OUTCOME BASED LEARNING AND TEACHING MANUAL

2021-22

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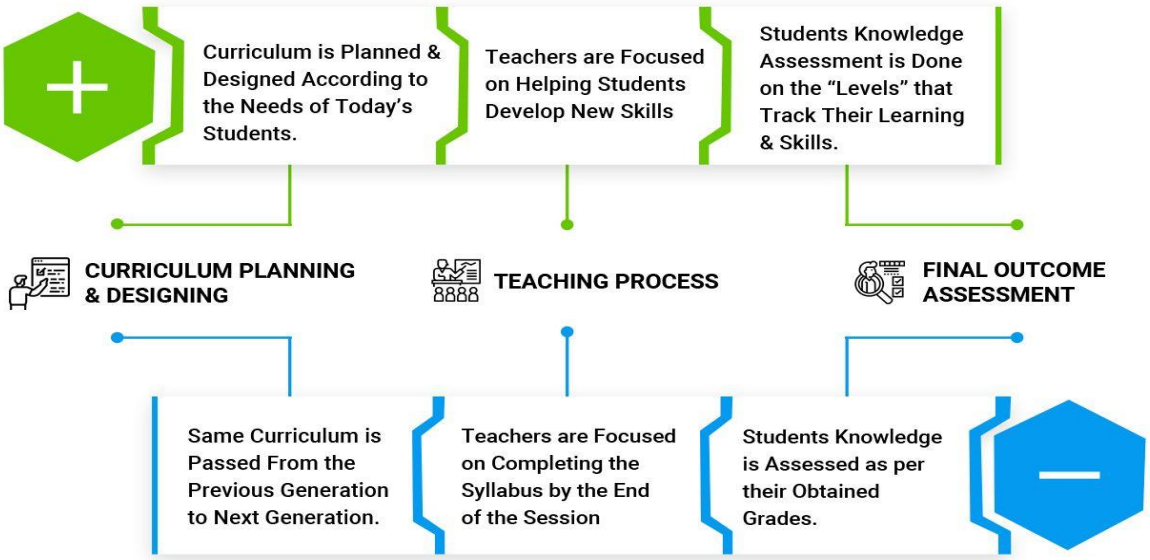
Outcome Based Education

Outcome based education (OBE) is student-centric teaching & learning methodology that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes. Its focus remains on evaluation of outcomes of the program by stating the knowledge, skill and behaviour a graduate is expected to attain upon completion of a program and after 4 – 5 years of graduation.

When we speak about the traditional education system, it is highly dependent on theoretical aspects of learning. It hardly provides any chance for students to develop new skills which might be useful for building their careers. In a traditional system, teachers are more focused on completing the curriculum with the given time frame rather than innovating! But now the aim of education is to prepare learners for life in society and for performing tasks. It is the intention of the outcome-based approach to focus as much on the process of learning and the final outcome will be the knowledge, skills and attitudes.

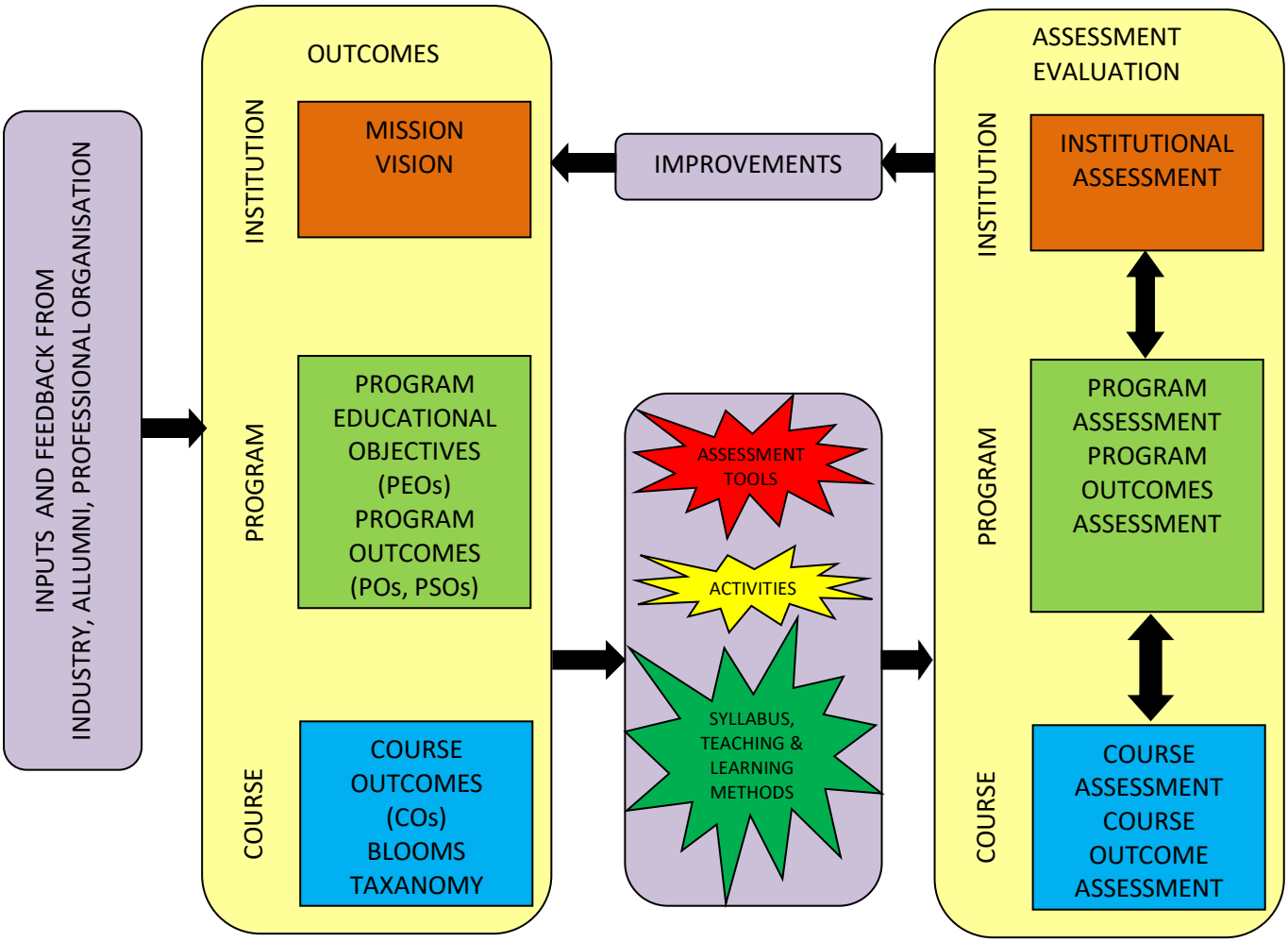
Outcome Based Education Vs. Traditional Teaching



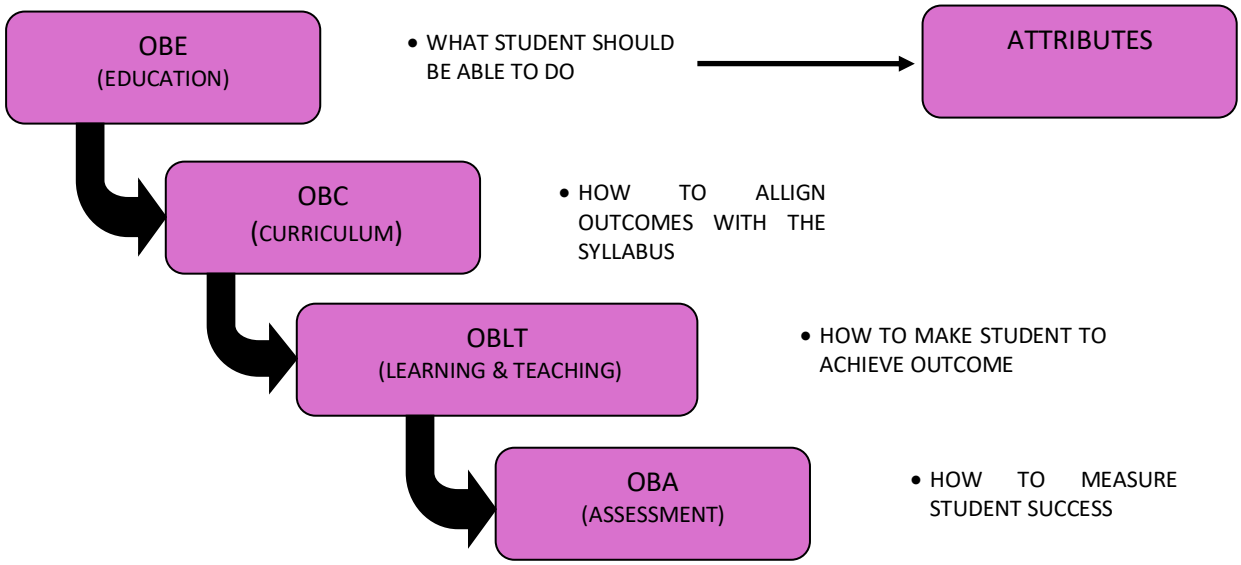
Outcome Based Curriculum Implementation Philosophy

Curriculum Implementation comes after curriculum design and development. It converts a blue print in the form of a curriculum into reality. It is said a good design and bad execution leads to a disaster.

OBE Framework



OBE SYSTEM



Outcome Based Curriculum (OBC)

An outcomes-based curriculum (OBC) model provides direction and guides students on what learning is important at a particular stage or phase. This enables students to define their learning needs; enables teachers to locate their teaching and assessment in relation to the whole; and offers program designers a basis for continuous quality control of the curriculum through assessment design and curriculum evaluation.

Outcome Based Learning Teaching (OBLT)

OBLT is a student-center approach for the delivery of educational programs. The curriculum topics in courses are expressed clearly as the intended outcomes for students to achieve. Teaching is then designed to directly facilitate students to achieve those outcomes. Assessment tasks address what students are supposed to learn and achieve as well. In this approach, teachers act as facilitators, and students should take responsibility and participate actively.

Outcome Based Assessment (OBA)

Outcome Based Assessment is the process of developing the appropriate assessments for the learning outcomes as well as conducting some necessary activities to make the assessments transparent, valid, and reliable. OBA plays a critical role in OBE since without the presence of transparent, valid, reliable assessments, it would not be possible to tell what and how the students have achieved with respect to the pre-determined learning outcomes.

Instructions for people involved in curriculum implementation

Following are the instructions to different class of people involved in curriculum implementation:

Instructions to Program Heads

Being a head of a whole Learning Teaching Process (LTP) at a program level, Program Heads have very important role to play. It is to canalize efforts of all courses faculty members not only of the program but also those of other programs/departments. By doing so shall ensure achievement of predetermined PEOs, POs, PSOs and COs. In that case Program Heads are required to establish formal dialogue with all course faculty members and in-charge/Heads of the other departments/programs, whose faculty members input, is equally important in successful curriculum implementation.

Program Heads are expected to do following in order to achieve that: -

- Prepare a program/department academic calendar (Annexure-I) based on the academic calendar (Annexure-II) declared by dean academics.
- Identify senior faculty and allocate him/her the portfolio of curriculum implementation and monitoring.
- Organize pre term commencement meeting of all faculty members.
- Guide faculties in preparing an integrated teaching plan (Annexure-III) of the course(s) they are going to teach.
- Monitor curriculum implementation though internal mechanism.

- Guidance and counseling mechanism should be developed at program level to address academically weak students; prepare and implement strategic plan for the same.
- Collect feedback from Parent (Annexure-IV), Faculty (Annexure-V), Alumni (Annexure-VI) ones in a year.
- Analyze the PEOs, POs, and PSOs of the program and take corrective measures/actions.
- Ensure that faculty's follows outcome based learning teaching process and assessment norms.

Instructions to Course Faculty

Course faculty has a very important role of converting curriculum into predetermined outcomes. Course faculty is an important person behind achieving PEOs, POs, PSOs and COs.

For that course faculties are required to do following things: -

- Read & comprehend Vision, Mission, Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs) of the program.
- Read & comprehend Course Outcomes (COs) of the course(s).
- Provide the authentic copy of curriculum to the students (Signed by PBOS Chairman and Secretary) and discus the curriculum with the students in first class.
- Prepare course file (Annexure-VII & Annexure-VIII) separate for each course in advance before the start of academic session to implement the course curriculum effectively. Course file comprises of the following documents with necessary data.
  - Academic Calendar of Department
  - Roll List
  - Curriculum of Courses allotted
  - Time Table
  - Teaching Plan Implementation
  - Practical/Tutorial Plan implementation
  - Mapping of Subject with CO, PO and PSO - (Annexure-IX)
  - Attendance Register
  - Assignment and samples
  - Detention list
  - Activity details
  - Progressive Test/MSE Question Paper(s)– (Annexure-X)
  - *CO attainment of Test/MSE*
  - Continuous Assessment of Theory
  - Rubrics – (Annexure-XI)
  - Continuous Assessment of Practical - (Annexure-XII)
  - Course Outcome Attainment Gap Analysis - (Annexure-XIII)
  - Course Outcomes (COs) Attainment (After result for current term)
  - POs and PSOs Attainment of the course (After result for current term)
  - Student Feedback - (Annexure-XIV)
  - End of Course Survey forms - (Annexure-XV)

- Course Material –handouts, notes, DVDs, PPTs, Model Question paper, Previous terms Question Papers, Progressive Test Papers etc
- Submit the course file to Head of the department for record after declaration of result.

