, Minor exams, mid semester exams, end semester exams



## Course Outcomes (COs)

In a nutshell, the TLP focuses on imparting

- Domain dependent skills (PO1-PO5) and PSOs
- Some of the domain independent skills (PO6-PO12)
- **KSQ Table...**
  - Identifies domain dependent skills to be imparted through teaching
  - Also some of the domain independent skills through TLP
  - Lecture wise objectives and outcomes are identified
  - Self-learning topics are identified and provided to students well in advance to inculcate life-long learning



## Table of Specifications (ToS)

- Provides detailed information about assessment of a particular course.
- MSE / MINOR / ESE / LAB EXAMS patterns are fixed and available in course web page

## Famous Quote -

- Tell me, and I forget
- Teach me, and I may remember
- Involve me and I learn



*--Benjamin Franklin*

***THANK YOU!!***