INTEGRAL UNIVERSITY
LUCKNOW - INDIA

A+ ACCREDITED BY NAAC

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF) / OUTCOME BASED EDUCATION (OBE) MANUAL

IQAC

INTEGRAL UNIVERSITY, LUCKNOW

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Introduction

Learning Outcomes based Curriculum Framework (LOCF)

The University Grants Commission (UGC) has initiated the missionof improving the quality of higher education in India through its Quality Mandate (QM) brought in to force during 2018. The quality mandate of theUGC has given thrust on curriculum reforms with an aim to equip the students with knowledge, skill, values and attitude. Therefore, Quality Mandate recommends the drive for developing **Learning Outcomes basedCurriculum Framework (LOCF)**. The idea behind the implementation of LOCF in the universities is to pre-determine what outcomes need to be achieved by planning, mapping & measuring the student outcomes with Choice Based Credit System (CBCS) for the undergraduate (UG) & postgraduate (PG) programs. The faculty needs to design a curriculum that would help students learn subjects of their interests while mapping their progress at every step.

Periodic curriculum revision process is critically important to ensurethat the programs offered in the universities are at par with the global standards, according to the UGC guidelines and as demanded by the fast-changing environment in which the learner has to operate.

Benefits of LOCF

The ultimate benefits of LOCF lies in enhancing the quality of higher education in India and encouraging the students to gain the best skills & knowledge during their student journey. Learning outcomes are determined in sync with what students are expected to understand at the end of their study program. The final expected student learning outcomes are considered as a reference to design the teaching-learning curriculum and graduate attributes. Once the final expected outcomes are defined clearly, teachers need to formulate a curriculum that would help them attain their goals. The curriculum intents to:

- Improve flexibility of learning
- Teaching-learning innovation
- Continuous teaching-learning improvements
- Assessment of students at various levels
- Periodic review of student performance
- Evaluating program specific outcomes (PSOs)
- Evaluating program outcomes (POs)
- Evaluating course outcomes (COs)
- Maintain highest standards of education
- Create an environment of global competitiveness

Benefits of adopting LOCF

a. Help formulate graduate attributes, qualification descriptors, program learning outcomes and course learning outcomes that are expected to be demonstrated by the holder of a qualification;

b. Enable prospective students, parents, employers and others to understand the nature and level of learning outcomes (knowledge, skills, attitudes and values) or attributes a

graduate of a program should be capable of demonstrating on successful completion of the program of study;

c. Maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility; and

d. Provide higher education institutions an important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programs and academic standards.

Outcome-based education (OBE)

OBE is an educational model that places each component of an educational process around outcomes (goals). In OBE model, all educational activities aim to help students achieve the outcomes. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities, and assessments should all help students achieve the specified outcomes. The role of the faculty adapts into instructor, trainer, facilitator, and mentor based on the outcomes targeted.

Outcome-based methods have been adopted in education systems around the world, at multiple levels since 1990's. In an international effort to accept OBE, The Washington Accord was created in 1989, which is an agreement to accept undergraduate engineering degrees that were obtained using OBE methods.

India has become the permanent signatory member of the Washington Accord since 13 June 2014. The National Assessment and Accreditation Council (NAAC) established by UGC and National Board of Accreditation (NBA), established by AICTE are the autonomous bodies for promoting global quality standards for technical education in India. NBA does program level accreditation for professional programs governed by AICTE, while NAAC does institutional level accreditation.

Both NAAC and NBA mandates establishing a culture of outcome-based education and use the reports of outcome analysis to find gaps and carryout continuous improvements in the education system of the University.

Benefits of OBE

- **Clarity:** The focus on outcome leads to clear expectation of accomplishment at the end of the program/ course.
- **Flexibility:** With clear sense of outcomes, instructors will be able to structure their lessons student centric and adopt pedagogies to achieve the outcomes.
- **Comparison:** OBE can be compared across individual, class, batch, program & University levels.
- **Involvement:** With clear sense of outcomes and increased involvement allows students to feel responsible for their own learning, and leads to self-learning.

The University Grants Commission has given its Quality Mandate (QM) brought in 2018. The quality mandate has given thrust on curriculum reforms with an aim to equip the students with knowledge, skill, values and attitude. Therefore, Quality Mandate recommends the drive for developing **Learning Outcomes basedCurriculum Framework (LOCF)**. LOCF which has adopted adopts Outcome Based Education (OBE) and emphasize on curricular reforms

Vision, Mission and Quality Policy of University

Vision

- To lead the teeming millions of the world through the wilderness of ignorance and illiteracy, as "Kindly Light" (Exodus 13:21) with the resounding divine proclamation. "Read: Thy Lord is the most bounteous (Quran 30:96:3)." and to educate them in the most constructive and innovative ways.
- To integrate the ebullience, intellect and dynamism of youth with decency, decorum, discipline and dedication through value-based quality education.

Mission

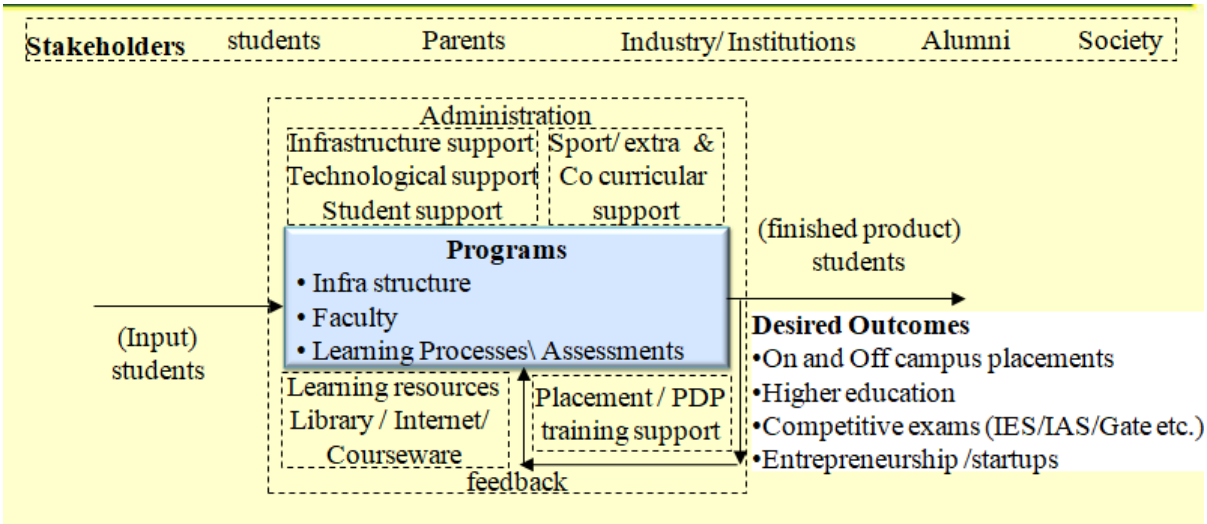
- To make every student a role model of intellectuals and torch bearer for others all over the world through his / her inspiring existence.
- To inculcate a spirit of confidence, self-respect and firm commitment in students along with farsighted wisdom and understanding.
- To make India a self reliant and dominant G-1 country recognized for quality education, higher economic growth and valuable moral practices.

Quality Policy

To pursue standards of excellence in all facets of the institution encompassing teaching, research, outreach and services that meet and exceed the expectations of all stakeholders. To comply with the standards and applicable statutory and regulatory requirements and to improve the Quality Management Systems effectiveness continually through periodical reviews and feedbacks at appropriate levels.

LOCF/OBE Framework of the University

Integral University's outcome-based framework is a cornerstone of its educational ethos, designed to ensure students are primed for success. It's a blend of academic rigor and practical application, tailored to meet industry demands. With a focus on experiential learning, students engage in projects, internships, real-world scenarios, personality development programs, co-curricular and extra-curricular activities honing their skills. Continuous assessment fosters accountability and growth, while personalized learning paths cater to individual strengths. This holistic approach equips graduates not just with knowledge, but with the adaptability and resilience needed to thrive in diverse professional environments.



Academic process

OBE process starts with clear statement of what knowledge, skills and attribute Graduates will be able to demonstrate at the completion of program. This statement should be measurable and aligned with Program Educational Objectives (PEO) and Vision/ Mission statements of the institution. These are called program outcome (PO) or Graduate attributes (GA).

1. Then outcome-based curriculum is designed/ modified for the program to achieve PO Curriculum through a set of courses. With each course having a set of course objective (CO) which contribute to PO attainment as well as Program specific outcome (PSO) attainment
2. A suitable planned teaching learning process (with appropriate assessment tools) and activities is put in place to achieve CO-PO.
3. PEO's/ PSO's are aligned with departmental Vision/ Mission while PO's are provided by NBA/ NAAC. Departmental Vision/ Mission and PEOs/PSOs are regularly reviewed.