Instructions to Examination Cell

Apart from framing and implementing its own curricula, the institute is empowered to conduct its own examination. Examination cell plays a vital role in curriculum evaluation process. Hence examination cell is expected to do following: -

- Prepare exam schedule and declare it well in advance before the beginning of the term.
- Follow rules, regulations and guidelines approved by Examination Committee, Board of Studies, Academic Council and Governing Body time to time.
- Execute evaluation process parameters included in course curriculum.
- Involve external experts in the student's evaluation process.

Instructions to Training and Placement Cell

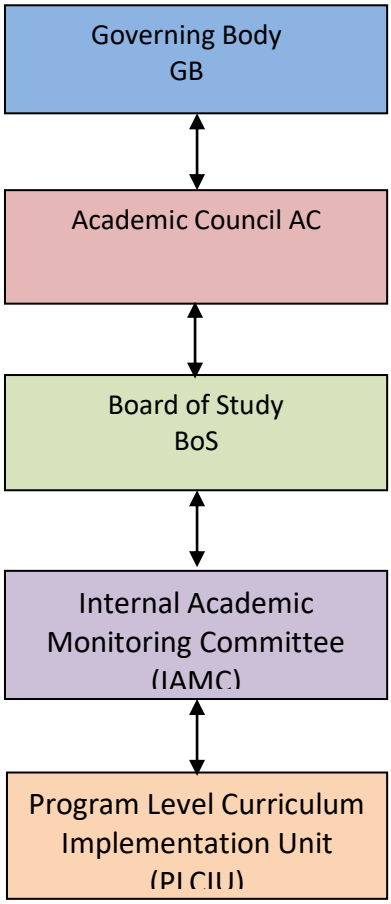
The Training and Placement cell should perform the activities like arranging industrial training/in-plant training, organization of workshops/ seminars for entrepreneur development, and campus placement. Industrial Training is a very important component of the OBE curriculum meant for the students and a valuable tool for Industry Institute interaction. Hence training and placement cell is expected to do following related to industrial training: -

- Provide letter for industrial training in winter and summer vacations to Multinational / National/ Private / Public Sector Undertakings/Government Departments, Research Laboratories/ Institutes or Academic Institutes as per the recommendation of Head of the program.
- Keep the record of industrial training of students after the completion of industrial training program wise. Collect the record of students completed industrial training from the program Head.
- Keep the record of campus placement. Provide it to Program Heads.
- Collect the program wise industry feedback at the time of campus interview.

Mechanism for curriculum implementation

Following figure shows the structure of curriculum implementation & monitoring mechanism, which consists of followings:

- Governing Board (GB)
- Academic Council
- Board of Studies (BOS)
- Internal Academic Monitoring Committee (IAMC)
- Program Level Curriculum Implementation Unit (PLCIU)



Structure of IAMC

The structure of IAMC will comprise of the following officials –

1. Program Head/ Head of Department - Chairman
2. Sr. Faculty – Member
3. Sr. faculty – Member Secretary

(If required more than 01 IAMC may be formed as per above structure)

Roles and responsibilities of IAMC

1. Monitor outcome based learning teaching and assessment process defined in these norms.
2. Verify the course files of faculties, and all documents related to data filled in internal academic monitoring.
3. Observe the working in laboratory and discuss with students any relevant issues.
4. Submit the Internal academic monitoring/audit report, to Principal.
5. Provide feedback of internal monitoring to Program/Department Head.

Terms of Reference

1. IAMC should carryout monitoring once in each semester/term.

2. Chairman IAMC will responsible for preparation and submission of reports.
3. Minimum quorum shall be two members (Chairman +one member).
4. Chairman IAMC reserves the right to alter the terms and change the member representative for smooth and efficient functioning of IAMC.

Program Level Curriculum Implementation Unit (PLCIU)

Program Level Curriculum Implementation Unit (PLCIU) shall be set-up at program level.

Structure of PLCIU

The structure of PLCIU will comprise of the following officials –
1. Head of program/department – Ex-officio Chairman
2. Academic incharge of the program/department – Ex-officio Member secretary
3. Sr. faculty of the program/department (to be nominated by HOD) – Member
4. Representative of students – 02 (One female and one male, to be nominated by HOD)

Roles and responsibilities of PLCIU

1. Study Curriculum development/ revision process and prepare curriculum implementation plan at program/department level.
2. Identify the resource gaps at program/department level and develop plan to make up the deficiencies.
3. Prepare action plan for effective implementation of curriculum as per academic schedule of the institute.
4. Guide the faculties and students regarding the philosophy of curriculum design and its implementation.
5. Ensure uniform implementation of OBLT&A norms for student assessment.
6. Analyze the reports of internal and external monitoring committees and take remedial action.
7. Maintain the records of all activities in the prescribed formats.
8. Report and present action taken report on suggestions of IAMC/EAMC to ICIU.

Terms of Reference

1. Ex-officio members are permanent members.
2. All other members will be by rotation.
3. The term of all other members shall be for 1 year.
4. PLICU will meet at least once in a term/semester.
5. Member secretary will prepare the agenda, maintain the minutes of the meeting and prepare the action taken report.
6. Minimum quorum shall be half the number of members +1
7. Chairman PLICU reserves the right to alter the terms and change the member representative for smooth and efficient functioning of PLCIU.

OBE Implementation

Outcome-Based Education (OBE) is implemented as per the following steps:

- Define Vision statements, Mission statements for the Institute and department
- Define Program Educational Objectives
- PO & PSO Statements
- Define Course Objectives
- Map courses with Program outcomes at suitable levels of Bloom's Taxonomy
- Define Course Outcomes with Bloom's Taxonomy for each course
- Map topics with Course outcomes
- Prepare lecture-wise Course teaching Plan
- Define pedagogical tools for course outcomes delivery
- Define rubrics for Tutorial, Practical, seminar, Mini Project, Final year Project.
- Measure the attainment of each CO through Direct/Indirect assessments
- Track students performance
- Identify Gaps in the Curriculum and adopt suitable measures to bridge the Gap
- Compare PO/PSO for last 3 academic years and propose remedial actions
- Assess the attainment of Program Educational Objectives

Vision and Mission of the Institute

Vision: To be a centre of excellence imparting professional education satisfying societal and global needs.

Mission:

1. Transforming students into lifelong learners through, quality teaching, training and exposure to concurrent technologies.
2. Fostering conducive atmosphere for research and development through well equipped laboratories and qualified personnel in collaboration with global organizations.

Program Educational Objectives (PEOs):

- PEOs describe the career and professional accomplishments that the program is preparing graduates to accomplish after 3 to 5 years of graduation.
- Knowledge, Skill and Attitude are the three behavioral elements based on which PEOs are constructed.
- PEOs are promises made by the institute to the stakeholder (Employers, students etc)
- PEOs should be measurable, appropriate, realistic, and achievable.

Mapping Mission statements with Program Educational Objectives

- The program educational objectives (PEOs) should fall in line with the Mission statements.
- The BoS of the department is to establish consistency of the PEOs with the Mission of the department.
- There are distinct elements of the mission statements such as academic development, industrial & social needs, human potential development etc. These key elements capture some key aspects of the PEO statements. On the basis of this, the correlation is established between PEOs and such distinct elements of mission statements, the correlation is quantized the correlation levels need to be entered as 1 or 2 or 3.
- "1" means that the correlation is low or slight, "2" means that the correlation is moderate or medium and "3" means that the correlation is substantial or is very high.

Program Outcomes (POs) defined by NBA

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

PO 2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 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.

PO 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.

PO 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.

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.

PO 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.

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

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

PO 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.

PO 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.

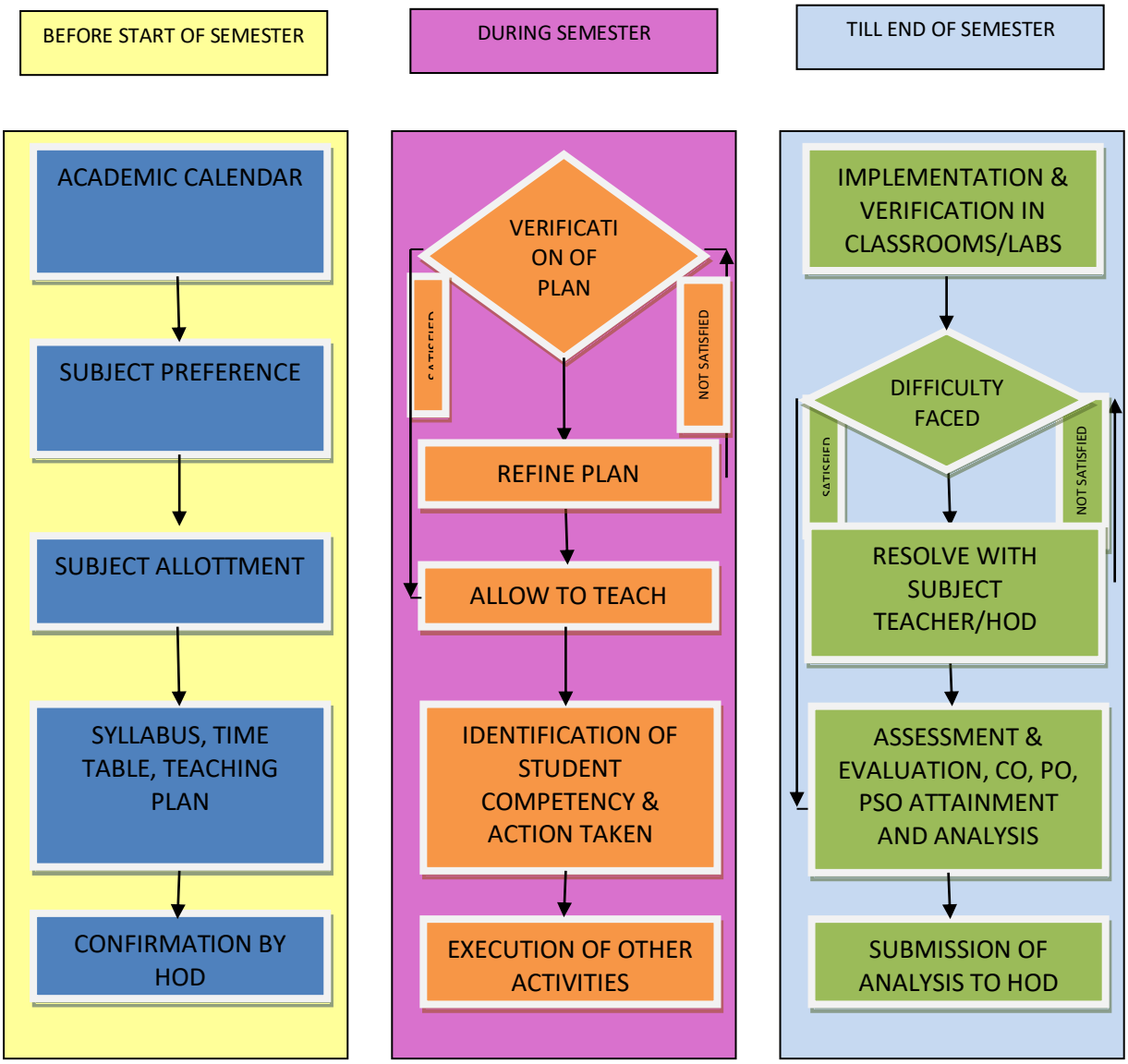
PO 12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

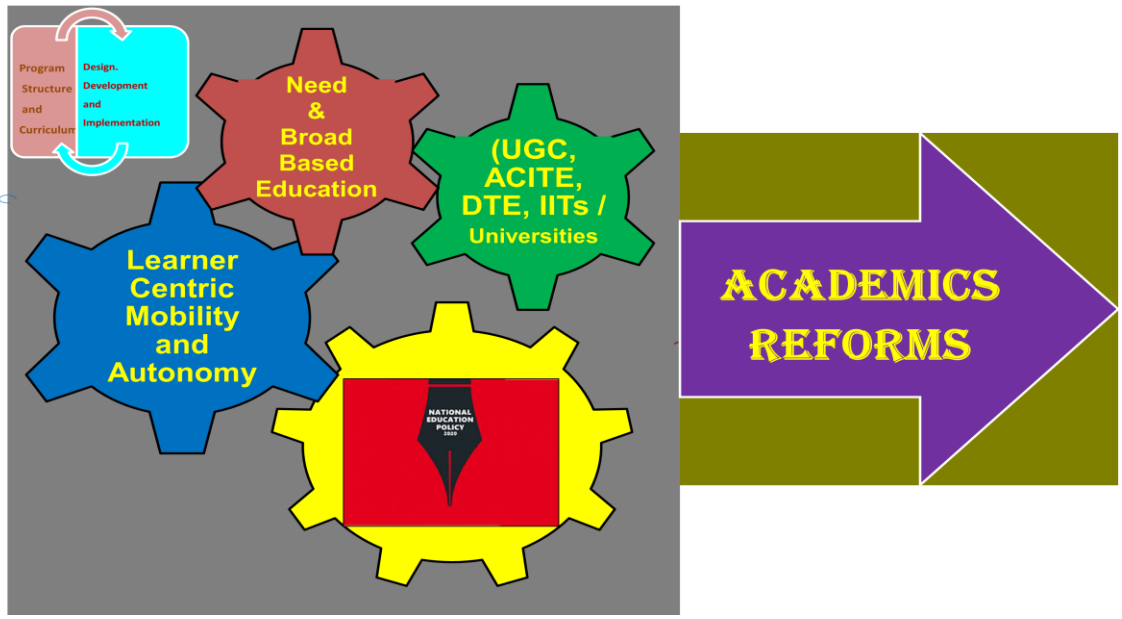
Program Specific Outcomes (PSOs)

- Program Specific Outcomes are statements that describe what the graduates of a specific engineering program should be able to do.
- PSOs characterize the specificity of the core courses of a program.
- PSOs are defined based on the Centre of Excellence of the Department.
- Generally, 2 to 4 Program Specific Outcomes (PSOs) that the graduates of the program will attain should be defined for each department.

