Outcome Based Education
and
NBA Accreditation Workshop
Hyderabad
14 September 2015

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Employability of Indian Engineering Graduates
A great Challenge before the nation

- India a young nation with 65% of population below the age of 35 years.

- Booz Allen Report, CII, FICCI, NASSCOM World Bank, TEQIP, Industry

- Demographic dividend or disaster

Why accreditation ??

- Quality Assurance
- Recognition by the stakeholders
- Branding
- Washington accord :
  India a signatory nation
- Recognition of graduates globally

Stake holders of an Institute to be satisfied

Students

Faculty

Support Staff

Industry and Employers

Parents

Government

Society

What is outcome based accreditation?

- **Outcome based education is student centered instruction that focuses on measuring student performance i.e. outcomes.**

- **Outcomes include knowledge, skills and attitudes.**

- **Outcome based accreditation – focus remains on evaluation of outcomes of the program, though Input and Output parameters are also important.**

Why outcome based accreditation

- Globalization has brought in a clear shift from education as transmission of expert knowledge to education as building learner competencies including learning to learn and life long learning.

  That means focus will have to be on

- Understanding fundamentals very well, and learning new skills/competencies that would enable individuals to cope with the demands of the rapidly changing workplace.

- Prepare global engineers who will have to solve problems and shoulder challenges which are not even known today!!

What is accreditation

- It assures Program Quality

What it is not ….

- Not a award system (Gold, Silver, 1,2,3,..)
- Not an Investigation of a complaint
- Not a *Regulatory Process.*
- Not an Audit
- ***Accreditation is not even a ranking system.***

Washington Accord
ABET - US

- ABET accreditation **provides assurance that a college or university** program **meets the quality standards** of the profession for which that program prepares its graduates.

IET UK

Accreditation is awarded to higher education programmes that meet the educational requirements of the UK Standard for Professional Engineering Competence (UK-SPEC). It centres on a review of a programme's content and delivery and includes areas such as relevance, coherence, challenge, assessment, staffing, quality assurance and resources.

Important Terms Used
in Accreditation Document : SAR

- Program Criteria
- Program Educational Objectives, **PEO**
- Graduate Profile
- Program Outcomes, **PO**
- Accreditation Criteria
- Course Outcomes, **CO**
- Assessment
- Evaluation

Vision, Mission Statements

- Statements help in defining aspirations and to remain focused

- Should be written in a simple language, easy to communicate and should define objectives which

    present near future of the Institute

- Vision statement is dream of where one wants the Institute to be and inspires all the stake holders

- Mission statements are actionable statements that guide the stake holders to act

How to formulate vision, mission

- Bottoms up approach
- Involve all stakeholders
- Discussion, Brain storming
- Gap analysis or SWOT analysis
- Challenges before the institute
- What are the immediate and long term goals
- Evolve vision, mission statements based on these discussions
- Strategic plan

What stakeholders look for

- **Infrastructure, Buildings and Facilities**

- **Faculty; Teaching Learning**

- **Industry Interaction; Brand**

- **Employability; Placement record**

- **What students can do after graduating??**

- **Whether institute provides all that is necessary for a confident engineer of tomorrow, prepare a 21st Century engineer**

Program Criteria

- Engineering Programs have their identities- Civil, Mechanical, Electrical, Computer Engineering etc
- Program Criteria judges if the program meets requirements for the title.