PEO, PSO, PO and CO definitions

Objective

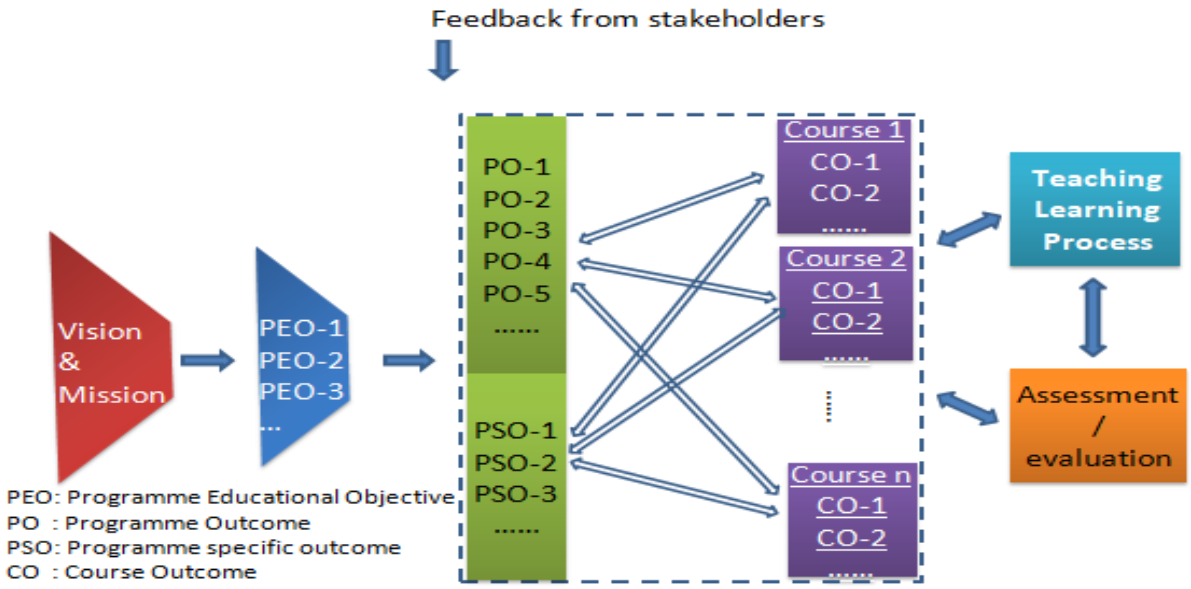
Program Educational Objectives (PEO): describes the expected achievement of graduates in the moderate span of their career, guided by local /global factors, stakeholders and defined by institution

Outcomes

Program Specific Outcomes (PSO): describe what the graduates should be able to do after completion of program. PSOs are defined by the departments.

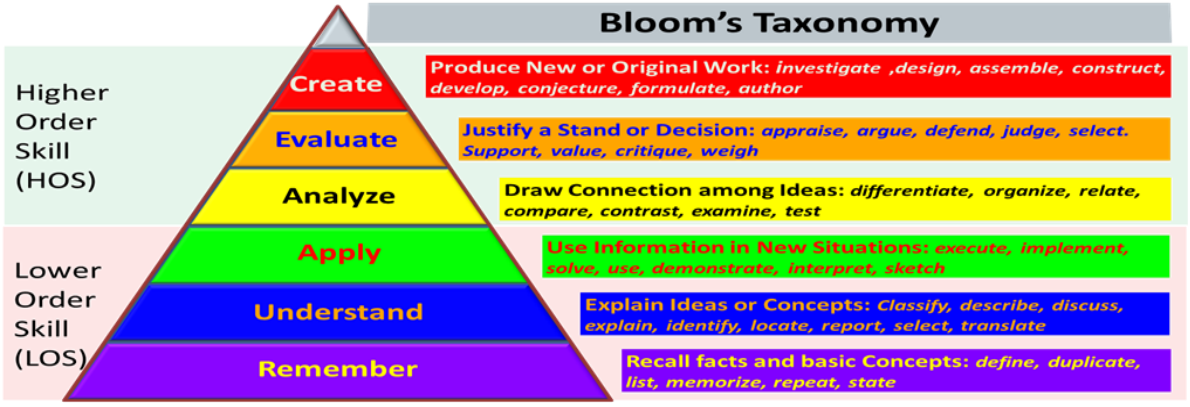
Program Outcome (PO): describes the expected knowledge, skills and attributes of the graduates of the program, *guided by accreditation agencies (NBA/NAAC)*

Course Outcome (CO): describe what students are expected to know, and be able to do at the end of each course/subject, *defined by teacher*



Blooms' Taxonomy

Bloom's Taxonomy, formulated by Benjamin Bloom in 1956 and revised in 2001 by Anderson and Krathwohl. Bloom's taxonomy categorizes cognitive learning into six levels, ranging from simple remember to complex create. In outcome-based education, Bloom's Taxonomy serves as a roadmap for designing curriculum and assessments that promote higher-order thinking skills. By flexible learning experiences to progressively challenge students, educators can ensure mastery of learning outcomes. From remembering and understanding foundational concepts to analyzing, evaluating, and creating innovative solutions, Bloom's Taxonomy provides a structured approach to foster deep understanding and application of knowledge. This facilitates the development of well-rounded graduates capable of navigating diverse challenges and contributing effectively to their professions and society.



Bloom's Taxonomy levels

Benjamin S. Bloom identified three 3 hierarchical models under which learning process takes place, to classify educational learning objectives in to Cognitive, Affective and Psychomotor (sensory) domains.

Domains of Learning Outcomes:

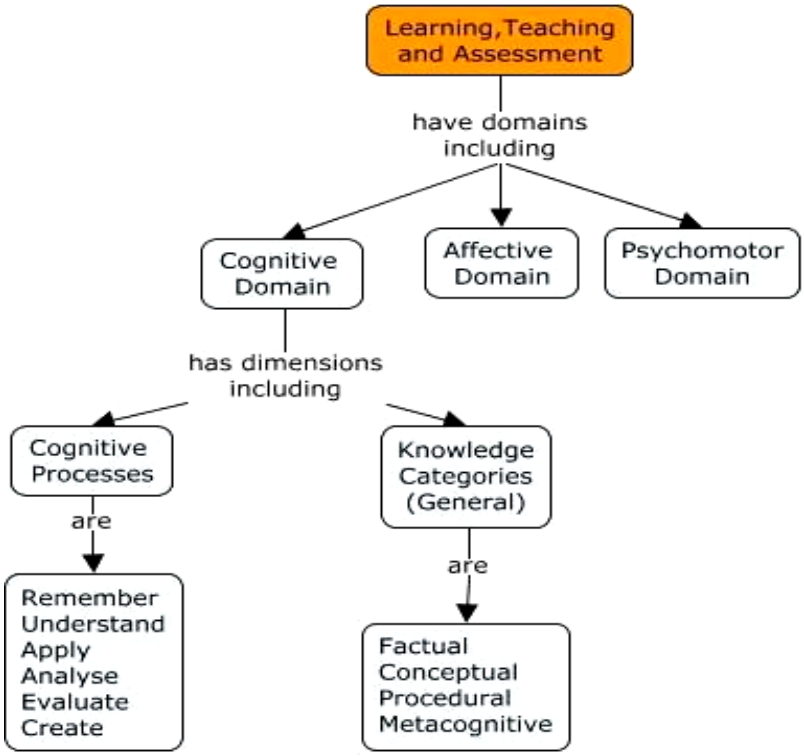
COGNITIVE - Thinking, intellectual abilities. Comprehending information,organizing ideas, evaluating information and actions.

AFFECTIVE - A learner's emotions toward learning. Interests, feelings, attitudes, opinions, appreciations, values, emotional sets

PSYCHOMOTOR - Basic motor skills, coordination, and physical movement. Speech development, reading readiness, handwriting, physical education, manipulative skills (keyboarding), industrial technology, performance areas in science, art, music.

American education and Indian education have been leaning more towardthe cognitive domain at the exclusion of the affective and psychomotor domains. Well-rounded and fully functioning people need development inall three domains.

The Taxonomy of cognitive objectives developed by Benjamin Bloom continues to be one of the most universally applied models, which providea way to organize thinking skills into six levels, from the most basic to the higher order levels of thinking. Lorin Anderson (former student of Bloom) revisited the taxonomy during 1990. The flowchart of the taxonomy is given in the figure below.



Flow chart of the Bloom taxonomy.