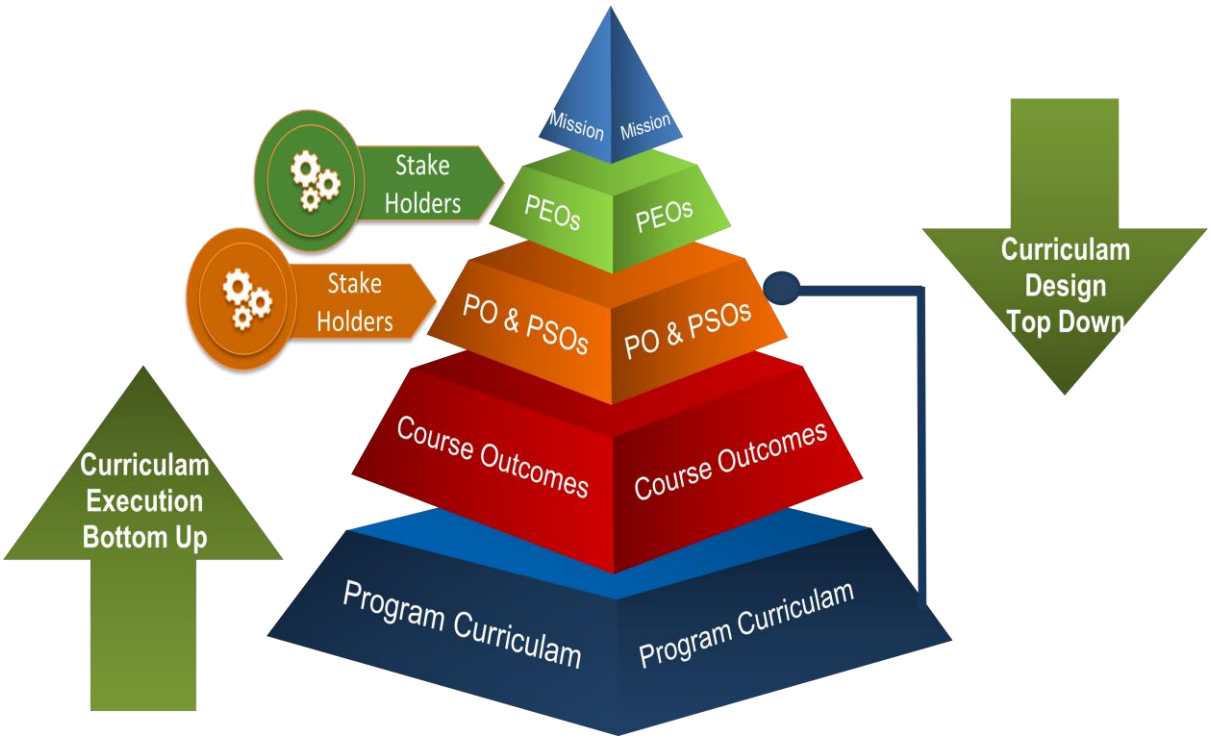
OBE PROCESS at JDCOEM

At JDCOEM, the OBE system has been implemented since 2019. It has been fine-tuned and institutionalized through focused policy formation and training. Various committees such as Academic Council (AC), Board of study (BOS), Internal Quality Assurance Cell (IQAC), Internal Academic Monitoring Committee (IAMC) and Program Level Curriculum Implementation Unit (PLCIU) have been formed by drawing members from Industry, Alumni, Parents, Management, Faculty, Staff and Students. These committees guide and monitor the implementation of OBE in the college.


BEFORE START OF SEMESTER
DURING SEMESTER
TILL END OF SEMESTER
ACADEMIC CALENDAR
SUBJECT PREFERENCE
SUBJECT ALLOTTMENT
SYLLABUS, TIME TABLE, TEACHING PLAN
CONFIRMATION BY HOD
VERIFICATION OF PLAN
SATISFIED
NOT SATISFIED
REFINE PLAN
ALLOW TO TEACH
IDENTIFICATION OF STUDENT COMPETENCY & ACTION TAKEN
EXECUTION OF OTHER ACTIVITIES
IMPLEMENTATION & VERIFICATION IN CLASSROOMS/LABS
DIFFICULTY FACED
SATISFIED
NOT SATISFIED
RESOLVE WITH SUBJECT TEACHER/HOD
ASSESSMENT & EVALUATION, CO, PO, PSO ATTAINMENT AND ANALYSIS
SUBMISSION OF ANALYSIS TO HOD


Program Structure and Curriculum
Design. Development and Implementation
Need & Broad Based Education
(UGC, ACITE, DTE, IITs / Universities
Learner Centric Mobility and Autonomy
NATIONAL EDUCATION POLICY
ACADEMICS REFORMS

OBE Model



Guidelines for writing Course Outcome Statements

- It is a detailed description of what a student must be able to do at the end of a course.
- COs are the statements of Knowledge/ Skills/ Attitude that students are expected to know, understand and perform, as a result of learning experiences.
- Course Outcome remains the base of the hierarchy of outcomes and is the tools that can be used to measure student performance in each course.
- It should be narrower and measurable statements
- Well-written COs facilitate the faculty in measuring the achievement of the CO at the end of the semester. It also helps the faculty in designing suitable delivery and assessment methods to achieve the designed COs.
- New COs is developed when a new course is offered.

Well-written course outcomes involve the following parts:

1. Action verb
2. Knowledge or Subject content
3. Condition (optional)
4. Criteria or Level of achievement as per BTL (optional)
5. Modes of performing task (optional)

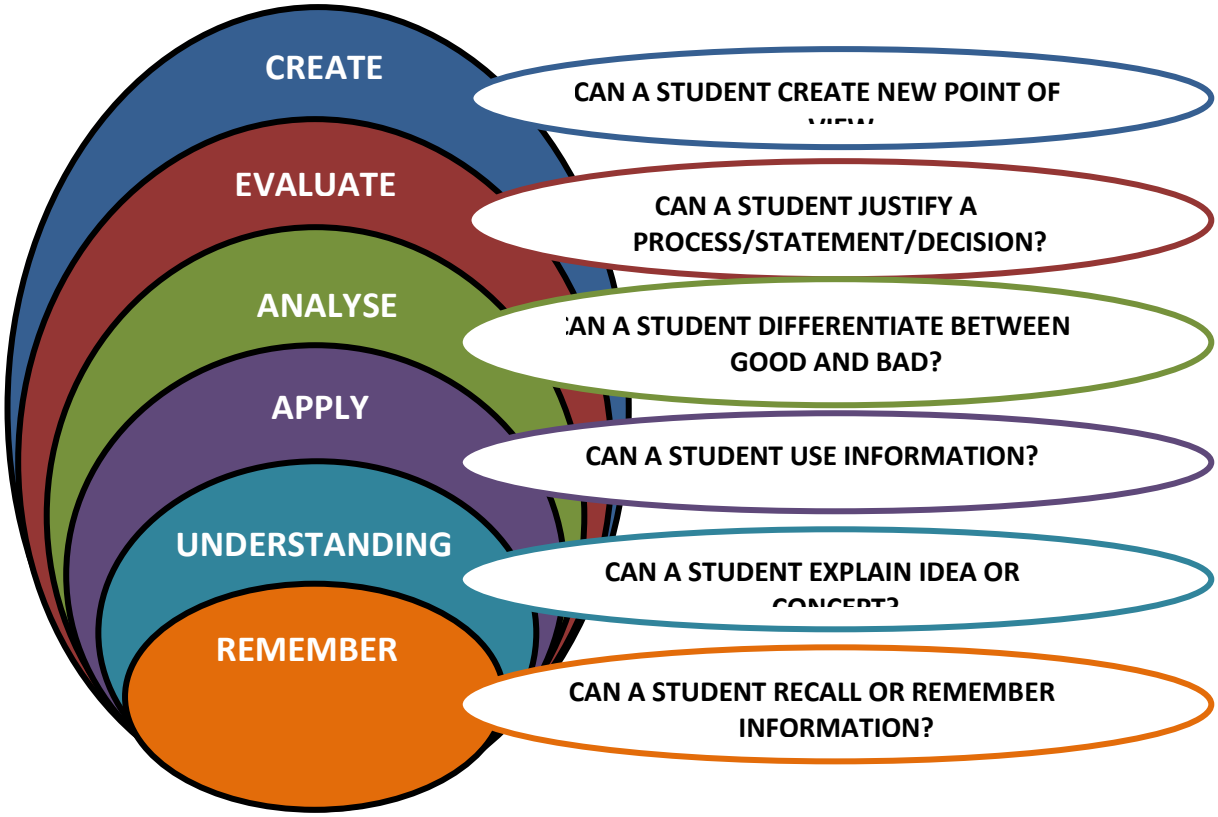
Illustration

Student should be able to

- Design column splices and bases. ⟶ Action verb (underlined)
- Determine the losses in a flow system. ⟶ Action verb , Knowledge or Subject content
- Use structural analysis software to a competent Level. ⟶ Condition, Criteria or Level of achievement
- Present seminar on real life problems. ⟶ Modes of performing task
- Calculate major and minor losses associated with fluid flow in piping networks. ⟶ Action Verb, Knowledge
- Determine the dynamic unbalanced the conditions of a given mechanical system of rigid bodies subjected to force and acceleration. ⟶ Action Verb, Knowledge & Condition
- Understand the effect of all the parameters in voltage controlled oscillators through simulation using TINATI. ⟶ Action Verb, Knowledge & Condition
- Determine the root of the given equation, accurate to second decimal place using Newton-Raphson method. ⟶ Action Verb, Knowledge, Criteria & Condition

The Cognitive Process Dimensions

Lower order Thinking (LOT)			**Higher order Thinking (HOT)**		
Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Recognizing (Identifying)	Interpreting	Executing	Differentiating	Checking (, , ,)	Planning
Recalling (Retrieving)	Illustrating	Implementing	Organising	Critiquing (judging)	Generating
	Classifying		Attributing	coordinating	Producing
	Summarising			detecting	
	Inferring (Concluding)			testing	
	Comparing			monitoring	
	Explaining				



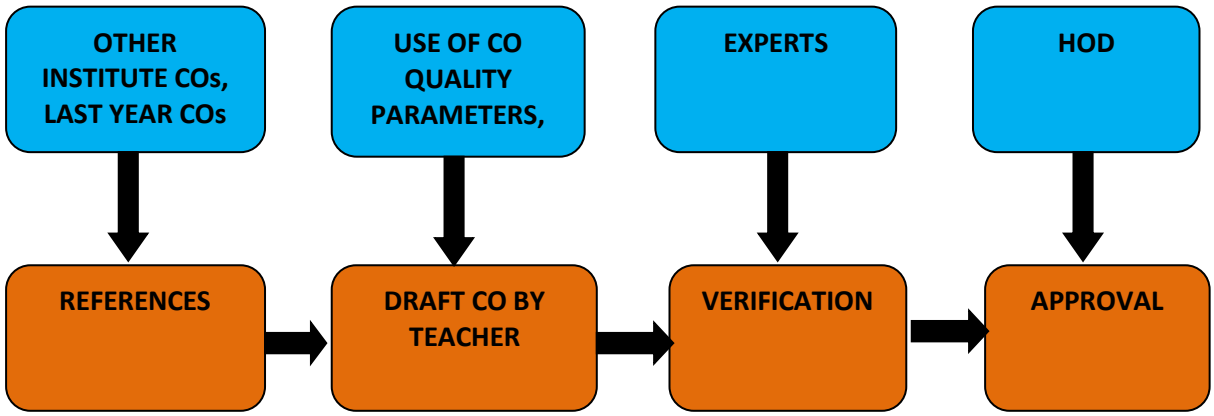
Sample action Verbs

Lower order Thinking (LOT)			Higher order Thinking (HOT)		
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

While writing COs the following questions/points must be addressed properly.

Specific	Is there a description of precise behaviour and the situation it will be performed in? Is it concrete, detailed, focused and defined?
Measurable	Can the performance of the outcome be observed and measured?
Achievable	With a reasonable amount of efforts and application can the outcome be achieved? Are you attempting too much?
Relevant	Is the outcome important or worthwhile to the learner or stakeholder? Is it possible to achieve this outcome?
Time-Bound	Is there a time limit, rate, number, percentage or frequency clearly stated? When will this outcome be accomplished?