PEOs

- Why does Program exist? What is its relevance?
- Program Educational Objectives (PEOs) are the statements that describe the expected achievements of graduates within first few years of their graduation from the program.
- The PEOs, may be guided by global and local needs, vision of the Institution, long term goals etc.
- For defining the PEOs the faculty members of the program must continuously work with all stakeholders: local employers, industry, students and the alumni.
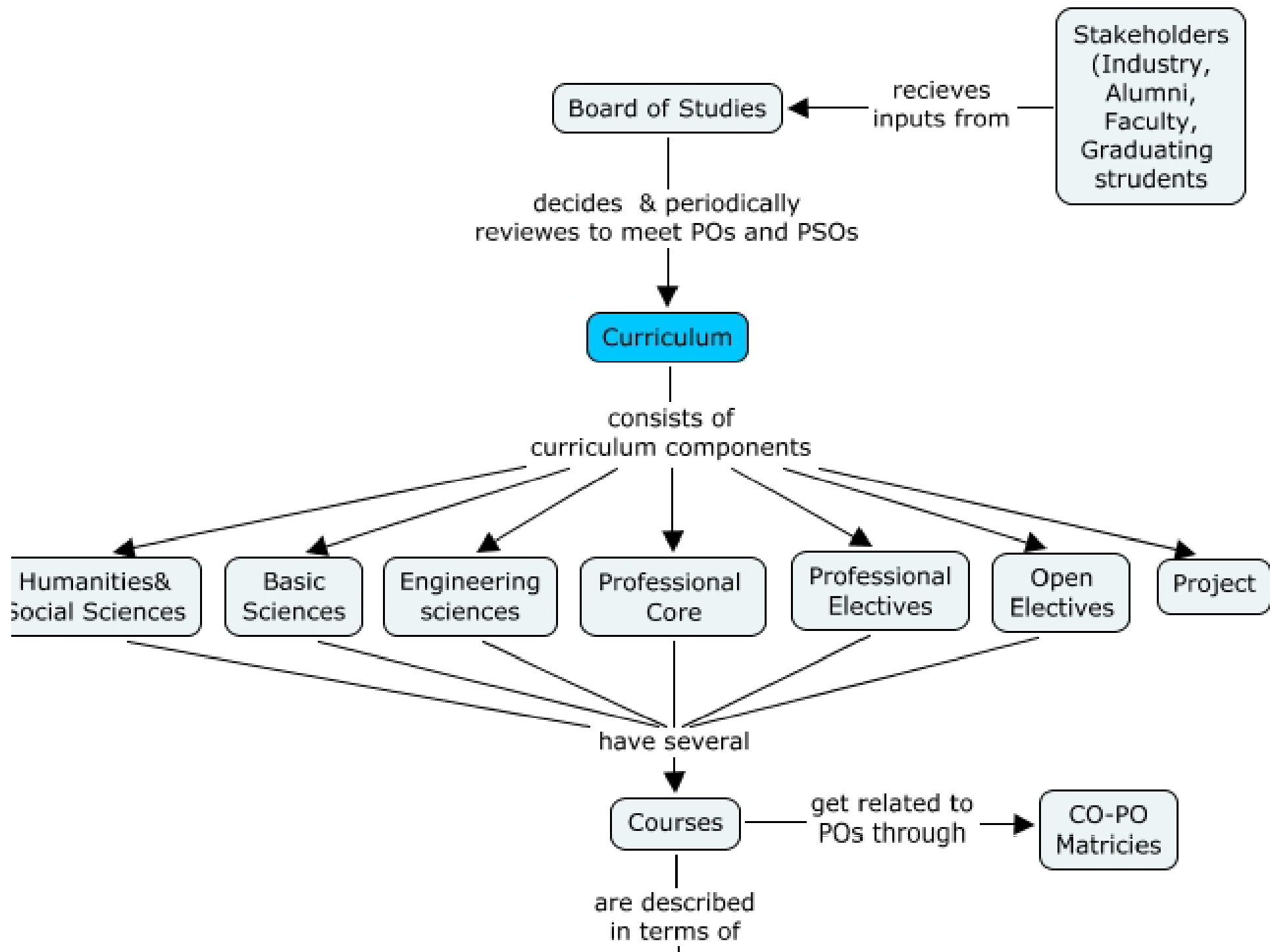
Processes for PEOs

- Feedback format for collecting data from stakeholders
- A process by which PEOs are created and reviewed periodically
- A process by which the curriculum is created to meet the stated PEOs
- A process to evaluate to what extent PEOs are attained
- Review, Mid correction, and Continuous Quality Improvement

Outcome based education emphasizes on

1. Stating what you want your students to be able to do at the end of the program?

2. Assessing the students whether they are able to do what they are expected to do.

3. Orienting teaching and other academic processes to facilitate students to do what they are expected to do.

Graduates of BTech/BE program in Mechanical Engineering will be able to

1. Engage in design and operation of systems, tools and applications in the field of mechanical engineering and allied engineering industries;

2. Apply the knowledge of mechanical engineering to solve problems of social relevance, pursue higher education and research;

3. Mechanical engineering graduates will work effectively as individuals and as team members in multidisciplinary projects;

4. Engage in lifelong learning, career enhancement and adopt to changing professional and societal needs.

Board of Studies

recieves inputs from

Stakeholders (Industry, Alumni, Faculty, Graduating strudents)

decides & periodically reviewes to meet POs and PSOs

Curriculum

consists of curriculum components

Humanities& Social Sciences

Basic Sciences

Engineering sciences

Professional Core

Professional Electives

Open Electives

Project

have several

Courses

get related to POs through

CO-PO Matricies

are described in terms of

Program outcomes

- POs are statements about the knowledge, skills and attitudes (attributes) the graduate of a formal engineering program should have