Categories of Knowledge:

Revised Bloom taxonomy (Anderson et al., 2001) suggests the following four categories of knowledge applicable to all disciplines:

- Factual Knowledge
- Conceptual Knowledge
- Procedural Knowledge
- Metacognitive Knowledge

The table below describes the types of knowledge and its elements

Types	Elements
Factual Knowledge	"Inert" knowledge; that is, students often seem to acquire a great deal of factual knowledge, but theymay not understand it at a deeper level. *Knowledge of terminology* (e.g., words, numerals, signs,pictures) *Knowledge of specific details and elements (Celsius, Fahrenheit, Kelvin etc.)*
Conceptual Knowledge	Relationships amongst pieces of a larger structure that makethem part of the whole. Knowledge of classification and categories, theories, modelsstructure etc. eg. Ideas about Earth, Rotation, Seasons etc. Concepts of the Evolution Theory, Origin of Life etc. Relationship between scarcity and choice, opportunity cost

Procedural Knowledge	How to do something, e.g. Knowledge of subject specific skills and algorithms Knowledge of the skills" to do painting with water colors Knowledge and skills on psychometric testing
Metacognitive Knowledge	Knowledge on one's own cognition in general Knowledge of thinking in general and individual thinking inparticular, eg. Strategic Knowledge, Knowledge about cognitive tasksSelf Knowledge

- Lower order skills (LOS) require less cognitive processing but makes important base for learning
- Higher order skills (HOS) require more cognitive processing and can be achieved only after LOS being achieved
- Industry 4.0 demand HOS.
- LOS may lead to entry level jobs but career progression is very slow.
- HOS leads to rapid career progression
- Top level skill of Bloom's Taxonomy leads to entrepreneurship

The Cognitive Process dimensions- Categories					
Lower Order Skills (LOS)			**Higher order Skills (HOS)**		
Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
• Recognizing (identifying) • Recalling (retrieving)	• Illustrating • Classifying • Summarizing • Inferring • Explaining	• Executing • Implementing • Applying	• Differentiating • Organizing • Attributing	• Checking • Detecting • Testing • Critiquing • Judging	• Planning • Generating • Producing • constructing

The Knowledge Dimension			
Concrete Knowledge		**Abstract Knowledge**	
Factual	**Conceptual**	**Procedural**	**Metacognitive**
• Knowledge of terminologies • Knowledge of specific details & elements	• Knowledge of classifications & categories • Knowledge of principles & generalizations • Knowledge of theories, models & structures	• Knowledge of specific skills & algorithms • Knowledge of subject specific techniques & methods • Knowledge of criteria for determining when to use appropriate procedures	• Strategic Knowledge • Knowledge about cognitive task, including appropriate contextual & conditional Knowledge • Self-Knowledge

Action Verbs for Course Outcome

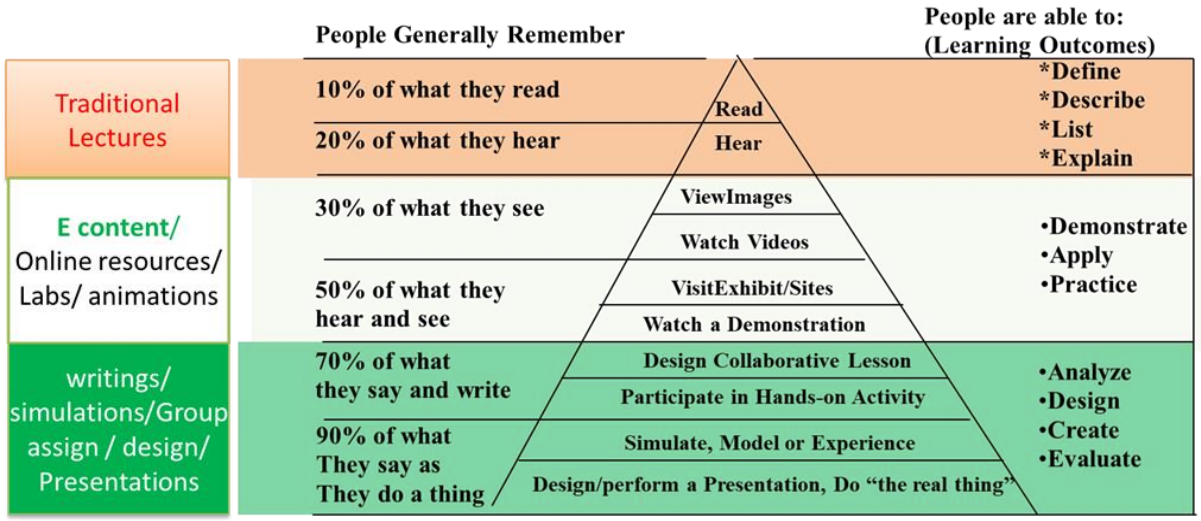
Lower Order Skills (LOS)			**Higher Order Skills (HOS)**		
Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Define	Explain	Solve	Analyze	Reframe	Design
Describe	Describe	Apply	Compare	Criticize	Create
List	Interpret	Illustrate	Classify	Judge	Plan
State	Summarize	Calculate	Distinguish	Recommend	Formulate
Match	Compare	Sketch	Explain	Grade	Invent
Tabulate	Discuss	Prepare	Differentiate	Measure	Develop
Record	Estimate	Chart	Appraise	Test	Organize
Label	Express	Choose	Conclude	Evaluate	Produce

Illustration

Use of Action Verbs	Factual	Conceptual	Procedural	Metacognitive
Remember	**List** the properties of metal	**Match materials** with characteristics	**Describe** working of diode	**Identify** strategies for data collection
Understand	**Summarize** features of a Bluetooth.	**Classify** materials by strength.	**Explain** assembly line.	**Predict** the behavior of system
Apply	**Respond** to the queries	**Provide** advice to group	**Carry out** pH tests of water samples.	**Use** modern tools & find solution
Analyze	**Explain** the selection of tool/ activity for the task.	**Differentiate** between LOS and HOS	**Integrate** compliance with regulations.	**Assess** the The project work
Evaluate	**Select** the appropriate tool for analysis	**Determine** relevance of results.	**Judge** efficiency of sampling techniques.	**Reflect** on progress of the project.
Create	**Generate** log of daily activities.	**Assemble** a team of experts.	**Design** efficient project workflow.	**Create** a learning portfolio.

Dale's Cone of Learning

Dale's Cone of Learning, proposed by Edgar Dale, illustrates the hierarchy of retention rates for various learning methods. It suggests that learners retain more information when they are actively engaged in the learning process. In outcome-based education, Dale's Cone serves as a guiding principle, emphasizing experiential learning over passive methods. By prioritizing hands-on activities, simulations, and real-world applications, educators can enhance students' retention and understanding of course material. This approach fosters critical thinking, problem-solving skills, and practical knowledge acquisition, aligning perfectly with the goal of producing competent graduates capable of making meaningful contributions in their chosen field



Dale's cone of Learning

PEO, PSO Example

PEO For B.Tech ECE

PEO1. To provide the necessary background in science and mathematics and to provide solid foundation in engineering fundamentals so that students are ready to face challenges in the field of Electronics & Communication Engineering Technology.

PEO2. To train students with engineering breadth by providing experimental exposure so that they can analyze, design & comprehend scientific data which may have direct application to society.

PEO3. To inculcate in students professional and ethical attitude, effective communication skills and team work needed for a successful professional carrier and entrepreneurship orientation.
PEO4. To make students aware of various social and environmental problems and relate engineering issues to broader social context.

PSO For B.Tech ECE

PSO1. Understand the concepts of Mathematics, Science, and Electronics & Communication
PSO2. Apply, and analyze engineering problems and simulate or design systems and solutions in the field of electronics and communication.
PSO3. Creative thinking, Effective communication, Group working ability and lifelong learning.
PSO4. Understanding of professional, social, ethical environmental concerns and responsibilities.

Sample PSOs of BSc Zoology

PSO1. Understand the nature and basic concepts of cell biology, Biochemistry, Taxonomy & ecology.
PSO2. Analyze the relationships among animals, plants and microbes
PSO3. Perform procedures as per laboratory standards in the areas of Biochemistry, Bioinformatics, Taxonomy, Economic Zoology and Ecology
PSO4. Understand the applications of biological sciences in Apiculture, Aquaculture, Agriculture and Medicine

Sample PSOs of BA Economics

PSO1. Understand the behaviour of Indian and World economy,
PSO2. Analyze macroeconomic policies including fiscal and monetary policies of India
PSO3. Determine economic variables including inflation, unemployment, poverty, GDP, Balance of Payments using statistical methods
PSO4. Understand the behavior of financial and money markets and perform cost-benefit analysis for making investment decisions

Reference http://www.naac.gov.in/images/docs/Manuals/University%20Manual%20Amended-%2020th%20June%202018n.docx

PO for Engineering	
Undergraduate	**Diploma**
PO1. Engineering knowledge PO2. Problem analysis: PO3. Design/development of solutions: PO4. Conduct investigations of complex problems PO5. Modern tool usage 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	PO1. Basic and Discipline specific knowledge PO2. Problem analysis PO3. Design/ development of solutions PO4. Engineering Tools, Experimentation and Testing PO5. Engineering practices for society, sustainability and environment PO6. Project Management PO7. Life-long learning
http://www.nbaind.org/Files/ug-sar-tier-i-final-ver-1.0.pdf	http://www.nbaind.org/files/diploma-sar-final-v1.pdf