Process at department level to maintain quality of CO



Guidelines/Checklist for COs:

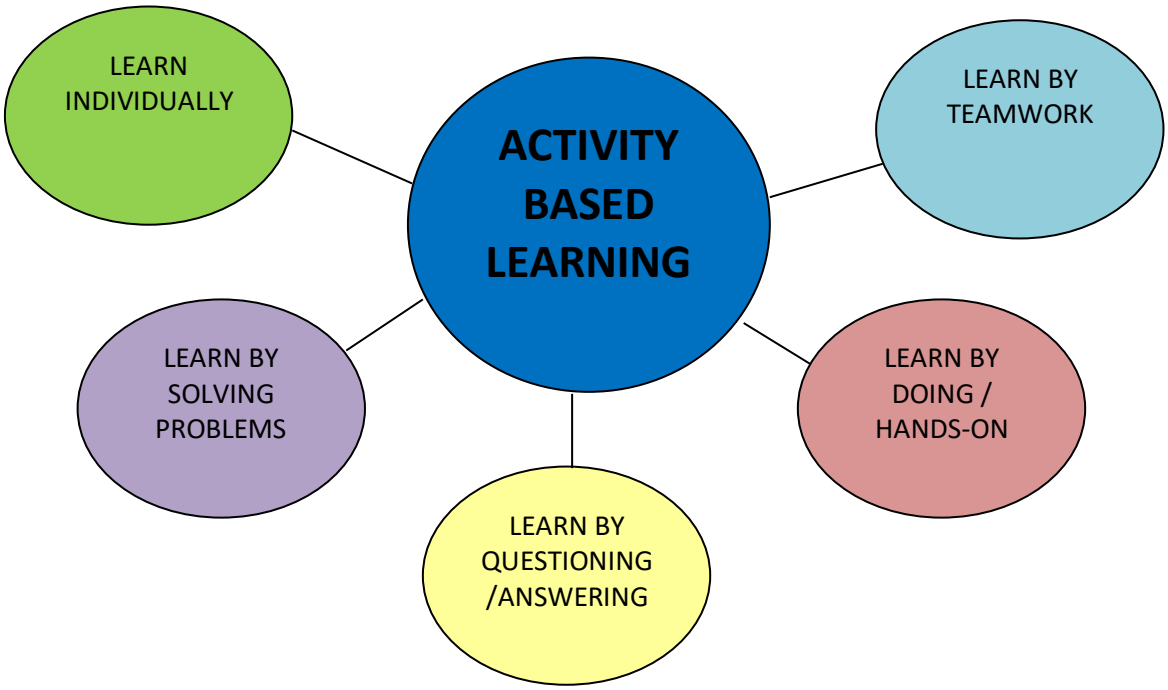
Number of COs	4 to 6 (Each CO will be based on entire syllabus)
CO essentials	Action Verb, Subject Content, Level of Achievement, Modes of Performing task (If Applicable)
Based on BTL	Understand, Remember, Apply, Analyse, Evaluate, Create
Number of BTL Considered in one course	Minimum 3
Technical Content/ point of curriculum	All curriculum contents are covered
Curriculum gap	Additional CO for gap identified/filling. Adds more weightage

The activity based learning

The activity based learning (ABL) is the important feature of OBE which is commonly defined as activities that students do to construct knowledge and understanding. The activities vary but require students to do thinking. The student thinking about their own learning is an important link between activity and learning. It develops self-learning skill among the learners and allows a student to study according to his or her skill.

In the process of learning, student experience, memorize and understand. Students need to be provided with data and materials necessary to focus their thinking and interaction in the lesson for the process of analyzing the information. It requires active problem solving by students in finding solution by their own investigation and analysis. With continued practice in these processes, we find students learn not the content of the lesson but also develop many other skills like,

- It enhances creativity.
- It gives reality for learning.
- Builds the student's self-confidence.
- Gets experiences, develop interest and provides motivation for reading.
- A student who lacks in verbal expression can make up through activity.
- Social relation provides opportunity to mix with others.



Methods of Assessment

Assessment methods are used to provide adequate feedback to the program to identify strengths and weaknesses. There are basically two types of assessment methods in order to gather evidence of student learning. The assessment should be done through direct and indirect method as given below.

Direct assessment

A direct assessment method is based on a sample of actual student work. Direct assessment consisting of following heads.

- Progressive Test
- Mid Sem Exam
- End Sem Exam
- Assignment
- Practical/ Lab work
- University Exam
- Activity
    - Quiz
    - Industrial Visit
    - Workshop
    - Strip sequence
    - Debate
    - Case study
    - One-minute paper
    - Peer Teaching
    - MOOC
    - Flip Teaching
    - Group discussion
    - Mini Projects

Indirect assessment

An indirect assessment is based upon a report of perceived student learning. Following feedbacks are used for indirect assessment.

- Student Feedback
- Course Exit Feedback
- Alumni Feedback
- Parent feedback
- Faculty Feedback
- Employer Feedback

Program Outcomes and Direct Assessment tools

PO1: Engineering Knowledge: Ability to *apply* knowledge of basic Mathematics, Science and Engineering to solve the engineering problems.

Direct Assessment tools:

- Test questions in exams on application/analyse level.

PO2: Problem Analysis: Ability to identify, formulate and analyze the applied engineering problems.

Direct Assessment tools:

- Test questions in exams.
- Assignments that involve problem analysis.
- Projects in various courses.

PO3: Design/Development of Solutions: Ability to design solutions and system for complex engineering problems.

Direct Assessment tools:

- Test questions in exams.
- Lab reports in engineering courses using rubrics.
- Assignments on specific analysis problems.
- Projects in various courses.

PO4: Conduct investigation of complex problems: Use research based knowledge and methods to provide conclusion.

Direct Assessment tools:

- Test questions in exams.
- Lab and field tools assessed.
- Projects in various courses.

PO5: Modern tool Usage: Apply appropriate technologies and tools with understandings of limitations.

Direct Assessment tools:

- Assignments that include analysis software, CAD programs, etc.
- Lab and field tools assessed by faculty and industry experts.
- Projects that assess student ability to appropriately apply tools.

PO6: The Engineer and Society: Demonstrate knowledge to assess the societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to engineering practice.

Direct Assessment tools:

- Assignments that examine student understanding of this attribute.
- Design projects in which this attribute is integrated.
- Complementary studies courses.

PO7: Environment and Sustainability: Understand the impact of engineering solutions in societal and environmental context, and demonstrate knowledge and need for sustainable development.

Direct Assessment tools:

- Assignments that examine student understanding of this attribute.
- Design projects in which this attribute is integrated.
- Complementary studies courses.

PO8: Ethics: *Apply* ethical principles and commit to professional ethics and responsibilities and norms of engineering practice

Direct Assessment tools:

- Through Seminar/Quiz.
- Exam questions in ethics related courses.
- Rubric to score essays from courses that discuss ethics.
- Reports and testing based on case studies.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse/ multidisciplinary teams.

Direct Assessment tools:

- Lab reports and design projects that involve group work.
- Observations of faculty members and industry experts.
- Project that involve group work.

PO10: Communication: An ability to communicate effectively.

Direct Assessment Tools:

- Conducting Quiz.
- Quiz after listening the video.
- Writing abstract of reports/papers/IS codes.
- Assignments in any course that require written work and presentations.

PO11: Project management and finance: Demonstrate, understand and apply the management principles to manage projects.

Direct Assessment Tools:

- Projects that assess student ability to manage finance.
- Work of students in various competitions.
- Rubric for project.

PO12: Life-long learning: Recognize the need for, and have preparation and the ability to engage in independent and life-long learning in context of technological changes.

Direct Assessment tools:

- Can be introduced in all courses.
- Engage in independent/ self-study.
- Assignments that assess student ability to search Internet and library.
- Rubric for project and experiments.
- Exam questions ethics course.
- Work of students in various competitions.

Sample List of Activities with BTL

Activities	**Possible BTL**	**PO Mapping**
Tutorial- Write-ups	Understand, Apply	Any relevant PO from 1 to 4
Practical-Experiments	Understand, Apply, Analyse, Evaluate, Create	Any Relevant PO
Test/Quiz	Understand, Apply, Analyse	Any relevant PO from 1 to 4
Students' Seminar	Understand, Apply, Analyse	Any PO from 1, 2, 8, 10

Case Study	Understand, Apply, Analyse	Any Relevant PO
Presentation/Oral	Understand	
Guest Lecture	Understand	
Visits	Understand	
Survey & Analysis	Apply & Analyse	
Workshop/Hands-on Training	Apply, Analyse, Evaluate	
Task	Evaluate, Create	
Minor Project	Create	

Note: Faculty/ department can conduct other than the mentioned activities with Blooms Technology, PO and proper justification.

Activity Planning Guidelines (PO5 to PO12)

Sr. No.	Activity Contact	Hours Minimum	Assessment Tool	Mapping Level
1	Seminar Presentation		Feedback or Quiz or Rubric Based Assessment	1
	Case Study			
	Guest Lecture			
	Visits			
	Survey & Analysis			
2	Visits	7 to 20 Hrs	Feedback or Quiz	2
	Survey & Analysis		Rubric Based Assessment for Report, Presentation etc.	
	Workshop / Hands -on			
	Training			
	Task			
3	Workshop/Hands - on Training	More than 20 Hrs	Feedback or Quiz	3
	Task		Rubric Based Assessment for each PO	
	Minor Project		Impact analysis	

Note: Department may use other additional criteria and justify the mapping level.

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.

Necessity of Rubrics

- Rubrics help to measure higher-order skills or evaluate complex tasks.
- Rubrics help to clarify vague, fuzzy goals.
- Rubrics help students to understand teacher's expectations.
- Rubrics help students to self-improve.
- Rubrics can inspire better student performance.
- Rubrics improve feedback to students.
- Rubrics make scoring easier and faster.
- Rubrics make scoring more accurate, unbiased, and consistent.
- Rubrics reduce arguments with students.
- Rubrics improve feedback to faculty and staff.

Use of Rubrics

Rubrics are used to assess followings.

- Essays/Papers
- Projects /reports
- Laboratory work
- Presentations /seminars
- Assignments
- Exam questions
- Performances
- Portfolios of student work
- Artwork
- Internships

Norms for Assessment

The assessment consisting of various heads i.e. Progressive (class) test, Assignments, Mid Sem Examination of Theory, Continuous assessment of practical, End Sem Examination of Theory and Practical etc. Assessment norms for the various heads are as follows.

Continuous Assessment (CA) (20 Marks): CA is based on the Attendance and Activity. Activity will be set on lower and the higher order level of bloom's taxonomy.

Norms for Activity

Prepare rubrics for assessment of activity and convert into 5 marks. The decimal marks should be converted into higher digit. (i.e. 8.01 marks to 9 Marks)

- Faculty should maintain the record of activity marks in (Format).
- Total five activities should be conducted.
  - **Assignment (5 marks):** There will be maximum two assignments (20 Marks each) should be given to students as per academic calendar. For marks calculation, it can be considered as Best of two assignments.

    Norms for Assignment (Format)
    - One or more home assignment should be given to student.
    - Assignment should base on one or more Course Outcomes (COs) of course.
    - Individual or group assignment should be given based on the type of assignment.

- Monitor the progress give feedback to the students.

❖ **Test (5 Marks)**: There will be only two test (20 Marks each) should be given to students as per academic calendar. For marks calculation, it can be considered as Best of two tests.

Norms for Progressive Test (PT)

- Faculty should prepare a sample test paper as per the guidelines mentioned below.
- The time table for progressive test should be displayed before the commencement of progressive test as per the academic schedule of the term.
- Two progressive tests will be of 20 marks each.
- First progressive test should cover minimum of one unit of curriculum and second progressive test should cover 3 units of curriculum.
- The progressive test question paper format should be as per format (Format) mentioning Course Outcomes (COs), Taxonomy level and marks of each question.
- Best of two progressive test marks should be considered.
- No improvement and absentee test will be allowed in any case.
- Faculty should prepare model answer of progressive test question papers and circulate to students.
- Faculty should show the answer paper of progressive test to the student and discuss the performance and guide them for improvement.
- Faculty should maintain the record of progressive test marks in format E: 10.

❖ **Sanskar Video (5 Marks)**: A motivational Video.

❖ **Two activities should be given to students from the following for attainment of Course outcomes.**

- Micro/ mini project (Format)
- Market survey (Format)
- Field survey (Format)
- Video presentation (Format)
- Case study (Format)
- Preparation of a paper in standard paper format based on survey (Format)
- Preparation of an abstract of published paper (Format)
- Web based design
- Online assignments and tutorials (Format)
- Onsite exercise
- Presentation (Format)
- Quiz (Format)
- Technical poster (Format)
- Coding/Virtual lab Based Activities (Format)

Norms for End Sem Examination Theory

➢ The end sem examination of theory is conducted at the end of academic session as per the academic calendar and exam time table.

➢ The end sem examination paper (Format) should be as per the Specification Table and Question Paper Profile (QPP) mentioned in the individual course curriculum.

- The end sem examination question paper format should be as per format E: 28 mentioning Course Outcomes (COs) of each questions.
- All the norms related to assessment and evaluation prepared by examination cell should be followed by all faculties for assessment of theory papers.

Norms for Continuous Assessment Practical

- Course faculty should prepare practical plan in (Format)
- Course faculty should conduct practical as per practical plan and continuous assessment should be done regularly.
- Display the list of experiments which are required for the practical in laboratory board.
- At the beginning of the term/semester, Course faculty should check and ensure that the material required to conduct practical are available in the laboratory/institute store.
- Course faculty should give the instructions to students regarding proper handling of laboratory tools/equipment.
- Sample experiment and manual should be prepared by the concerned faculty before the commencement of each practical.
- Course faculty should assess the students on the basis of his/her participation during practical.
- Monitor the progress of student performance regularly and give feedback to the students.
- Rubrics should be shown to the students for improvement of performance before practical performance.
- Calculate the average marks out of marks mentioned for continuous assessment of practical.
- Faculty should check the record of practical prepared by student (Journal / drawing sheet/work book etc.) continuously and allot the marks at the end of session.
- Faculty should display assigned continuous assessment marks in (Format) at the end of term/semester.