- POs are defined by Accreditation Agencies of the country (NBA in India)

Graduate Attributes defined by NBA 1 to 12

- Washington accord signed by India in 2014

- NBA Accreditation process has changed from the past and it is now outcome based
- Tier-I and Tier-II Accreditation processes
- Tier-I is applicable to autonomous institutes

What is autonomy and Why autonomy

- Autonomy is freedom with responsibility
- Academic freedom
- University curriculum changes are too slow
- In autonomous institutes, changes can be at a pace of one's choice depending on industry and societal requirements
- Better employability of graduates
- Proud feeling and ownership about institute

Autonomy leads to excellence

New outcome based accreditation can be easily achieved through effective use of autonomy

Clear vision, mission, goals

Strategic planning

Program Education Objectives (PEOs)

Program Outcomes (POs) : Course Outcomes (COs)

Measuring attainment of program outcomes

Teaching learning process and Learning evaluation

Continuous improvement

Process of getting autonomy

- Application for permanent affiliation to Univ.
- Application for 2F and 12B to UGC
- NOC from Univ. and the State Government
- Application for autonomy to UGC
- Visit of Committee from UGC and AICTE
- Approval from UGC for 6 years
- Approval from University for 6 years

Tier-II Institutes who are affiliated to University

- There are certain challenges because curriculum and examination system is not in their control.

- Still under the given circumstances, how they can perform and get accredited…

Program outcomes (POs)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. 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.

3. 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

4. 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.

5. 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.

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.

7. 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.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. 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.

11. 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.

12. 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.

Program Education Outcomes

Program Outcomes

Course Outcomes

Curriculum Design (Iterative)

Teaching Learning

Classes, Tutorials, Assignments, Laboratory, Projects, Seminars, Internship

PEO – PO Matrix

- One can have 4-5 PEOs.
- All PEOs should be mapped to all 12 POs.
- Create a matrix to describe this mapping so that none of the POs are left out.

PEO	PO1	PO2	PO3	PO4			PO10	PO11	PO12
1	1	2					3		1
2		3	1	2		1		2	
3	1				2				
4	3						2		3

- Each PO is attained through program specific courses.

Course outcomes

- POs are attained through program specific Core Courses
- Each course is designed to meet (about 5-6) Course Outcomes
- The Course Outcomes are stated in such a way that they can be actually measured
- Understanding systems of an automobile
- Design of an engine
- Troubleshooting an engine
- Performance of an engine
- Design of a transmission system etc.

Course-PO relationship

- Each CO can be identified to address a subset of POs

- Based on the number of COs and the sessions dedicated to them it is possible to identify the strength of mapping (1, 2 or 3) to POs

- Based on these strengths of selected POs a C-PO matrix can be established.

COURSE	PO1	PO2	PO3				PO10	PO11	PO12
CO1	1	0	2	3	1	0	0	3	2

CO Attainment

- The assessments should be in alignment with the COs
- Question paper should be so set to assess all COs
- The average marks obtained in assessments against items for each CO will indicate the CO attainment
- Instructors can set targets for each CO of his/her course
- Attainment gaps can therefore be identified
- Instructor can plan to reduce the attainment gaps or enhance attainment targets

Continuous improvement

- All POs can be adequately addressed through the selection of core courses and their COs

- Attainable targets can be selected for each of the CO.

- If assessment is in alignment with COs the performance of the students indicates the CO attainment

- These measurements provide the basis for continuous improvement in the quality of learning

Sample Program Outcomes

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of *complex engineering problems.*

Not text book exercise problem

Design a electrical power distribution system for a village where the power availability from grid is 40% and balance has to be generated locally through renewable resources.

. **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

- There is lot of noise disturbing a classroom due to road traffic from nearby road
- The laboratory experiment results are varying from time to time

Assessment and Evaluation

Typical Assessment Tools

• Quizzes, Mid-Semester and End Semester Examinations

• Tutorials

• Home Assignments

• Lab assignments : Design of experiments

• Project work- Viva-Voce, Seminars etc.

• Employer/Alumni Feedback

• Student feedback : exit survey

Evaluate Attainment of COs, POs and PEOs

- Depending on attainment levels,
- Improve the strategy to either improve the attainment level or raise the target level.
- Cycle of Continuous improvement
- No complacency
- Excellence

Thank you