Pharmacy	
Undergraduate	**Diploma**
PO1. Pharmacy Knowledge PO2. Planning Abilities PO3. Problem analysis PO4. Modern tool usage PO5. Leadership skills PO6. Professional Identity PO7. Pharmaceutical Ethics PO8. Communication PO9. The Pharmacist and society PO10. Environment and sustainability PO11. Life-long learning	PO1. Pharmacy Knowledge PO2. Modern tool usage PO3. Leadership skills PO4. Professional Identity PO5. Pharmaceutical Ethics PO6. Communication PO7. The Pharmacist and society PO8. Environment and sustainability PO9. Life-long learning
http://www.nbaind.org/Files/ug-pharmacy-sar-v0.pdf	http://www.nbaind.org/files/Diploma_Pharmacy_SAR_April2019.pdf
PO for MCA	**PO For MBA**
PO1. Computational Knowledge PO2. Problem Analysis PO3. Design /Development of Solutions PO4. Conduct investigations of complex Computing problems PO5. Modern Tool Usage PO6. Professional Ethics PO7. Life-long Learning PO8. Project management and finance PO9. Communication Efficacy PO10. Societal and Environmental Concern PO11. Individual and Team Work PO12. Innovation and Entrepreneurship	PO1. Apply knowledge of management theories and practices to solve business problems. PO2. Foster Analytical and critical thinking abilities for data-based decision making. PO3. Ability to develop Value based Leadership ability. PO4. Ability to understand, analyze and communicate global, economic, legal, and ethical aspects of business. PO5. Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment. Note: Program may add up to three additional Pos.
http://www.nbaind.org/Files/MCA_Tier_II%20manual.pdf	http://www.nbaind.org/Files/pg-mgmt-sar.pdf
PO for other Higher Educational programs	
PO1. Critical Thinking PO2. Effective Communication PO3. Social Interaction PO4. Effective Citizenship PO5. Ethics PO6. Environment and Sustainability PO7. Self-directed and Life-long Learning	
http://www.naac.gov.in/images/docs/Manuals/University%20Manual%20Amended-%2020th%20June%202018n.docx	

Guidelines for Writing Course Outcome Statements

- The number of COs of courses carrying a different number of credits can be suitably adjusted.
  - For a (3-0-0 or 3-1-0) theory course consisting of five units should have preferably five CO's each CO covering one unit.
  - For a (0-0-1 or 0-0-2) course consisting of field/ practical/ laboratory activities, 2-4 CO's can be defined by grouping activities/experiments using some theme that can serve as a Course Outcome.
  - For a (3-1-1 or 3-0-1) course integrating field/ practical/ laboratory activities, preferably 2-4 CO's should be defined for theseactivities beside CO's of each unit of theory content.
- CO should focus on higher order skills (HOS), i.e. Analyze, Evaluate and Create
- Each CO may take few lectures (7-10) on an average.
- CO's are written using action verbs, which are specific, measurable and can be demonstrated by students after successful completion of the course

- Attainment of each CO leads to one or more PO attainment.
- For professional courses PO are normally guided by accreditation agency/ governing bodies.

A well written course outcome use a action verb representing the blooms taxonomy level and the following features

- Condition component
- Performance component
- Criterion Component

Example CO

Given the integrable real time input signals, would be able to perform Fourier analysis and analyze the spectral characteristics.

	CO statement	Missing Features
Poor CO statement	Understand Fourier Analysis	No Condition No Performance
Weak CO statement	Understand Fourier Analysis and apply it on signal analysis	No Condition
Good Co statement	Given the integrable real time input signals, would be able to perform Fourier analysis and analyze the spectral characteristics	

CO-PO Mapping Guidelines

Course Articulation matrix represent relationship between CO's of the course and PO/PSO of the program. It mentions the strengths to which the COs of a course address Pos and PSOs.

- Every CO may address a subset of Pos and PSOs.
- In the matrix COs are tagged with Pos and PSOs that are addressed by it with a representation of strength of relationship
- In determining the strength to which a CO relates a PO/PSO, it is convenient to tag each CO with the number of Class Hours /Laboratory Hours used for delivery/instruction, which also indicate the depth to which the instructor intends to deal the topic/ CO.
- The strength of mapping is defined using three levels:
    - 1 -Low contribution
    - 2 - Average contribution
    - 3 – Strong contribution

- A approximate quantitative method to measure the strength to which a PO/PSO is addressed is to relate the strength with the number of hours devoted to the COs, which address that PO/PSO.
    - For >40 % of class sessions/lab hours address a PO/PSO → 3 - Strong contribution
    - For 10-40% of class sessions/lab hours address a PO/PSO → 2 - Average contribution
    - For 1-10% of class sessions/lab hours address a PO/PSO → 1 - Low contribution
    - For 0% of class sessions /lab hours address a PO/PSO → 0 - No contribution

CO for a course "Signals and Systems" (B.Tech EC II year)

S No.	CO description	Unit Covered by CO
CO1	Given the integreable real continuous time input signals, would be able to perform Fourier transformation and analyze the spectral characteristics.	I

CO2	Given a system description, would be able to explore alternate description and implement using basic building blocks of the system	II
CO3	Given the real discrete time system description, would be able to perform discrete time Fourier transformation/ Z transformation and analyze the characteristics of the system.	III
CO4	For a system with input output relationship described in standard form, would be able to characterize the time/ frequency characteristics and demonstrate in graphical form,	IV

Example Course Articulation Matrix (CO-PO-PSO mapping)

Course Articulation Matrix (CO-PO-PSO mapping) for a course "Signals and Systems"

B.Tech. ECE: Program Specific Outcomes (PSO's)

PSO1. Understand the concepts of Mathematics, Science, and Electronics & Communication
PSO2. Apply, and analyze engineering problems and simulate or design systems and solutions in the field of electronics and communication.
PSO3. Creative thinking, Effective communication, Group working ability and lifelong learning.
PSO4. Understanding of professional, social, ethical environmental concerns and responsibilities.

B.Tech. ECE: Program Objectives (PO's)

PO1. Engineering knowledge
PO2. Problem analysis:
PO3. Design/development of solutions:
PO4. Conduct investigations of complex problems
PO5. Modern tool usage
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

		PO's												PSO's			
S No.	CO description	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Given the integreable real continuous time input signals, would be able to perform Fourier transformation and analyze the spectral characteristics.	3	2	2	3	1								3	2		
CO2	Given a system description, would be able to explore alternate description and implement using basic building blocks of the system	3	3	3	3	2							1	3	3		
CO3	Given the real discrete time system description, would be able to perform discrete time Fourier transformation/ Z -transformation and analyze the characteristics of the system.	3	2	2	3	1								3	3		
CO4	For a system with input output relationship described in standard form, would be able to characterize the time/ frequency characteristics and demonstrate in graphical form	3	3	2	3	1					1			3	3		
Signals and Systems PO Mapping		3	2.5	2.25	3	1.25					0.25		0.25	3	2.75		

3 Strong contribution,
2 average contribution,
1 Low contribution

Curricular Structure BTech ECE III year V Sem																		
S. No.	Code	Subject	PO's												PSO's			
			PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	IEC501	Computer Organization and Architecture	2	2	3	2								1	3	3		
2	IEE501	Control System	3	2	2	2	2	1						1	3	3		
3	IEC502	Integrated Circuits	2	2	2		2								3	3		
4	IEC503	Communication Systems	3	3	2	2	2							1	3	3		
5	IHU501	Industrial Management					2	1	2		1	1	2		2	2		
6	IEC506	Antenna & Wave propagation	2	2	2										3	3		
7	IEC551	Seminar						1		2	2	3		2	1		3	
8	IEE551	Control System Lab			2	1	1								3	2	2	1
9	IEC552	Integrated Circuits Lab			2	1	1								3	2	2	1
10	IEC553	Communication Lab-I			2	2									3	2	2	1
Average contribution of all courses			**2.4**	**2.2**	**2.13**	**1.67**	**1.67**	**1**	**2**	**2**	**1.5**	**2**	**2**	**1.25**	**2.7**	**2.56**	**2.25**	**1**
3 Strong contribution, 2 average contribution, 1 Low contribution																		

CO Attainment Computations

Targets / Attainment Levels

CO Attainment are measured in terms of 'reference attainment levels' against a 'benchmark' defined by institution.

- Reference level and Benchmark are decided by the institution judiciously
- Target attainment level chosen is set higher than previous year attainment as part of continuous improvement

CO attainment is weighted combination of two components

- Direct Attainment 80% weightage
- Indirect Attainment 20% weightage

Example Reference attainment level (example)

Level 1 Satisfactory: 60% students scoring more than benchmark (X)
Level 2 Moderate: 70% students scoring more than benchmark (X)
Level 3 Substantial: 80% students scoring more than benchmark (X)

- Benchmark may be university average of subject, or average of last three years of subject or any other value decided judiciously by institution
- Target attainment level chosen is set higher than previous year attainment as part of continuous improvement

If target is that 65 % students score more than X then attainment level target is set as 1.5 with reference to the defined levels

Course evaluation scheme example

- End sem Examination: 100 (66.7%)
- Internal assessment 50 (33.3%)

Total **150 (100%)**

Break up of Internal assessment

- Mid sem test 30
- Presentation/ Group Project 10
- Assignment 10

Attainment is measured separately for internal assessment and End sem exam (using benchmark/ levels, if not defined by institution assume it and mention in bracket as assumed)

Average Course attainment measurement example

- Let attainment target for End Sem assessment and internal assessment is decided as
  - End Sem Examination: 60% students will score more than benchmark (X)
  - Internal assessment: 70% students will score more than benchmark (X)

  Then CO attainment target for
  End sem Examination: 1
  Mid sem Examination: 2

- Set the final attainment target using the weightage of marks (internal/ external)
  Final attainment target = 66.7% of external target + 33.3% of internal target
  = 0.667 x 1 + 0.333 x 2
  = 1.33

(if weight of internal assessment in curricular structure is 33.3% or other weightage decided judiciously)

- Let result summary obtained in mid sem assessment and internal assessment is
  End sem assessment: 68% student score more than X = 1.8 attainment level
  Mid sem assessment: 70 % student score more than X = 2 attainment level
  Achieved attainment level = 75% of End sem exam+ 25% of Internal assessment
  = 75% of 1.8+ 25% of 2
  = 1.35+ 0.25 = 1.6

Average Course Outcome Contribution PO/PSO Attainment

PO/PSO attainment is computed at the end of the program using CO attainment of various courses. A simple method to compute PO/PSO attainment is to compute weighted average of Courses attainment with Courses contribution to PO/PSO. If Course attainment is combination of direct attainment or and indirect attainment then PO/PSO attainment can be computed using Course attainments only. Alternatively direct component of PO/PSO attainment can be computed using weighted average of direct component of Course attainments and adding indirect component based on surveys/ feedback.