Norms for End Sem Practical Examination

- The end sem examination of practical is conducted at the end of academic session as per the academic calendar and exam time table.
- Prepare rubrics for assessment of practical as per the practical evaluation scheme mentioned in curriculum and assigned the marks to each practical.
- Rubrics should be shown to the students for improvement of performance before practical performance.
- Practical/problem/job/drawing/task based on the practical course outcomes (COs) mentioned in the individual curriculum should be given to the student.
- The assessment of practical shall be carried out jointly by Internal and External Examiner or by Internal only (whichever applicable as per teaching-examination scheme).
- The marks obtained by the candidate after assessment shall be entered in mark sheet. Internal examiner shall submit the mark sheet duly signed by the examiners, to Examination Cell on the same day.

- Procedure adopted by Exam Cell for submission of mark sheet and other relevant documents should be followed by the examiners.

Norms for Project and Seminar Courses

- Students should form a group of four to five students and submit the list of students with their percentage of marks obtained in the previous term end examination, along with the preferences of guide (faculty) available in the program.
- Program Head should allot the guide to the students as per the average percentage of group of students and their faculty preferences, within seven days from the registration of course(s).
- Allot maximum two groups of students to each faculty.
- Program Head should display the list of faculty wise groups for industrial project and seminar course on notice board.
- The group of students should prepare the project diary and continuous feedback from the guide should be obtained.
- Guide (faculty) should prepare rubrics for assessment of industrial project and seminar course as per the evaluation scheme mentioned in curriculum and assessment should be done accordingly.

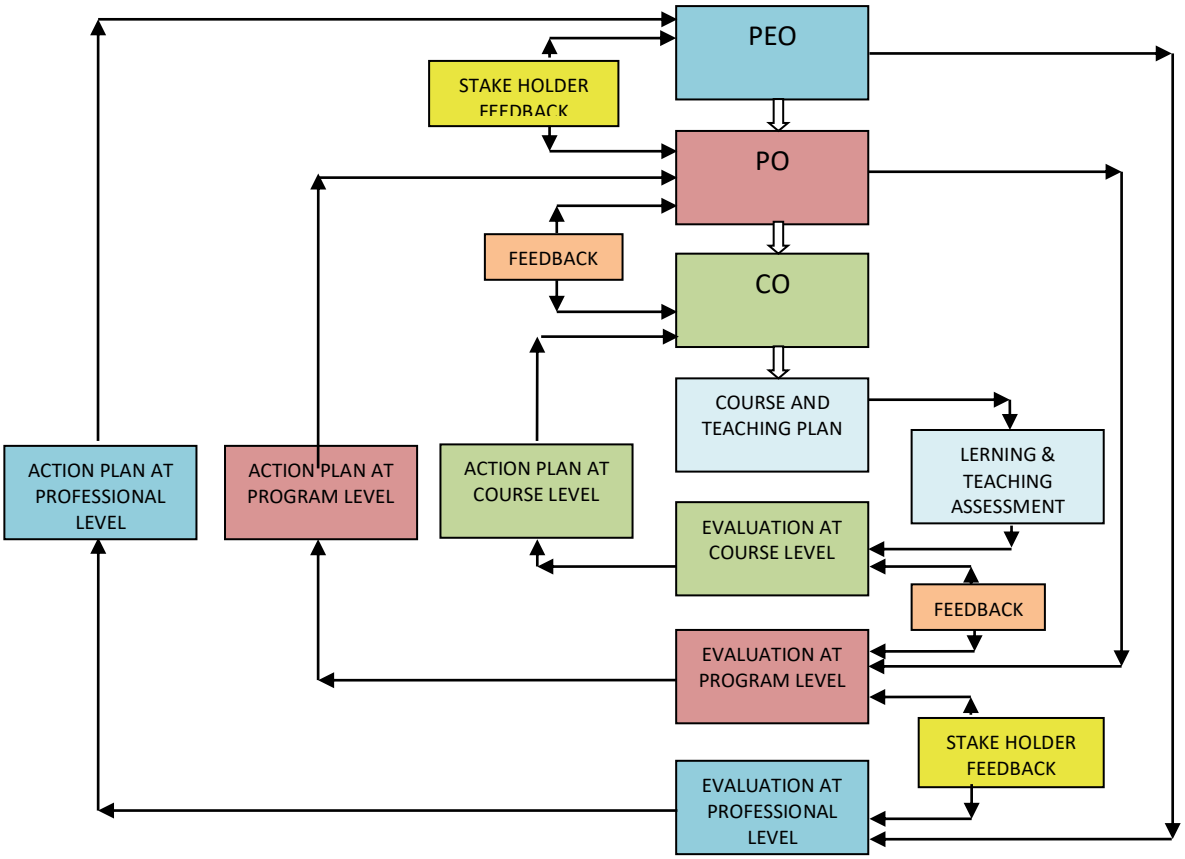
Norms for Professional Elective courses

- Program Head should display the list of professional elective courses on notice board or through Google form.
- Students should opt a course available in the list.
- Minimum 20 students should be there to start any elective course.
- Program Head should display the student wise list for professional elective course on notice board.

Norms for Open Elective courses

- Centralized coordinator should display the list of open elective courses on notice board or through Google form.
- Two courses should opt from each department.
- Student should choose other department course only and not from parent department.
- Students should opt a course available in the list.
- Minimum 20 students should be there to start any elective course.
- Program Head should display the student wise list for open elective course on notice board.

CO, PO, PEO Attainment Process

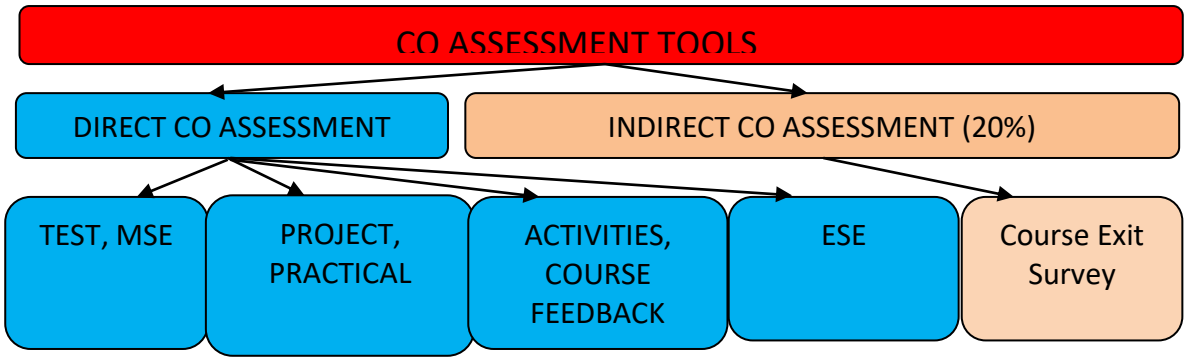


CO Attainment Calculations

Consider following weightage for CO Assessment Tools

The process for finding the attainment of Course outcomes uses various tools/methods. These methods are classified into two types: **Direct Tools and indirect Tools.**

- Direct Tools display the student's knowledge and skills from their performance in the internal assessment tests, assignments, semester examinations, seminars, laboratory assignments/practicals, mini projects, activities etc. These methods provide a sampling of what students know and/or can do and provide strong evidence of student learning. Assessment done by faculty at department level.
- Indirect Tools such as **course exit survey** to reflect on student's learning. They are used to assess opinions or thoughts about the graduate's knowledge or skills. Assessment done by faculty at department level.



Direct Assessment tool used for CO attainment

Sr. No.	Direct assessment Method	Assessment Frequency
1	Internal Assessment Test	Twice in a Semester
2	Lab Experiments	Once in a week
3	Mid Sem Exam	Once in a semester
4	End Sem Exam (Theory & Practical)	Once in a semester
5	Assignment	Twice in a semester
6	Various activities	Once in a semester

Indirect Assessment tool used for CO attainment

Sr. No.	Indirect assessment Method	Assessment Frequency
1	Course Exit Survey (Format)	End of Semester

Method of Direct CO attainment

- The Program/Department will have access continuous assessment of Theory (Progressive test and assignment) and continuous assessment of practical.
- Average percentage of each COs should be calculated for continuous assessment of Theory (Progressive test and assignment) and continuous assessment of practical.
- Faculty should use MS Excel Program prepared for calculation of CO attainment.

Illustration of Mid Sem Examination (Direct) Attainment:

Course	EDC
Maximum Marks	20 for (CO1: 5 Marks)
Number of Students Appeared	50
Passing Level (Threshold Based Target)	3 (50% here) or **average marks**

- The table below shows score/response of all students in CO1

1	**1**	**1**	**1**	**1**
2	**2**	**2**	**2**	**2**
3	**3**	**3**	**3**	**3**
4	**4**	**4**	**4**	**4**
5	**5**	**5**	**5**	**5**

1	**1**	**1**	**1**	**1**
2	**2**	**2**	**2**	**2**
3	**3**	**3**	**3**	**3**
4	**4**	**4**	**4**	**4**
5	**5**	**5**	**5**	**5**

Number of student achieving 3 or more marks	**30**
% of students achieving 3 or more marks	**(30/50)*100 = 60%**

1 – if 40 % students score more than target
2 – if 50 % students score more than target
3 – if 60 % students score more than target
Then Attainment is = 3 (from 60 %)

Illustration of Progressive Test (Direct) Attainment:

Course	EDC
Maximum Marks	20 only CO1 is covered
Number of Students Appeared	50
Passing Level (Threshold Based Target)	8 (40% here) or **average marks**

The table below shows marks of all students

1	**11**	**1**	**11**	**1**
2	**12**	**2**	**12**	**2**
3	**13**	**3**	**13**	**3**
4	**14**	**4**	**14**	**4**
5	**15**	**5**	**15**	**5**
6	**16**	**6**	**16**	**6**
7	**17**	**7**	**17**	**7**
8	**18**	**8**	**18**	**8**
9	**19**	**9**	**19**	**9**
10	**20**	**10**	**20**	**10**

Number of student achieving 8 or more marks **(Average Marks = 9.5)**	**29**
% of students achieving 8 or more marks	**(29/50)*100 = 58%**

1 – if 40 % students score more than target
2 – if 50 % students score more than target
3 – if 60 % students score more than target
Then Attainment is = 2 (from 58 %)

So in Continuous Assessment student performance for CO1 is (**3 + 9.5**)/25 = 50%.

Let in End sem examination, for CO1 class average performance is 60%.
Then total CO1 attainment through direct tools is 0.6 x 50 + 0.4 X 60 = 54% or Level 2.

Illustration of Feedback/Exit Survey (Indirect) Assessment & Attainment

Sr. No.	CO Statements
1	Demonstrate the concept of linear, nonlinear data structure
2	Design an algorithm to implement stack, queue data structures and apply the concept for an application
3	Design an algorithm to implement linked list data structures and apply the concept for an application
4	Demonstrate the concept of tree and apply to solve the problems
5	Demonstrate the concept of graph and apply to solve the problems
6	Design an algorithm to implement sort and search operations

Example of Course Exit Survey

Sr. No.	Question	Average Score/Marks	attainment
1	Rate yourself based on understanding of the concept of linear, nonlinear data structure	78%	3
2	Rate yourself based on ability of designing an algorithm to implement stack, queue data structures and apply the concept for an application	75%	3
3	Rate yourself based on ability of designing an algorithm to implement linked list data structures and apply the concept for an application	70%	3
4	Rate yourself based on understanding of the concept of tree and apply to solve the problems	71%	3
5	Rate yourself based on understanding the concept of graph and apply to solve the problems	71%	3
6	Rate yourself based on ability of designing an algorithm to implement sort and search operations	67%	2
Average		72%	3

Overall Attainment of CO

Let's assume CO1 is assessed using

1. any 2 direct (Test and MSE)
2. any 2 Indirect (feedback as above & ESE as attainment level of 3 & 3 respectively), then

A. Overall CO Attainment = (Weightage x average of Direct CO attainment) + (Weightage x average of Indirect CO attainment) For University regular B. Tech. Curriculum and hence

Overall CO1 Attainment = (0.2 X 54) + (0.8 x 78) = 73.2% or (0.2 x 2) + (0.8 x 3) = 2.9

For Autonomous Pattern, (Format)

B. Overall CO Attainment = (80 % x average of Direct CO attainment) + (20% x average of Indirect CO attainment)

Overall CO1 Attainment = (0.8 X 54) + (0.2 X 78) = 58.8% OR (0.8 x 2) + (0.2 x 3) = 2.2

Note: Appropriate % weightage distribution may be considered for any number of direct/indirect assessment tools with proper justification at department/faculty level.

Likewise calculate for all CO attainment and average of CO attainment should be used for PO attainment calculation.

Setting Targets for CO Attainment

Setting targets for Course Outcomes and identification of attainment gap (Format)

- Targets are set for each COs of a course separately.
- The entire faculty uses one single common method for all the courses in all the programs.
- Setting target has the advantage of finding out the difficulty of specific COs.
- Attainment gap is identified by comparing CO attainment and setting target.
- Suitable action is initiated to fill the gap at the course faculty level and the same is documented.
- If the target achieved, higher target is set.

Example:

Course Outcome	Target (Class Average)
CO1	**60%**
CO2	**80%**
CO3	**75%**
CO4	**65%**
CO5	**70%**
CO6	**80%**

In terms of level:

- If 70% of student achieved class average then level 3.
- If 50% to 70% student achieved class average then level 2.
- If below 50% of students achieved class average then level 1.

Here CO1 target is 60% and CO1 attainment percentage is 58.8%. Hence the CO1 attainment gap is 60 – 58.8 = 1.2.