Sample Course Articulation Matrix of BM 101 Financial Accounting

S No	CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
1	CO1	3	2	1	1	1	2	0	3	2	1	2
2	CO2	2	1	1	3	1	0	0	1	1	2	1
3	CO3	1	2	1	1	2	3	0	1	2	2	3
4	CO4	3	2	1	2	1	1	0	1	2	1	2
5	CO5	3	1	2	1	2	1	0	2	1	2	1
BM101 Average Course Outcome Contribution	**BM101**	**2.4**	**1.6**	**1.2**	**1.6**	**1.4**	**1.4**	**0.0**	**1.6**	**1.6**	**1.6**	**1.8**

Sample Program Articulation Metrics of BBA program													
Course Code:	**Course Name**	**Sem**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
BM101	Financial Accounting	I	2.4	1.6	1.2	1.6	1.4	1.4	0.0	1.6	1.6	1.6	1.8
MT105	Quantitative Techniques	I	2.0	1.0	2.0	2.0	1.0	2.0	0.0	2.0	2.0	1.0	1.0
BM102	Office Management	I	2.4	2.0	1.6	2.4	2.2	2.0	0.0	2.0	2.0	1.8	2.2
BM103	Principles of Economics	I	2.0	2.0	1.0	0.0	3.0	0.0	0.0	3.0	3.0	2.0	1.0
BM104	Principles & Concepts of Management	I	1.8	2.2	2.4	1.8	2.2	2.4	2.4	2.4	2.6	1.8	1.2
LN104	Essential Professional Communication	I	2.0	1.0	2.0	2.0	1.0	2.0	0.0	2.0	2.0	1.0	1.0
BM105	Business Organization	II	3.0	1.6	2.4	1.0	1.0	2.0	0.0	3.0	2.0	1.0	2.0
BM106	Public Finance	II	1.8	1.6	1.8	1.8	1.4	2.4	1.8	2.0	1.6	1.4	2.2
MT116	Business Statistics	II	2.0	1.0	2.0	2.0	1.0	2.0	0.0	2.0	2.0	1.0	1.0
BM107	Advance Accounting	II	1.0	1.0	1.0	1.0	0.0	0.0	0.0	3.0	3.0	3.0	1.0
BM108	Introduction to Business Environment	II	2.8	2.4	2.4	2.2	2.2	2.0	0.0	1.8	1.8	2.2	2.2
BM109	Computerized Accounting	II	2.4	2.2	2.2	2.2	2.2	2.0	0.0	2.4	2.0	1.8	2.2
BM201	Cost Accounting	III	2.4	2.0	0.0	0.6	0.0	1.0	0.0	3.0	2.0	0.0	1.0
BM202	Corporate Law	III	2.4	2.0	0.6	0.6	1.0	1.0	0.0	3.0	2.0	0.0	1.0
BM203	Principles of Marketing Management	III	3.0	1.4	2.0	1.0	1.0	2.4	0.0	3.0	2.0	1.0	2.6
BM204	Human Resource Management	III	2.4	2.0	0.0	0.6	0.0	1.0	0.0	3.0	2.0	0.0	1.0
BM205	Introduction to Indian Economy	III	3.0	2.0	1.0	2.0	2.0	0.0	0.0	3.0	3.0	0.0	1.0
BM206	Income Tax	III	1.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0
BM207	Corporate Accounting	IV	0.0	2.4	0.0	0.0	0.0	2.4	0.0	3.0	2.4	2.0	2.4
BM208	Financial Auditing	IV	0.4	1.0	0.0	0.2	0.2	0.8	0.0	2.2	1.8	1.6	1.6
BM209	Business Psychology & OB	IV	2.4	2.0	2.2	2.4	2.2	2.0	0.0	2.0	2.0	1.8	2.2
BM210	Introduction to Micro Economics	IV	1.0	1.0	1.0	1.0	1.0	0.0	0.0	1.0	1.0	1.0	1.0
BM211	Indian Financial System	IV	2.4	1.8	2.6	1.8	1.4	1.2	0.0	2.0	2.0	1.6	1.8
BM212	Introduction to E-Business	IV	2.2	2.0	2.2	1.6	1.6	1.2	0.0	2.0	2.0	1.8	2.2
BM301	Financial Management	V	0.6	0.6	0.4	0.0	0.0	2.2	0.0	2.2	1.8	1.6	1.8
BM302	Entrepreneurship Development	V	1.8	1.4	0.8	1.2	1.2	0.6	0.0	1.6	0.8	0.8	1.0
BM303	Money & Banking	V	2.2	1.8	1.6	1.6	1.2	2.2	0.0	1.6	1.8	1.4	1.8
BM304	Production & Operations Management	V	2.2	1.2	1.4	1.2	0.6	0.6	0.0	2.0	2.0	1.8	2.0
BM305	Project Financing	V	2.2	1.8	1.6	1.6	1.2	2.2	0.0	1.6	1.8	1.4	1.8
BM306	Introduction to Consumer Behaviour	V	1.6	2.0	2.0	1.8	2.2	1.8	2.0	2.0	2.0	2.2	1.8
BM307	Basics of Insurance Management	VI	2.2	1.4	1.4	1.2	0.6	0.6	0.0	2.0	2.0	1.8	2.0
BM308	Security Analysis	VI	2.2	1.8	1.6	1.6	1.2	2.2	0.0	1.6	1.8	1.4	1.8
BM309	Introduction to International Business	VI	2.6	1.4	1.0	1.8	1.0	2.4	0.0	2.6	2.2	1.2	3.0
BM310	Management Information System	VI	2.6	1.4	1.0	1.8	1.0	2.4	0.0	2.6	2.2	1.2	3.0
BM311	Introduction To Financial Markets	VI	2.0	1.0	2.0	2.0	1.0	2.0	0.0	2.0	2.0	1.0	1.0
BM312	Investment and Portfolio Management	VI	2.2	1.6	1.2	0.4	0.8	0.6	0.0	2.0	1.2	0.8	2.0
BM313	Marketing Communication	VI	3.0	1.4	2.4	1.4	1.0	2.4	0.0	2.0	2.0	1.2	2.6
BM314	International Marketing Management	VI	1.0	1.8	1.4	2.2	2.6	2.2	0.0	2.2	1.2	2.2	2.0
BM315	Introduction to Industrial Relation	VI	1.0	2.0	2.0	1.5	2.0	2.0	0.0	2.3	2.0	2.5	2.0
BM316	Organisation Development	VI	1.4	1.8	1.8	2.4	2.6	2.2	0.0	2.2	2.0	2.2	2.0
BM317	Viva Voce	VI	2.0	0.0	0.0	0.0	0.0	3.0	2.0	0.0	0.0	0.0	0.0
	Average Courses Outcome Contribution		**2.0**	**1.6**	**1.4**	**1.4**	**1.2**	**1.6**	**0.2**	**2.1**	**1.9**	**1.4**	**1.7**

Individual CO Attainment Computation

Average CO attainment target of the course may be split down to each CO target or activity target if required.

CO attainment for each CO may be computed by measuring score obtained in each assessment component contribution to each CO using attainment levels and benchmark.

Activities and assessment planned for an example course for internal assessment given in table below

Mid Sem 1				Mid Sem 2				Improvement				**Quiz1**					**Quiz2**				**Assignment**			
Question		MM (30)	Mapped CO	Question		MM (30)	Mapped CO	Question		MM (30)	Mapped CO	Question		MM (1)	Mapped CO		Question		MM (1)	Mapped CO	Question		MM (1)	Mapped CO
Q1	1	1	CO1	Q1	1	1	CO3	Q1	1	1	CO3	Q1	1	1	CO1		Q1	1	1	CO1	Q1	1	1	CO5
Q1	2	1	CO1	Q1	2	1	CO3	Q1	2	1	CO3	Q1	2	1	CO2		Q1	2	1	CO2	Q1	2	1	CO5
Q1	3	1	CO1	Q1	3	1	CO3	Q1	3	1	CO3	Q1	3	1	CO3		Q1	3	1	CO3	Q1	3	1	CO5
Q1	4	1	CO1	Q1	4	1	CO3	Q1	4	1	CO3	Q1	4	1	CO1		Q1	4	1	CO1	Q1	4	1	CO5
Q1	5	1	CO1	Q1	5	1	CO3	Q1	5	1	CO3	Q1	5	1	CO1		Q1	5	1	CO1				
Q1	6	1	CO2	Q1	6	1	CO4	Q1	6	1	CO4	Q1	6	1	CO1		Q1	6	1	CO1				
Q1	7	1	CO2	Q1	7	1	CO4	Q1	7	1	CO4	Q1	7	1	CO4		Q1	7	1	CO4				
Q1	8	1	CO2	Q1	8	1	CO4	Q1	8	1	CO4	Q1	8	1	CO5		Q1	8	1	CO5				
Q1	9	1	CO3	Q1	9	1	CO4	Q1	9	1	CO4	Q1	9	1	CO1		Q1	9	1	CO1				
Q1	10	1	CO3	Q1	10	1	CO3	Q1	10	1	CO3	Q1	10	1	CO2		Q1	10	1	CO2				
Q2	1	5	CO1	Q2	1	5	CO1	Q2	1	5	CO2													
Q2	2	5	CO2	Q2	2	5	CO4	Q2	2	5	CO4													
Q2	3	5	CO3	Q2	3	5	CO3	Q2	3	5	CO3													
Q3	1	10	CO1	Q3	1	10	CO1	Q3	1	10	CO1													
Q3	2	10	CO2	Q3	2	10	CO4	Q3	2	10	CO4													

For mid sem 1 in above table performance of students

	Mid Sem 1																CO wise marks Obtained in Midsem1 (MM:30) Maximum marks as per exam conducted						Scaled CO wise marks Obtained in Midsem1 (MM: 7.5) Contribution in final marks					
Q No	Q1_1	Q1_2	Q1_3	Q1_4	Q1_5	Q1_6	Q1_7	Q1_8	Q1_9	Q1_10	Q2_1	Q2_2	Q2_3	Q3_1	Q3_2	Total												
MM	1	1	1	1	1	1	1	1	1	1	5	5	5	10	10		20	18	7	0	0	45	5	4.5	1.75	0	0	
Mapped CO	CO1	CO1	CO1	CO1	CO1	CO2	CO2	CO2	CO3	CO3	CO1	CO2	CO3	CO1	CO2		CO1	CO2	CO3	CO4	CO5	Total	CO1	CO2	CO3	CO4	CO5	Total
Student1	1	1	1	1	1	1	0	1	1	1	5	5		9		28	19	7	2	0	0	28	4.75	1.75	0.5	0	0	7
Student2	0	0	0	1	0	0	1	1	0	1	5		4	9		22	15	2	5	0	0	22	3.75	0.5	1.25	0	0	5.5
Student3	1	1	1	1	1	1	1	1	1	1	4		1		6	21	9	9	3	0	0	21	2.25	2.25	0.75	0	0	5.25
Student4	1	1	1	1	1	1	0	0	0	0	5	4		9		24	19	5	0	0	0	24	4.75	1.25	0	0	0	6
Student5	1	1	1	1	1	1	0	1	1	1	4	1		6		20	15	3	2	0	0	20	3.75	0.75	0.5	0	0	5

In similar way CO wise marks of students can be obtained in covering all mid semester and end semester assessments can be obtained. Addition of CO wise score of all students for all assessment activities can be used to compute individual CO attainment as explained in example.

PO/SO Attainment Computation

PO/PSO attainment can be computed by weighted sum of Average CO attainment of contributing courses weighted to course articulation metric of the program. Also, indirect attainment component of PO/PSO attainment obtained by end of program surveys/ statics etc. converted matching to three level score may be added to earlier computed value in a ratio of 80:20 to obtain final score.

Reference Level & Benchmark

Reference levels and benchmark is reviewed and notified by COE for computation purposes. Benchmark for each course may be separately defined by providing proper justification in consonance of competent authorities. Since adoption of OBE from session 2020-21 the reference levels and benchmark adopted is

Reference Attainment Level

Level 1 Satisfactory:	60% students scoring more than benchmark (X)
Level 2 Moderate:	70% students scoring more than benchmark (X)
Level 3 Substantial:	80% students scoring more than benchmark (X)

Benchmark: 65 % score

Since implementation of OBE, average course attainment is computed by examination cell. From even semester 2023-24, department are advised to compute attainment of individual CO's.

Student Competency

1. Academic Competence: critical thinking, research abilities, analytical skills, and the ability to comprehend and synthesize complex information.
2. Communication Skills: Written and oral communication skills, including the ability to express ideas clearly, engage in productive discourse, and effectively communicate with diverse audiences.
3. Problem-Solving Skills: Problem-solving abilities, including identifying problems, analyzing situations, evaluating options, and implementing solutions.
4. Collaboration and Teamwork: Collaborative projects, team work, navigate group dynamics.
5. Ethical and Social Responsibility: ethical principles relevant to their field, integrity and consider social impact of decisions.
6. Adaptability and Flexibility: adaptable and flexible, able to learn new skills and adjust to evolving circumstances.
7. Information Literacy: ability to locate, evaluate, and effectively use information from various sources, including libraries, databases, and the internet.
8. Technological Competence: basic digital literacy and more advanced technical skills relevant to the student's field of study.
9. Global Awareness and Cultural Competence: understanding of global issues, cultural diversity, and intercultural communication skills.
10. Leadership and Initiative: leadership qualities, take initiative, and demonstrate the ability to motivate and inspire others.
11. Self-Management and Time Management: manage their time effectively, prioritize tasks, and balance academic responsibilities with personal and extracurricular activities.
12. Resilience and Emotional Intelligence: resilience in the face of challenges, emotional intelligence skills such as self-awareness, empathy, and self-regulation.
13. Creativity and Innovation: encouraging students to think creatively, generate new ideas, and explore unconventional solutions to problems.
14. Career Development and Professionalism: networking, resume writing, interview techniques, and professionalism in the workplace.
15. Financial Literacy: basic financial principles, budgeting, managing debt, and making informed financial decisions

Rubrics for Assessment

What is Rubric?

A scoring guide with criteria for evaluating students' work in direct relation to one or more of the PO's and a rating scale indicating differing levels of performance.

Rubrics are:

- Used to examine how well students have met CO or PO rather than how well they perform compared to their peers.
- Typically include measurable descriptors that define expectations at each level of performance for each criterion.

Sample Rubrics

RUBRICS FOR PROJECT EVALUATION

Rubrics Review

Review #	Agenda	Assessment	Review Assessment Weightage	Over all Weightage
Review 1	Project Synopsis/ Proposal Evaluation	Rubric R1	(15)	(75)
Review 2	Mid-Term Project Evaluation	Rubric R2	(28)	
Review 3	End Term Project Evaluation	Rubric R3	(32)	
External Evaluation			(75)	(75)
Total			(100)	(100)

Rubric #R1: Project Synopsis/ Proposal Evaluation

Maximum Marks*: 15

			Level of Achievement			
		Weight	Good (3)	Average (2)	Poor (1)	Score
a	Identification of Problem Domain and Analysis	3	Detailed explanation of the purpose and need of the project	Average explanation of the purpose and need of the project	Minimal explanation of the purpose and need of the project	
b	Study of the Existing Systems and limitations	3	Detailed explanation	Collects some basic information	incomplete information	
c	Objectives of the Proposed Work	3	All objectives of the proposed work are well defined;	Incomplete justification to the objectives proposed;	Objectives of the proposed work are either not identified or not well defined;	
d	Methodology of the Proposed Work	3	Steps to solve the defined problem are clearly specified	Steps are mentioned but unclear;	Incomplete and improper methodology	
e	Team work	3	Appropriate distribution of project work	Distribution of project work un-even	Inappropriate distribution of project work	

Rubric #R2: Mid-term Project Evaluation

Maximum Marks*: 28

			Level of Achievement				
		Weight	**Excellent (4)**	**Good (3)**	**Average (2)**	**Poor (1)**	**Score**
a	Modular approach of	4	Division of problem into	Division of problem into	Division of problem into	Modular approach not adopted	

	problem solving		modules and good selection of computing framework	modules and good selection of computing framework	modules but inappropriate selection of computing framework		
b	Design Methodology	4	Appropriate design methodology with justification	Design methodology not properly justified	Design methodology not defined properly	Design methodology not defined	
c	Planning of Project Work	4	Time frame properly specified and being followed	Time frame properly specified and being followed	Time frame properly specified, but not being followed	Time frame not properly specified	
d	Team work	4	Appropriate distribution of project work	Distribution of project work somehow acceptable	Distribution of project work un-even	Inappropriate distribution of project work	
e	Demonstration	4	Objectives achieved as per time frame	Most of the Objectives achieved as per time frame	Few Objectives achieved as per time frame	No objectives achieved	
f	Presentation Content	4	Contents of presentations are appropriate and well arranged	Contents of presentations are appropriate but not well arranged	Contents of presentations are appropriate but not well arranged	Contents of presentations are not appropriate and not well delivered	
g	Presentation style	4	Excellent presentation: Proper eye contact, clear voice, good language	Good presentation: clear voice, good, language, eye contact not proper	Average Presentation	Poor delivery of presentation	