- **If Gap > 0, then target is not attained. Improvement must be planned to increase improvement next time.**
- **If Gap < 0, then target attained. Attainment target must be enhanced next time.**

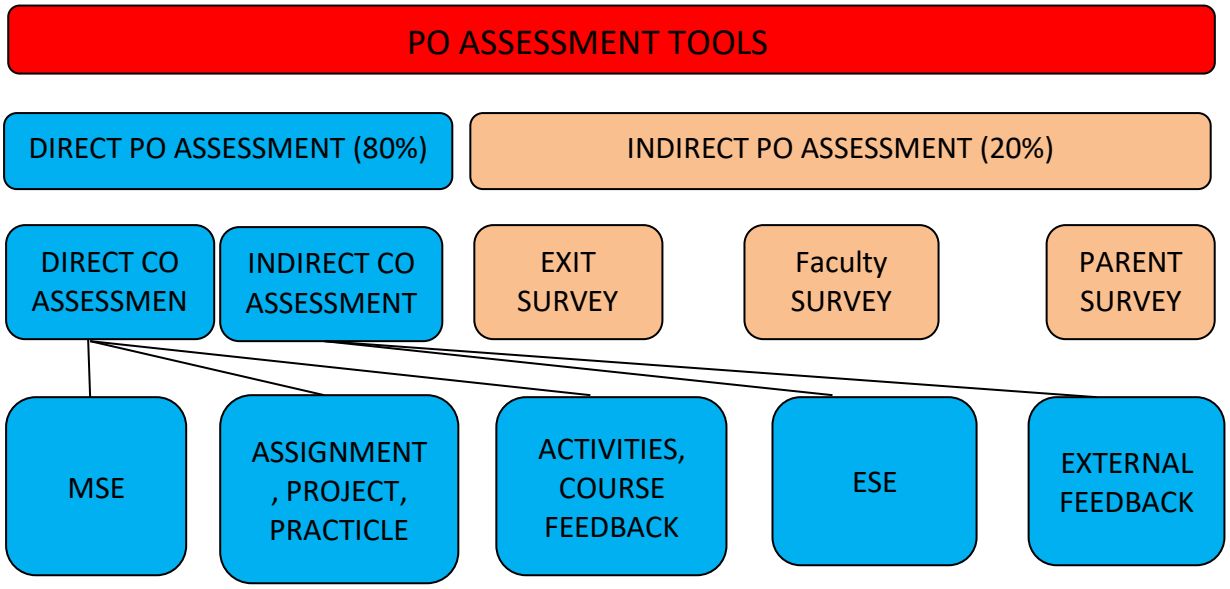
PO and PSO Attainment

POs and PSOs are attained through program specific Core Courses.

- Each Course addresses a sub-set of POs and PSOs to varying levels (strengths) (1, 2 or 3).
- COs have to be written to meet the identified POs/PSOs.

Direct Tools: (Measurable in terms of marks and w.r.t. CO) Assessment done by faculty at department level.

Indirect Tools: (Non measurable in terms of marks and w.r.t. CO) Assessment done at Department or Institute Level.



CO-PO Mapping Guidelines

Strength of CO-PO/PSO Mapping

- Attainment of a PO/PSO depends both on the attainment levels of associated COs and the strength to which it is mapped.
- To determine the level (mapping strength) a particular PO/PSO is addressed by the course.
- Strength of mapping is defined at three levels: Low (1), Medium (2) and Strong (3)

Method to relate level of PO/PSO

Contact Hours: Lecture, Tutorial and Practical

Level	**Contact Hours in Percentage (including Lecture, Tutorial & Practical)**
No mapping (-)	< 5%
Low (1)	5 - 25 %
Medium (2)	25 - 40 %
High (3)	40 %

Description

Number of Lectures = 2 per week x 12 weeks = 24 Hours
Tutorial = 1 Hr x 12 Weeks = 12 Hours
Activity = 1 Hr x 12 Week = 12 Hours
Total Hrs = 24 + 12 + 12 = 48 Hrs

COURSE OUTCOME		PO	PSO	CL	CLASS
CO1	Understand and explain the basic concepts of OPAMP.	1, 2, 3, 12	1	U	4
CO2	Demonstrate the working principle of various analog circuits.	1, 2, 3, 12	1	U	10
CO3	Conduct experiments using analog electronic components, electronic instruments and modern tool	1, 3, 4, 5, 9	1, 2	A	8
CO4	Analyze analog circuits to evaluate various performance parameters.	1, 2, 3, 4, 5, 12	1, 2	E	10
CO5	Compare multivibrator circuits, Data converters.	1, 4	1	U	4
CO6	Design and realize filters, Oscillators, linear and non-linear applications of Op-Amp.	1, 2, 3, 4, 12	1, 2	C	12
	TOTAL HRS OF INDSTRUCTIONS				**48**

PO/PSO	CO	SESSIONS	MAPPING STRENGTH
1	1, 2, 3, 4, 5, 6	48	**3**
2	1, 2, 4, 6	36	**3**
3	1, 2, 3, 4, 6	44	**3**
4	3, 4, 5, 6	34	**3**
5	3, 4	18	**2**
9	3	8	**1**
12	1, 2, 4, 6	36	**3**
PSO1	1, 2, 3, 4, 5, 6	48	**3**
PSO2	3, 4, 6	30	**3**

Example: Let, PO5 related points are engaged in 14 lectures + 4 Tutorial
Then contact hours = 14 + 4 = 18 hours
Therefore, contact hours in percentage = (18/48) x 100 = 38 %. Level of mapping is 2.

CO-PO Correlation / Course Outcomes	Program Outcomes												Program Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**3**	**3**	**3**									**2**	**3**		

CO2	3	3	3									2	3		
CO3	3	3	3	3	2				1				3	3	
CO4	3	3	3	3	2							2	3	3	
CO5	3			3									3		
CO6	3	3	3	3								2	3	3	
Co Average	3	3	3	3	2				1			2	3	3	

POs/PSOs Attainment Method

PO/PSO attainment is calculated using following formula-

- PO/PSO attainment = Mapping strength of PO/PSO x Average of CO attainment addressing the particular PO/PSO.
- These computations are approximate but indicative PO/PSO attainment
- Evaluations of attainment of POs and PSOs based on Direct and Indirect Methods are combined to arrive at the Final Evaluation.
- Combined Evaluation= (Weightage of direct attainment x Attainment value) + (Weightage of indirect attainment x Attainment value)
- Typical values of weight age of direct and indirect attainment are 0.8 and 0.2 respectively.
- Values of indirect attainment are calculated from feedback system as follows:
  - Student Exist Survey: 10% (Format)
  - Faculty Survey: 5% and (Format)
  - Parent Survey: 5% (Format)
- Use MS Excel Program for finding PO/PSO attainment.

Example:

CO	Overall attainment
1	1.78
2	1.6
3	1.6
4	1.6
5	1.6
6	1.6
Average	1.63

PO/PSO Attainment through Direct Method for one course (Average CO attainment = 1.63)															
PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
Average CO Correlation	**3.00**	**3.00**	**3.00**	**3.00**	**2.00**				**1.00**			**2.00**	**3.00**	**3.00**	
Direct Attainment with relevance	**1.63**	**1.63**	**1.63**	**1.63**	**1.09**				**0.54**			**1.09**	**1.63**	**1.63**	

Direct attainment is obtained from formula- (Average Correlation * Average CO Attainment)/3. in this case average Co-attainment is 1.63.

Sample calculations:

PO1 attainment 3 x 1.63/3 = 1.63 (up to 2 decimal places)
PO5 attainment 2 x 1.63/3 = 1.09
PO9 attainment 1 x 1.63/3 = 0.54
PSO1 attainment 3 x 1.63/3 = 1.63

PO/PSO Attainment for a program through Direct Tools for all courses

SEM	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
III	CAO	1.78	2.20	1.65	1.65									1.37	1.78	1.51
III	DCFM	1.27	1.90		1.27	0.63		0.63				0.63	0.63	0.63	1.27	0.63
III	ACPLD	0.44	0.88											1.32	1.10	1.32
III	EIT	0.7	0.7	0.7					1.0					0.7	0.7	0.6
III	M-III	0.9	0.6	0.6	0.3											0.3
IV	DSPD	2.1	2.6	1.9	1.9									1.6	2.1	1.8
IV	TFCS	0.7	0.7	0.7	0.0							1.0	0.7	1.0	0.7	0.0
IV	OS	1.7	2.6	1.7	1.7										2.6	
IV	DMGT	1.8	1.2	1.2	0.6	0.6	0.6									0.6
IV	SP	0.6	1.2	0.6	1.9								0.6	1.9	0.6	1.2
V	OOP	1.6	1.6	2.4	1.6	1.6	1.6						0.8	1.6	2.4	1.6
V	DBMS	2.0	2.9	2.9	2.9	2.9				2.0	2.9	2.9	2.9	2.9	2.0	2.0
V	CG	1.6	1.1	1.1	1.6	1.1	1.6					1.1		1.1	1.6	1.1
V	DAA	2.4	2.4	2.5	1.8	2.4						1.8	2.2	2.5	2.5	2.4
V	DC	1.3	1.3	1.3	1.3	0.7								0.7	1.3	0.7
VI	AI	1.7	1.7	1.7	1.7	2.5	2.5	2.5	1.7	1.7		1.7		1.7	1.7	1.7
VI	CN	0.8	1.6	1.6	1.6	1.6					0.8		0.8	1.6		0.8
VI	DP	1.7	1.7	1.7	1.7	1.7				1.7			0.9	1.7	2.6	1.7
VI	SEPM	1.7	1.7	2.5	1.7	1.7	1.7						0.8	1.7	2.5	1.7
VI	FE	1.3	0.7	2.6	1.3								0.7	1.3	0.0	2.6
VII	LP	0.8		2.5	1.7								2.5			
VII	MC	2.9	2.9	2.9	2.9	1.9	1.0						1.0	2.9	1.0	1.9
VII	TCP/IP	1.3	1.3	1.3	1.3	1.3	0.7	1.3					0.7	1.3	0.7	1.3
VII	DWM	1.8	1.8	1.8	1.8	1.2			0.6			1.2	0.6	1.8	0.6	1.2
VIII	DOS	1.7	1.1	1.7	1.1	1.7	0.56	0.6		1.1		1.7	1.7	1.7	1.7	1.1
VIII	ICS	1.2	1.2	1.8	1.2	1.2	1.2						0.6	1.2	1.8	1.2
VIII	CCC	2.9	2.9	2.9	2.9	2.9					1.9	1.0	1.9	2.9	2.9	1.9
VIII	AWSN	1.8	1.2	1.8	0.6	1.2					1.2		0.6	1.2	1.8	
AVERAGE		**1.51**	**1.61**	**1.77**	**1.54**	**1.60**	**1.26**	**1.25**	**1.09**	**1.61**	**1.71**	**1.44**	**1.14**	**1.59**	**1.57**	**1.31**

Indirect Assessment tool used for PO/PSO attainment

Sr. No.	Tools	Assessment Frequency
1	Program Exit Survey	Once in a Year
2	Faculty Survey	Once in a Two Year
3	Parent feedback	Once in a Semester
4	Co & Extra Curricular Activities	Once in a Semester

PO attainment through indirect tools

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Faculty survey	72	77	85	52				81	89	75		77	82		
Exit Feedback	71	65	70	69				80	35	40		79	70		
Technical workshop feedback	72	77	85	52				80	89	75		77	82		
AVERAGE	71.7	73	80	57.7				80.67	71	63.33		77.67	78		
Attainment Level	3	3	3	1				3	3	2		3	3		

Overall PO attainment

Direct attainment – 80%
Indirect Attainment – 20%

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Direct Attainment	1.51	1.61	1.77	1.54	1.60	1.26	1.25	1.09	1.61	1.71	1.44	1.14	1.59	1.57	1.31
Indirect Attainment	3	3	3	1				3	3	2		3	3		
Overall attainment	1.8	1.88	2.02	1.432	1.28	1.008	1.00	1.472	1.888	1.768	1.152	1.512	1.872	1.256	1.048

Continuous Improvement

A) CO attainment and Continuous Improvement (Faculty Level)

CO	Action to be taken by faculty
High attainment of all CO (>2.5 out of 3)	Set new higher targets or attainment levels for next Academic Year (A.Y.)
Moderate attainment of all CO (1.5 to 2.49 out of 3)	Record observations, Continue action plan of last A.Y. with plan for improvements.
Low attainment of all CO-PO (0.9 to 1.49 out of 3)	Record observations, assess the target set, revise/improve action plan of last A.Y. to achieve the attainment with plan for improvements.
CO not attained, poor performance(< 0.9 out of 3)	Record observations, Critical assessment of target with Program Assessment Committee (PAC), Revise action plan of last A.Y. at faculty/department level.

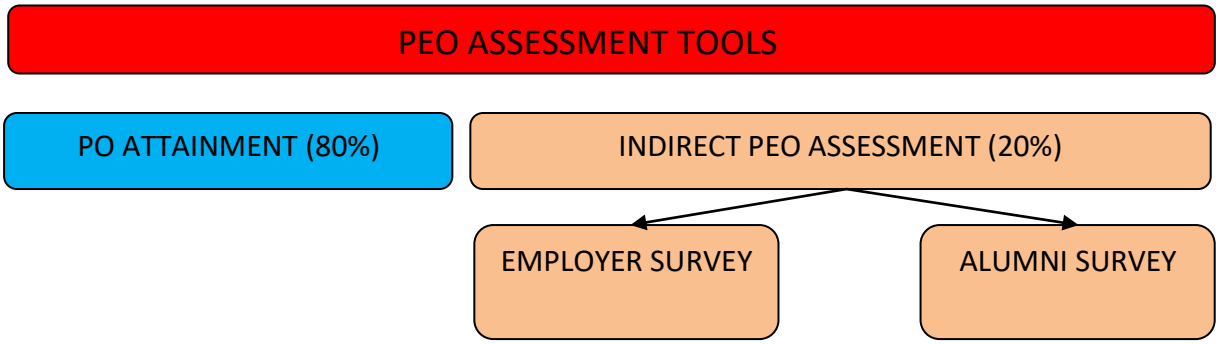
B) PO attainment and Continuous Improvement (HoD Level)

Category	Outcome	Action by HoD
Course related	PO attained highly	Include activities with HOT.
	PO not attained highly	Identify concerned courses, plan for immediate improvements, guide, support and monitor its execution.
Activity related	Activities Conducted	Critical assessment, impact analysis to be done and revise as per the need for improvements.