Rubric #R3: End Term Internal Project Evaluation

Maximum Marks*: 32

Level of Achievement							
		Weight	Excellent (4)	Good (3)	Average (2)	Poor (1)	Score
a	Modular approach of problem solving	4	Division of problem into modules and good selection of computing framework	Division of problem into modules and good selection of computing framework	Division of problem into modules but inappropriate selection of computing framework	Modular approach not adopted	
b	Design Methodology	4	Appropriate design methodology with justification	Design methodology not properly justified	Design methodology not defined properly	Design methodology not defined	
c	Planning of Project Work	4	Time frame properly specified and being followed	Time frame properly specified and being followed	Time frame properly specified, but not being followed	Time frame not properly specified	
d	Team work	4	Appropriate distribution of project work	Distribution of project work somehow acceptable	Distribution of project work un-even	Inappropriate distribution of project work	
e	Demonstration	4	Objectives achieved as per time frame	Most of the Objectives achieved as per	Few Objectives achieved as per time frame	No objectives achieved	

				time frame			
f	Incorporation of Suggestions	4	Changes are made as per modifications suggested during midterm evaluation and new innovations added	Changes are made as per modifications suggested during mid-term evaluation and good justification	Few changes are made as per modifications suggested during mid-term evaluation	Suggestions during mid-term evaluation are not incorporated	
g	Presentation Content	4	Contents of presentations are appropriate and well arranged	Contents of presentations are appropriate but not well arranged	Contents of presentations are appropriate but not well arranged	Contents of presentations are not appropriate and not well delivered	
h	Presentation style	4	Excellent presentation: Proper eye contact, clear voice, good language	Good presentation: clear voice, good, language, eye contact not proper	Average Presentation	Poor delivery of presentation	

Activity Based Learning

- CO should target HOS
- Teaching learning process should foster HOS
- Assessment tools should also measure HOS with LOS
- Course activities should be designed to foster HOS with consideration of Dale's cone of learning experience.

Pedagogies

- Flipped Classroom,
- Think Pair Share,
- Peer Learning
- Problem-Based Learning
- Experiment-Based Learning
- Collaborative Learning
- Gamification
- Personalized Learning,
- Group Discussion,
- Debate,
- Case Studies

List of Assessment Tools

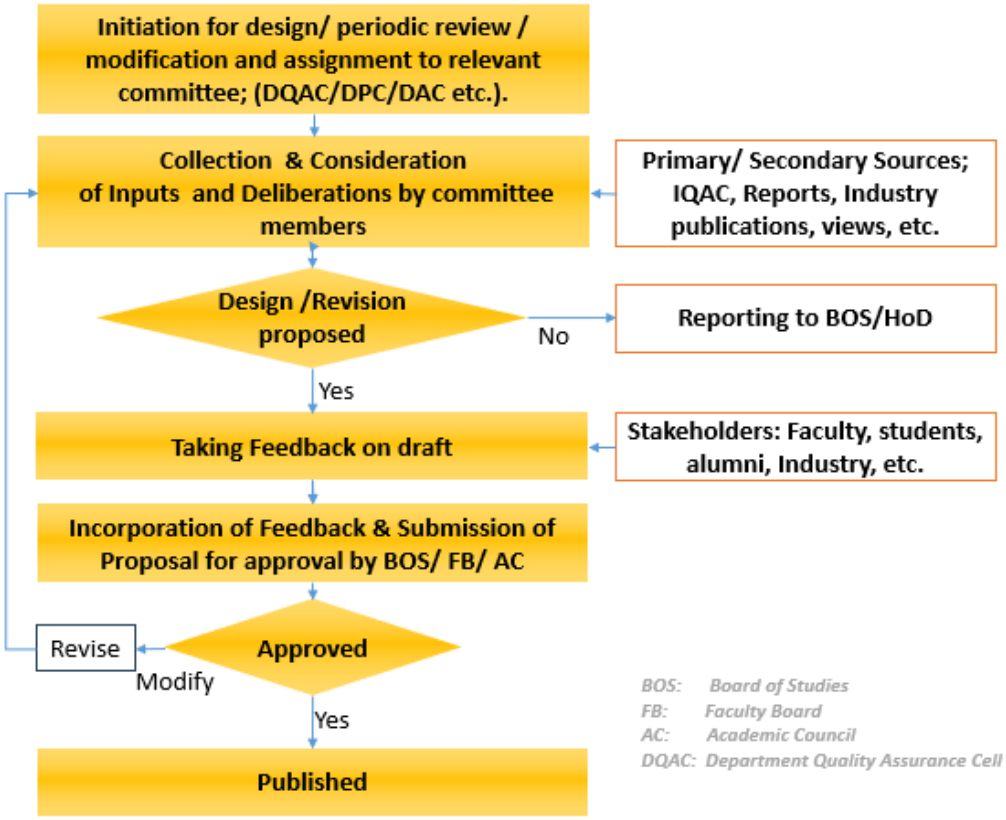
I. Mid semester Test
II. End semester Examination
III. Quiz
IV. Assignment
V. Practical/ Lab work
VI. Industrial Visit, Workshop
VII. Seminar Presentation/Colloquium presentation
VIII. Project/ Dissertation
IX. Other Task/Activity

Continuous Improvement

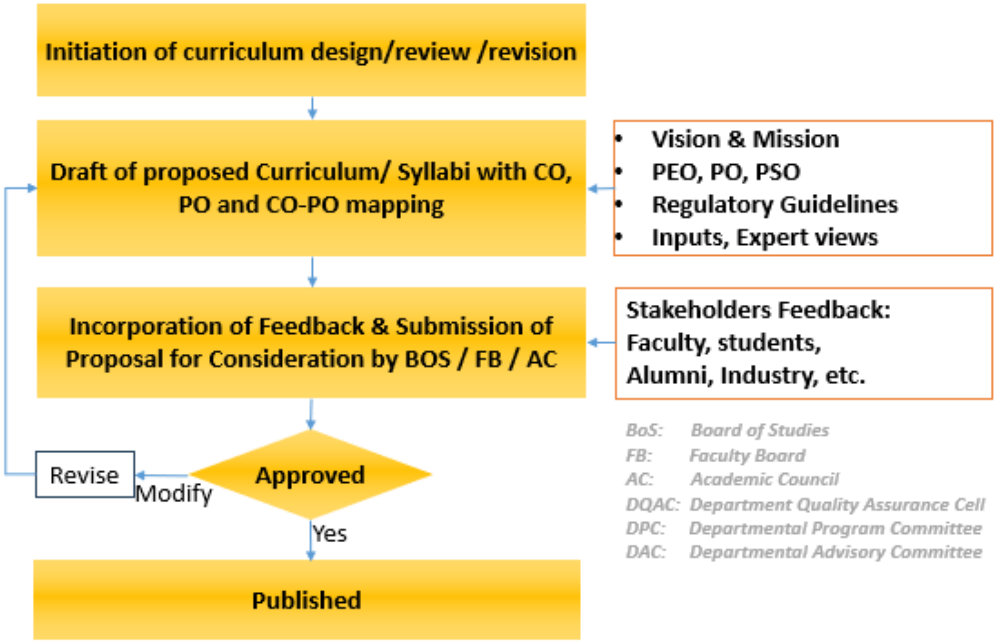
Continuous improvement in OBE involves systematically reviewing, analyzing, and enhancing educational processes and outcomes to ensure they meet the evolving needs and expectations of stakeholders, including students, faculty, employers, and society at large. Stakeholder engagement, data-informed decision-making, and ongoing professional development are key strategies. Challenges include resource constraints and resistance to change. Balancing innovation with stability is crucial. By fostering a culture of collaboration and innovation, institutions can ensure that educational programs remain relevant and effective in preparing students for success in a rapidly changing world.

Annexture: Suggested Processes

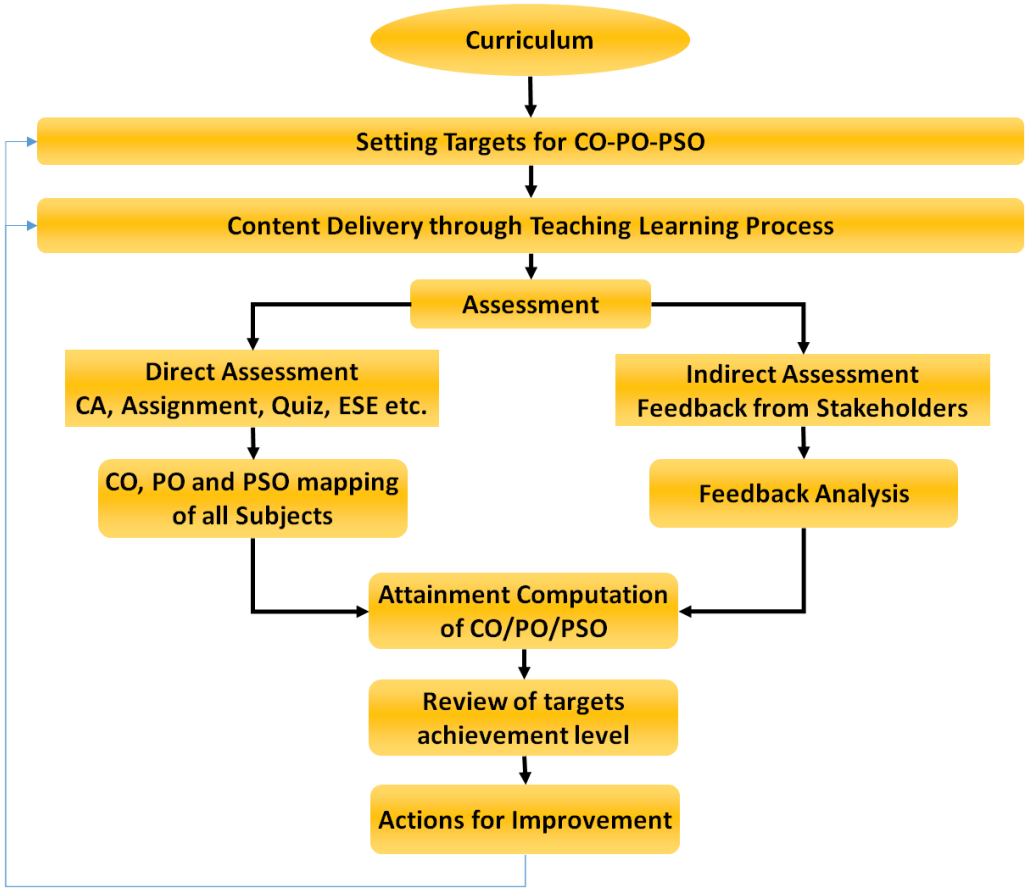
a) Process for defining /Review of Vision, Mission, Program Objectives and Outcomes.



b) Process for Curriculum Design

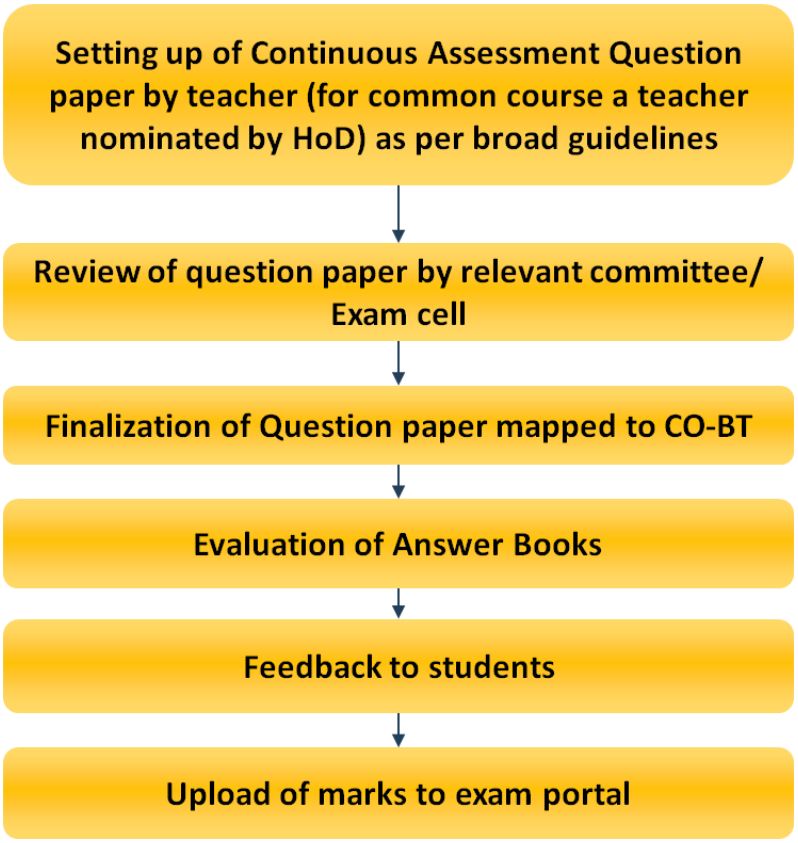


c) Process for identifying extent of compliance of the curriculum for PO/PSO attainment



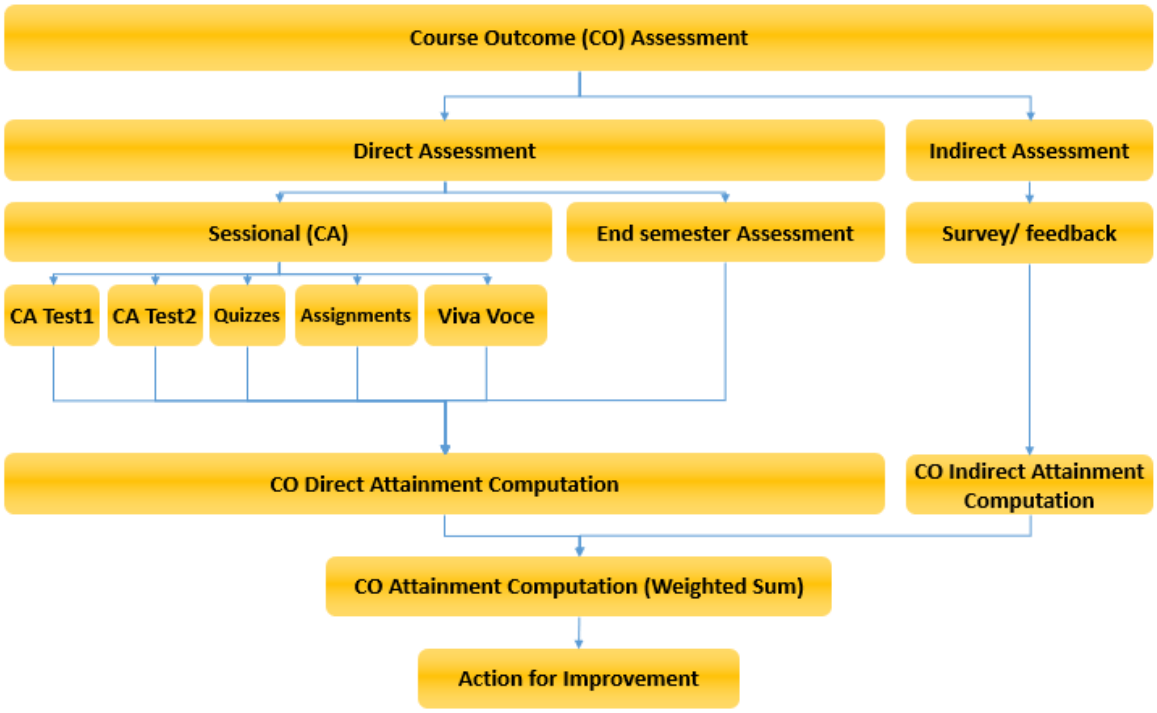
d) Process to improve quality of Teaching-Learning

e) Process for Continuous Assessment Question Paper setting with outcomes/ learning levels perspective, evaluation and effective process implementation

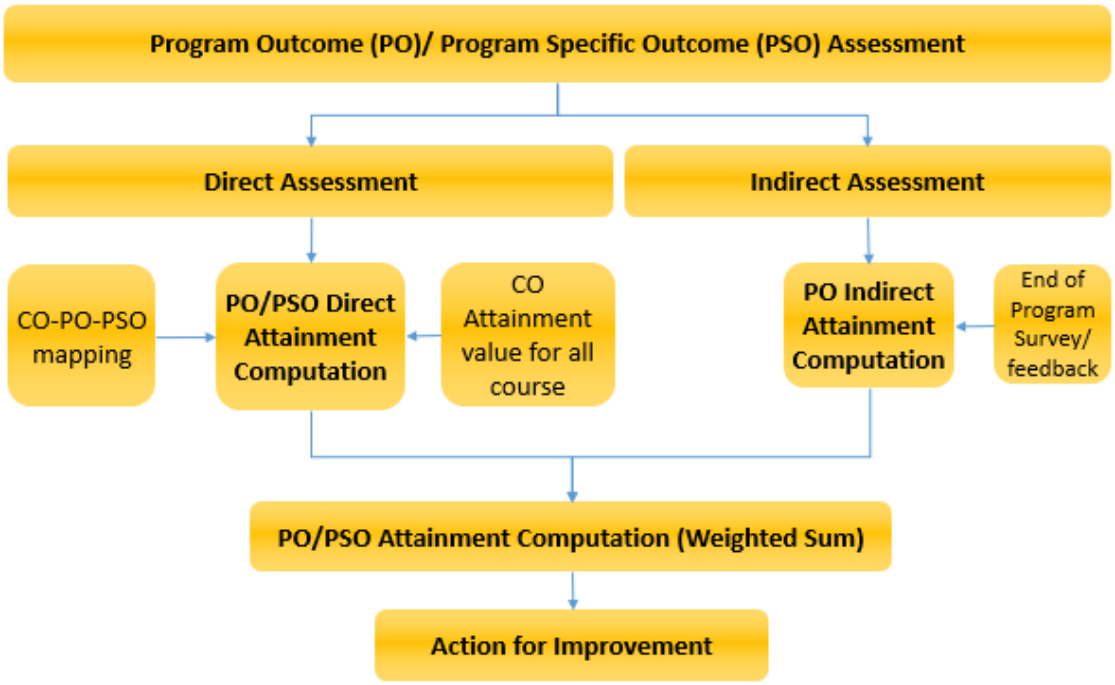


f) Process of Project Allocation, Monitoring, Evaluation and Assessment of performance

g) Assessment processes used to gather the data upon for evaluation of CO



h) Assessment tools & processes for assessing the attainment of POs & PSOs.



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