Attainment of Program Educational Objectives (PEOs)

- POs –PEOs mapping of each program.
- Attainment of PEOs is based on attainment of POs and Indirect Methods.
- Combined Evaluation = (Weightage of direct attainment x Attainment value of POs) + (Weightage of indirect attainment x Attainment value from feedback)

- Typical values of weightage of direct and indirect attainment are 0.8 and 0.2 respectively.
- Values of indirect attainment are calculated from feedback system as follows:
    - Employer Survey: 10%
    - Alumni Survey: 10%
- Use MS Excel Program for finding PO/PSO attainment.



Student Competency

Action Plan:

1. Categorisation of students
2. Remedial Action
3. Impact at the end of semester

Categorisation of students

- Previous result
- Performance in Test & MSE
- Attendance & Behaviour of student

Base Score for student category

- <40% - Slow Learner
- 40% to 60% - Average Learner
- >60%- Advanced Learner

Strategies for Slow, Average and Advanced Learners

For Slow learners

- Document/record of remedial classes with timetable & attendance
- Specially designed assignment/ task
- Student study group for peer to peer learning
- Individual Counseling

Note: Remedial sessions should be conducted every week.

For Average Learners

- Additional assignment/ task
- Encouraging for timely and effective completion of work
- Conduction of quiz, orals etc.
- Solving previous year question papers and test papers

- Presentation on technical topics/ case studies/mini projects

Note: Activities should be on continuous basis.

For Advanced Learners

- Encouraging to present & publish papers in journals/conferences/competitions
- Guidance for GATE/ competitive Examination
- Encouraging to participate in professional activities.
- Specially designed activities to improve the portfolio of students.
- Individual guidance for career building.

Note: Activities should be on continuous basis.

List of Documents

Sr. No	Title	Details
1	Vision, Mission of Institute	Maintain at Deptt. Level (HoD)
2	Vision, Mission of Program	Maintain at Deptt. Level (HoD)
3	PEO of Program, PEO-PO/PSO Mapping	Maintain at Deptt. Level (HoD)
4	PO and PSO of Program	Maintain at Deptt. Level (HoD)
5	CO , PO/PSO, Mapping	Maintained by every faculty in Course File.
6	Revised Bloom's Taxonomy Level and OBE Framework	Print to be maintained in Course File of Faculty & displayed in department all labs.
7	Course List with Course Codes	Maintain at Dept. Level (HoD)
8	List of PO Assessment Tools	Maintain at Dept. Level (HoD)
9	List of CO Assessment Tools Used	Maintained by every faculty in Course File
10	Program Assessment Committee & DAB	Maintain at Dept. Level (HoD)
11	Course and Module Coordinators	Maintain at Dept. Level (HoD)
12	Course Plan	Along with delivery details and assessment tools by Faculty
13	Attainment Levels/ Targets of all courses of your program	Maintained by every faculty in Course File
14	Rubrics	Course wise rubrics to be maintained by every Faculty All activity rubrics to be maintained at dept. Level (HoD)
15	Record of all Assessment Details	Test Papers, Model Answers, Sample Answer Papers, Results, Sample Journals of students, Lab Manuals, Sample Seminar, Project Report & other record concerned with assessment to be maintained by Faculty
16	Slow-Advanced Learners	Identification, Action Taken Record to be maintained by Faculty
17	Course Exit Survey of every	To be maintained by concerned

	course	Faculty
18	Program Exit Survey, Alumni Feedback, Employer Feedback	End of Final Year: Maintain at Dept. Level (HoD)
19	CO Attainment	At End of Course: Maintained by Faculty and to be submitted to department
20	PO Attainment	At end of A.Y.: (Direct + Indirect) to be maintained by PC & HoD at Dept. Level
21	Impact Analysis and Continuous Improvement Related Documents	CO level documents to be maintained by concerned faculty. PO level documents to be maintained by HoD.

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(An Autonomous Institute, with NAAC "A" Grade)
Affiliated to DBATU, RTMNU & MSBTE Mumbai
Department of ----------

"Igniting minds to illuminate the world"

VISION MISSION

Annexure-I: DEPARTMENT ACADEMIC_CALENDAR
SESSION ----------

All the students of ----- Semester of ---------- department are hereby informed that the regular classes will commence from ----------. Maintenance of minimum 75% attendance is mandatory for all.

MONTH	DAY							No. of Working Days	Holidays	Activities
	SUN	MON	TUE	WED	THU	FRI	SAT			
Note: The dates mentioned for activities are subject to change depending on review of academics & other constraints.										

Academic Incharge **HOD (EE)** **Dean (Academics)** **Principal**

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Education to Eternity

||ज्ञानम् सर्वार्थ साधनम्||

VISION	MISSION
To be a center of excellence imparting professional education satisfying societal and global needs.	1. Transforming students into lifelong learners through, quality teaching, training and exposure to concurrent technologies. 2. Fostering conducive atmosphere for research and development through well equipped laboratories and qualified personnel in collaboration with global organizations.

Annexure-II: COLLEGE ACADEMIC CALENDAR

SESSION ----------

Sr. No.	ACTIVITY	Dates

Dean Academics

Principal

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SESSION ----------

VISION	MISSION

Annexure-III: Teaching Plan

Program : B. Tech ----------		**Year/Semester** : ----------	
Name of the Teacher : ----------		**Subject Code** : ----------	
Subject : Integrated Circuits & applications		**Section** :----------	
Lectures per Week (each 60 min) : ----		**Lecture**	--
		Tutorial	--
		Practical	--

Course Objective	Course Outcomes
	Students should be able to: 1.

Sr. No	Lec No	Topic Code	Contents to be Covered	Planned Teaching Dates	Text Books (Page no) Reference Book (Page no)	URL's (NPTEL/Online Material/PPt/Video)	Applications (R&D/ Industry)	Learning Outcomes	CO mapping
Unit I ----------									
Unit II – ----------									

Unit III – ----------									
Unit IV – ----------									
Unit V – ----------									
Unit VI – ----------									

*T=Text Book; R= Reference Book; C= Company name; R= Research Paper

Total number of lectures as per syllabus: - ---

Total number of lectures as per planned: - ---

Tutorial Plan			
Week	**Topic**	**No. Of Problems**	**Mapped With CO**
Assignment Plan			

Assignment No.	Topic	Given Date	Submission Date	Mapped With CO

Content Beyond Syllabus Topic – Planned			
Sr. No.	**Content Beyond Syllabus Topic**	**Date Given**	**Mapped with CO's not covered in TP**

Text Books / Reference Books:

Code	Title of the Book	Author Name/Designation/ Organization	Publisher	Edition/ Publication Year
T1				
T2				
T3				
T4				
T5				

Company/Industry:

Code	Company/Industry Name	Website	Detailed Information
C1			
C2			
C3			
C4			
C5			

Research Paper:

Code	Title of the Paper	First Author Name	Journal/Conference Name	DOI no.	Issue/Volume/Page no/Year
P1					
P2					
P3					
P4					
P5					

Subject Teacher **Academic Incharge** **HOD (EN/ETC)**

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Annexure-IV: Parent Feedback cum Suggestions

Name Of Parent/Guardian:

Contact No:

Email-Id:

Working Details:

Name of the Student:

Roll No:

Name of the Department:

Year:

Please rate each feature and select appropriate number box according to the following response scheme.

Sr. No.	Program Outcomes (POs)	1	2	3	4
1	Basic knowledge of mathematics, science and Engineering fundamentals.				
2	Ability to identify, formulate and analyze Engineering problems				
3	Design/development of complex engineering problems and their solutions				
4	Conduct investigations of Complex Problems				
5	Demonstrate the ability to apply advanced technologies to solve contemporary and new problems.				
6	Understanding professional engineering solutions in societal and environmental contexts				
7	Awareness to apply engineering solutions in global, national, and societal contexts.				
8	Understanding of professional and ethical responsibilities.				

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9	Ability to function as an effective member in multidisciplinary teams				
10	Proficiency in the English language in both communicative and technical forms				
11	Demonstrate the ability to choose and apply appropriate resource management techniques				
12	Capable of self-education and a clear understanding of the value of updating their professional knowledge to engage in life-long learning.				
13	**PSO related questions**				
14	**PSO related questions**				
15	**PSO related questions**				

uggestions if any

Signature of parent

VISION	MISSION
To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

Annexure-V: Faculty Survey

Dear Sir,

The purpose of this survey is to obtain input from faculty, on the quality of education the students have received and level of preparation they had in **……** (Name of program) program at JDCOEM, Nagpur. The survey is meant to assess the Program Outcomes (POs) and Program Specific Outcomes (PSOs). As the part of faculty contribution in the development and the continuous improvement of POs and PSOs of **……** (Name of program) program at JDCOEM, Nagpur, we seek your help in completing this survey. Your response is a key part of our continuous improvement process and is critical to our NBA accreditation Endeavour. Your participation is greatly appreciated.

Name of Faculty: ……

Designation: ……

Department / program: ……

Email ID: …….. **Mobile**……

Please select the appropriate box to indicate the degree of your satisfaction.

1: Poor, 2: Fair, 3: Good, 4: Excellent

Sr. No.	Program Outcomes (POs)	1	2	3	4
1	Basic knowledge of mathematics, science and Engineering fundamentals.				
2	Ability to identify, formulate and analyze Engineering problems				
3	Design/development of complex engineering problems and their solutions				
4	Conduct investigations of Complex Problems				
5	Demonstrate the ability to apply advanced technologies to solve contemporary and new problems.				
6	Understanding professional engineering solutions in societal and environmental contexts				
7	Awareness to apply engineering solutions in global, national, and societal contexts.				
8	Understanding of professional and ethical responsibilities.				

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9	Ability to function as an effective member in multidisciplinary teams				
10	Proficiency in the English language in both communicative and technical forms				
11	Demonstrate the ability to choose and apply appropriate resource management techniques				
12	Capable of self-education and a clear understanding of the value of updating their professional knowledge to engage in life-long learning.				
13	**PSO related questions**				
14	**PSO related questions**				
15	**PSO related questions**				

(Sign of Faculty)

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Annexure-VI: Alumni Survey

Dear Alumni,

The National Board of Accreditation (NBA) is the professional accrediting organization in India that accredits Engineering and Technology programs. The NBA requires each accredited program to demonstrate that certain criteria are met through a specific process. The purpose of this survey is to obtain input from the alumni, on the quality of …… (Name of program) engineering programs at JDCOEM, Nagpur and to assess the Program Educational Objectives (PEOs). We seek your help in completing this survey. Your response is a key part of our continuous improvement process and is critical to our NBA accreditation endeavour. Your participation is greatly appreciated.

Name: …… **Program:** ……

Name of Organization: ……

Position: …… **Year of Degree:** ……

Email ID: …… **Mobile:** ……

Please insert ✓ in the appropriate box to indicate the degree of your satisfaction level.

1: Poor, 2: Fair, 3: Good, 4: Excellent 1: Poor, 2: Fair, 3: Good, 4: Excellent

Sr. No.	Program Outcomes (POs)	1	2	3	4
1	Basic knowledge of mathematics, science and Engineering fundamentals.				
2	Ability to identify, formulate and analyze Engineering problems				
3	Design/development of complex engineering problems and their solutions				
4	Conduct investigations of Complex Problems				
5	Demonstrate the ability to apply advanced technologies to solve contemporary and new problems.				
6	Understanding professional engineering solutions in societal and environmental contexts				
7	Awareness to apply engineering solutions in global, national, and societal contexts.				
8	Understanding of professional and ethical responsibilities.				

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9	Ability to function as an effective member in multidisciplinary teams				
10	Proficiency in the English language in both communicative and technical forms				
11	Demonstrate the ability to choose and apply appropriate resource management techniques				
12	Capable of self-education and a clear understanding of the value of updating their professional knowledge to engage in life-long learning.				
13	**PSO related questions**				
14	**PSO related questions**				
15	**PSO related questions**				

Program Educational objectives are at highest level, which are the broad statements that describe the career and professional accomplishments that the program are preparing diploma holders to achieve, 3-5 years after passing diploma.
Please insert ✓ in the appropriate box to indicate the degree of your satisfaction level.

1: Poor, 2: Fair, 3: Good, 4: Excellent

Sr. No.	Program Educational Outcomes (PEOs)	1	2	3	4
1					
2					
3					
4					

(Sign of Alumni)

Annexure-VII: INDEX (Theory Subject)

1) **Academic Calendar of Department**
2) **Roll List**
3) **Rubrics for internal (Marks Distribution criteria)**
4) **University/Autonomy Syllabus**
5) **Mapping of Subject with CO, PO and PSO**
6) **Teaching Plan**
7) **Test-1 Exam Paper**
8) **Mark sheet of Test-1**
9) **CO Attainment of Test-1 exam**
10) **MSE Exam Paper**
11) **Mark sheet of MSE**
12) **CO Attainment of MSE**
13) **Test-2 Exam paper**
14) **Mark sheet of Test-2**
15) **CO Attainment of Test-2 exam**
16) **Previous exam Question Paper(Last 3 exam)**
17) **Assignment I sheet**
18) **Assignment II sheet**
19) **Assignment Submission Sheet**
20) **Content beyond syllabus (With all Supporting documents)**
21) **Details of Innovative practice adopted (With all Supporting documents)**
22) **Question Bank**
23) **Tutorial Sheet**
24) **Activity Details**
25) **Mark sheet of Activities**
26) **CO attainment of Activities**
27) **PPT/Notes/Videos**
28) **Attendance Register (Th)**
29) **Sample assignment copy (minimum 3)**
30) **Sample answer sheets (minimum 5 each for Sessional I, II and MSE)**
31) **CO Attainment of End sem exam**
32) **Overall CO attainment**
33) **Student Feedback**

Annexure-VIII: INDEX (Practical Subject)

1) **Academic Calendar of Department**
2) **Batch wise Roll List**
3) **Rubrics for internal (Marks Distribution criteria)**
4) **List of experiments with CO, PO and PSO mapping**
5) **Plan of conducting experiments**
6) **Marks sheet**
7) **Experiment beyond syllabus (With all Supporting documents)**
8) **Details of Innovative practice adopted (if applicable)**
9) **Attendance Register(Pr)**
10) **Sample journal (minimum 5)**
11) **CO attainment of practical**
12) **Student Feedback**

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Annexure-IX: CO-PO MAPPING

CO-PO Correlation	Program Outcomes												Program Specific Outcomes		
Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															
Co Average															

Subject Teacher HOD

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Department of Electronics and Telecommunication Engineering
"Rectifying Ideas, Amplifying Knowledge"
--------- (Odd Sem)

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Annexure-X: TEST/MID SEM EXAMINATION

Program: B. Tech. in

Course:

Course Code:

Year/Semester:

Max Marks: 20 **Date:---/--/----**

Duration:- 1 Hr.

Instructions to the Students:
1. All the questions carry marks as indicate.
2. Assume suitable data whenever necessary.
3. Illustrate your answer whenever necessary with the help of neat sketches.

Students should be able to:
1.

SECTION A

1. **All Questions are compulsory.**
2. **Answer in one word/sentence.**

Q. No.	Questions	Level/CO Mapped	Marks
Q.1			1
Q.2			1
Q.3			1
Q.4			1

SECTION B

1. **All Questions are compulsory.**
2. **Answer in one two three sentence.**

Q.5			2
Q.6			2
Q.7			2
Q.8			2

SECTION C

1. **Solve any two questions.**

Q.9			4
Q.10			4

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Q.11			4

Signature of faculty

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Annexure-XI: Internal Mark Rubrics

Name of Department: **Sem :** **Section:**

TYPE OF COURSE: **Name of Subject:**

SUBJECT CODE: **Name of Teacher:**

Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
ABC	ABC001	XYZ	2	0	0	20	20	60	100	3

Continuous assessment mark distribution:

CA	Activity	Attendance
20 Marks	15 Marks	5 Marks
Cognitive Level	L-1, L-2, L-3, L-4, L-5, L-6	
CO	CO1,C02,C03,C04,CO5	
PO	PO1, PO2, PO3, PO4--, PO12	

- **Continuous Assessment (CA) (20 Marks):** CA is based on the Attendance and Activity. Activity will be set on lower and the higher order level of bloom's taxonomy.
- **Attendance (5 Marks):**

Attendance	Marks
96 % - 100%	**5**
91 % - 95 %	**4**
86 % – 90 %	**3**
81% – 85 %	**2**
75 % - 80 %	**1**
Less than 75 %	**0**

- **Activities (15 Marks) :** Any five activities should be conducted for 15 Marks.
  1. **Assignment (5 marks):** There will be two assignments (20 Marks each) should be given to students as per academic calendar. For marks calculation, it can be considered as Best of two assignments.
  2. **Test (5 Marks):** There will be two tests (20 Marks) should be given to students as per academic calendar.

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3. **Sanskar Video (5 Marks): A motivational Video**

% response of each student	Marks to be given
40 to 50	1
51 to 60	2
61 to 70	3
71 to 80	4
Above 80	5

4. **Technical model (5 Marks: Based on Minimum three units).**
5. **Case Study (5 Marks)**
6. **Presentation (5 Marks)**
7. **Quiz (5 Marks)**
8. **Technical poster (5 Marks)**
9. **Coding/Virtual lab Based Activities (5 Marks)**

All these activities should be aligned with COs and map with the POs. Subject Teacher should conduct any five activities.

Laboratory Activity Evaluation Criteria

Sr. No.	Criteria	Marks Weightage
1	Presentation (How student present the experiment)	2
2	Technical skill (Setup the Experiment & conduct as per instructions)	2
3	Discipline in Lab	2
4	Knowledge (viva)	2

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J.D.College of Engineering & Management, Nagpur

Department of --

Session ---------------------

Name of Subject: **Name of faculty:**

Batch: **Sem:** **Branch:**

Roll No	Name of Student	P	T	D	K	J	Total	P	T	D	K	J	Total	P	T	D	K	J	Total	P	T	D	K	J	Total	P	T	D	K	J	Total	Overall Total	(X+Y)/Z
		2M	2M	2M	2M	2M	10	2M	2M	2M	2M	2M	10	2M	2M	2M	2M	2M	10	2M	2M	2M	2M	2M	10	2M	2M	2M	2M	2M	10		
		Experiment no. 1						Experiment no. 2						Experiment no. 3						Experiment no. 4						Experiment no. 5						X	
		Experiment no. 6						Experiment no. 7						Experiment no. 8						Experiment no. 9						Experiment no. 10						Y	
		Experiment no. 1						Experiment no. 2						Experiment no. 3						Experiment no. 4						Experiment no. 5						X	
		Experiment no. 6						Experiment no. 7						Experiment no. 8						Experiment no. 9						Experiment no. 10						Y	
		Experiment no. 1						Experiment no. 2						Experiment no. 3						Experiment no. 4						Experiment no. 5						X	
		Experiment no. 6						Experiment no. 7						Experiment no. 8						Experiment no. 9						Experiment no. 10						Y	
		Experiment no. 1						Experiment no. 2						Experiment no. 3						Experiment no. 4						Experiment no. 5						X	
		Experiment no. 6						Experiment no. 7						Experiment no. 8						Experiment no. 9						Experiment no. 10						Y	
		Experiment no. 1						Experiment no. 2						Experiment no. 3						Experiment no. 4						Experiment no. 5						X	
		Experiment no. 6						Experiment no. 7						Experiment no. 8						Experiment no. 9						Experiment no. 10						Y	

Z= Total Number of Practicals conducted

P :- Presentation Skill | T :- Technical skills | D :- Descipline & Regularity | K :- Knowledge Skill

Signature of faculty:

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
Website: www.jdcoem.ac.in E-mail: info@jdcoem.ac.in
(An Autonomous Institute, with NAAC "A" Grade)
Affiliated to DBATU, RTMNU, MSBTE MUMBAI
Department of Electronics and Telecommunication Engineering
"Rectifying Ideas, Amplifying Knowledge"
2022-23 (Odd Sem)

VISION	MISSION
To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

Annexure-XIII: Course Outcomes Attainment Gap Analysis

(TERM : _____ODD/EVEN)

Name of Program/ Dept: ……..

Course Code : …… **Course Name : ……..**

Name of Faculty: ……..

Course Outcomes	COs Target in %	COs Attainment in %	COs Attainment Gap in %	Action Proposed to Bridge the Gap	Modification
1					
2					
3					
4					
5					
6					

(Name & Sign of Course Faculty)

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Annexure-XIV: Feedback-Theory

(Session ----------)

NAME OF PROGRAM: ----------

NAME OF FACULTY: **SEM:**

SUBJECT:

Sr.no	**A1:Theory**	**Score**	**%**
1	Whether the teaching/ session plan, syllabus and the hand-outs of the course were given In the semester.		
2	Whether the teacher has informed about the course material (question bank, books, worksheets etc) and location of its availability?)		
3	The topics are taught with basic concepts and examples.		
4	The teacher encourages students to think and ask doubts.		
5	The topics taught till now are well understood by me.		
6	The teacher has good oral communication, blackboard writing and presentations in the classroom		
	A2:Faculty Specific		
1	The teacher is regular and punctual in engaging the classes.		
2	The teacher has good class control during teaching		
3	The teacher always shows a decent and impartial behaviour towards the students.		
4	The teacher is always available for guidance, doubts, clarification of queries in times other than regular lectures		

Principal

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Annexure-XV- Course Exit Survey

Course Code:---------- Name of Course: ……

Dear Student,

The purpose of this survey is to obtain input from the students, for assessment the Course Outcomes (COs). As a student of …….. (Name of program) program at JDCOEM, Nagpur, we seek your help in completing this survey. Your response is a key part of our continuous improvement process and is critical to our accreditation endeavor. Your participation is greatly appreciated.

Please insert right tick in the appropriate box to indicate the degree of your satisfaction level.

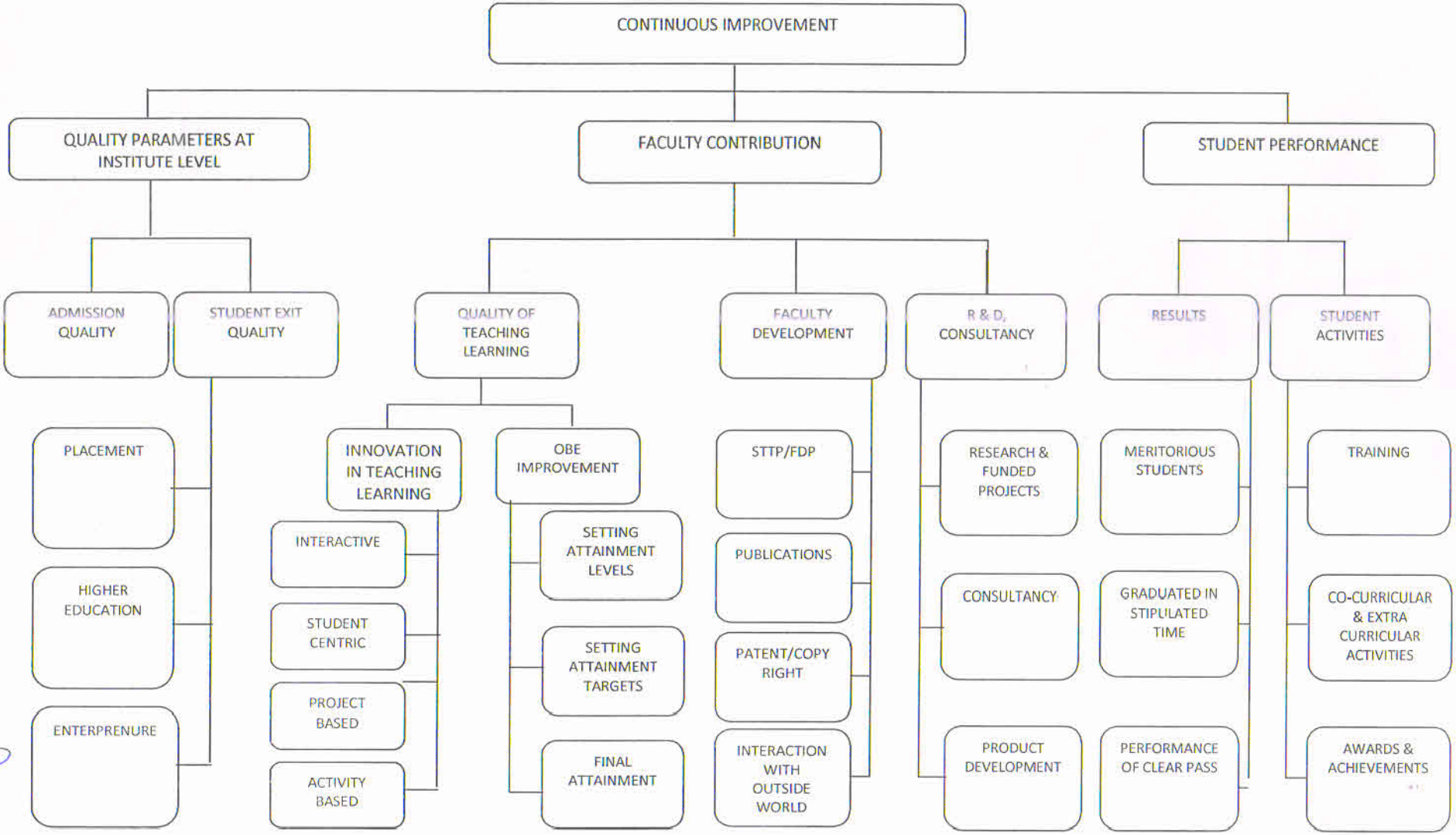
1: Poor, 2: Fair, 3: Good, 4: Excellent

Sr. No.	Course Outcomes	1	2	3	4
To what level you are able to					
1	Explain fundamentals of OPAMP.				
2	Explain workings of various analog circuits.				
3	Conduct various analog circuit experiments using modern tools/software.				
4	Analyze analog circuits and determine their output and parameters.				
5	Compare various types of multivibrators and data converters.				
6	Design various analog circuits.				

Any other suggestions: How to improve? / Any other comments.

……

Signature of Student:……



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