Standard Operating Procedure

FOR OBE IMPLEMENTATION

1 INTRODUCTION:

The purpose of the higher education is to make an individual capable of utilizing the knowledge in identifying the problems prevailed in various sectors and providing the best solution by employing learned skill and generating new ideas to make society and country to progress.

1.1 Outcome Based Education (OBE):

OBE in higher education is a unique way of learning in which curriculum is guided by the learning outcomes which learner should demonstrate at the end of the program. It is a complete transformation of the education led by quality and standards. OBE model is a student-centric in which required knowledge and skill sets for a particular degree are predetermined and the students are evaluated for all the required parameters (Outcomes) in all the courses of the program. Relevant curriculum content, diverse teaching and learning strategies and appropriate evaluation methods are the backbone of this learning. OBE is result oriented, learning centric system which benefits all. Key performance indicators such as performance in various assessment, employability rate after course completion are some of the important outcomes in OBE.

Key steps in implementation of Outcome-Based Education include –

- Development of a curriculum framework that outlines specific and measurable outcomes.
- Instructional Methodology to ensure delivery for specified outcomes.
- Assessments to determine if students have achieved the predetermined standard.

2 OBJECTIVE

The main objective of these guidelines is to ensure that the standards are maintained while measuring the students' performance, knowledge, and skills against the learning outcomes. These guidelines are to facilitate the instructors on using the appropriate tools for teaching &

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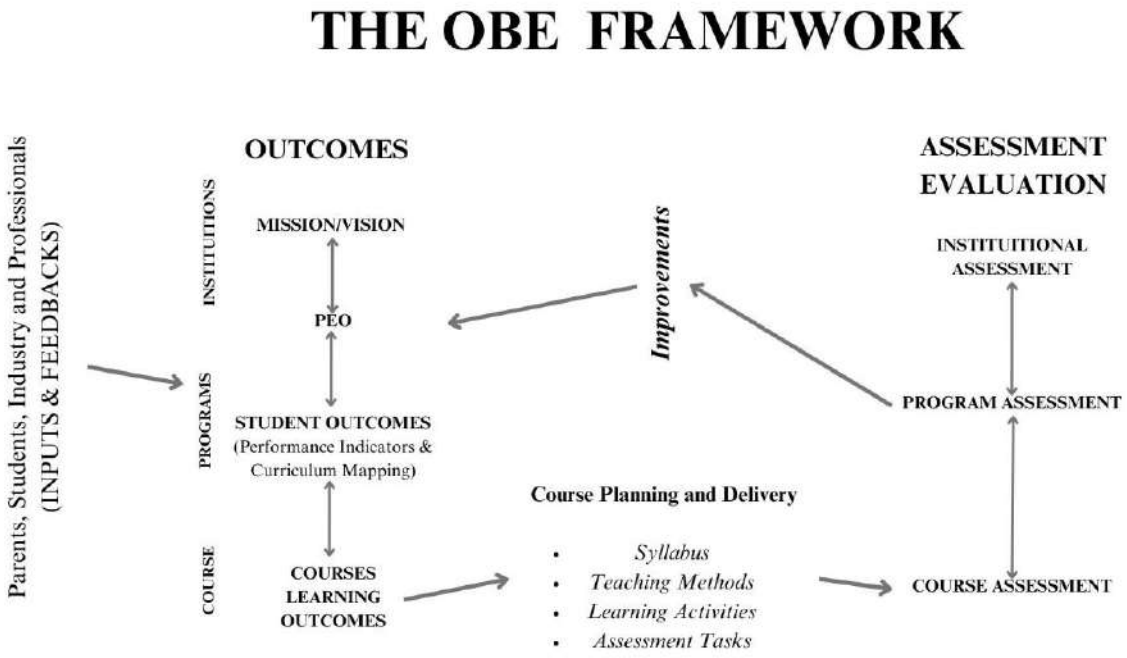
learning, assessments and use of pedagogy that can facilitate continuous quality improvement via relevant feedback from stakeholders.



3 DEFINITIONS

Vision: A vision is an outline of all the future goals of the Institution. It gives a brief overview on long-term objectives of Institutions. Vision statement can be viewed as a guide for choosing actions that support the goals of the organisation.

An effective vision statement helps an organisation in:

(a) Motivate people and maintain their focus within the organisation.

(b) Make quicker and more informed judgements.

(c) Attract talented individuals.

Mission: A mission is the measures taken by an Institution to achieve its vision. It gives an Institution's actions a distinct dimension. It establishes the purpose of the organisation and keep the focus in the right direction.

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A mission statement should clearly state the following:

a) What organisation does?

b) The manner in which the organisation operates.

c) Rationale behind organization's actions.

d) A mission statement shall be simple, straightforward, and operative and be known to every member of the organisation.

Program: An arrangement of modules/courses that are structured or designed over a specified duration and learning volume to achieve stated learning outcomes usually leading to an award of a qualification.

Program Educational Objectives (PEOs): PEOs are broad statements that describe the expected achievement of graduates that the program is preparing graduates to achieve. PEOs state that graduates could demonstrate certain skillsets within a period of 3 to 5 years after graduation.

The following details need to be considered while defining the program's educational objectives:

- PEOs should align with the Institution's mission.
- Institution's faculty and stakeholders should actively participate in framing the PEOs.
- PEOs needs to be precise.
- PEO shall be manageable and achievable by the program.

Program Outcomes (PO): POs are statements that describe what students are expected to know and be able to do upon graduating from the Program. These are related to description of the knowledge, skills, attitudes, competences, and values a student display at the completion of the program.

- POs shall be specific, measurable and achievable
- POs shall be in line with the graduate attributes

Program-Specific Outcomes (PSOs): PSOs are a statement that describes what students are expected to know and be able to do in a specialised area of discipline upon graduating from a program. These are defined for a program, if required.

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Course: A unit of teaching and learning also referred as module or subject that forms the building block of a programme, containing the specific outcomes, the content to be covered and the teaching-learning as well as assessment methods that support the attainment of the learning outcomes.

Course Outcomes (CO): COs are narrower statements that describe what students are expected to learn at completion of a course. These outcomes should be meaningful, observable and measurable. These outcomes are mainly affective, cognitive and behavioral outcomes.

- COs shall derive from the program outcome.
- Shall begin with the action verb from Bloom's taxonomy

Learning Domains: Educational objectives are divided in three domains affective, psychomotor, and cognitive according to Bloom's Taxonomy with the main goal of assisting and motivating educators to focus on all three domains thus imparting holistic form of education.

Lesson Plan: It is a document which contains written description on how to teach academic contents. It facilitates to organise teaching objectives and methods and provides focus for the lesson to be presented. It has various components.

Blueprints for Assessment: Blueprints for assessment are important in ensuring that the assessment is in-line and appropriate to evaluate predefined outcome with predetermined difficulty level for each course.

Assessment: Assessment is one or more processes that identify, collect, and prepare data to evaluate the attainment of learning outcomes in relation to the program outcomes and program specific outcomes. Effectiveness of the program could be assessed by analysis of program. Assessment could provide the key information to improve the curriculum by indicating the performance of each program outcome.

Formative Assessment: The assessment of student progress throughout a course, in which the feedback from the learning activities is used to improve student attainment.

Rubrics for Assessment: It is a scoring tool that assists the evaluator to assess a student's performance based on the sum of attributes rather than a single numerical score.

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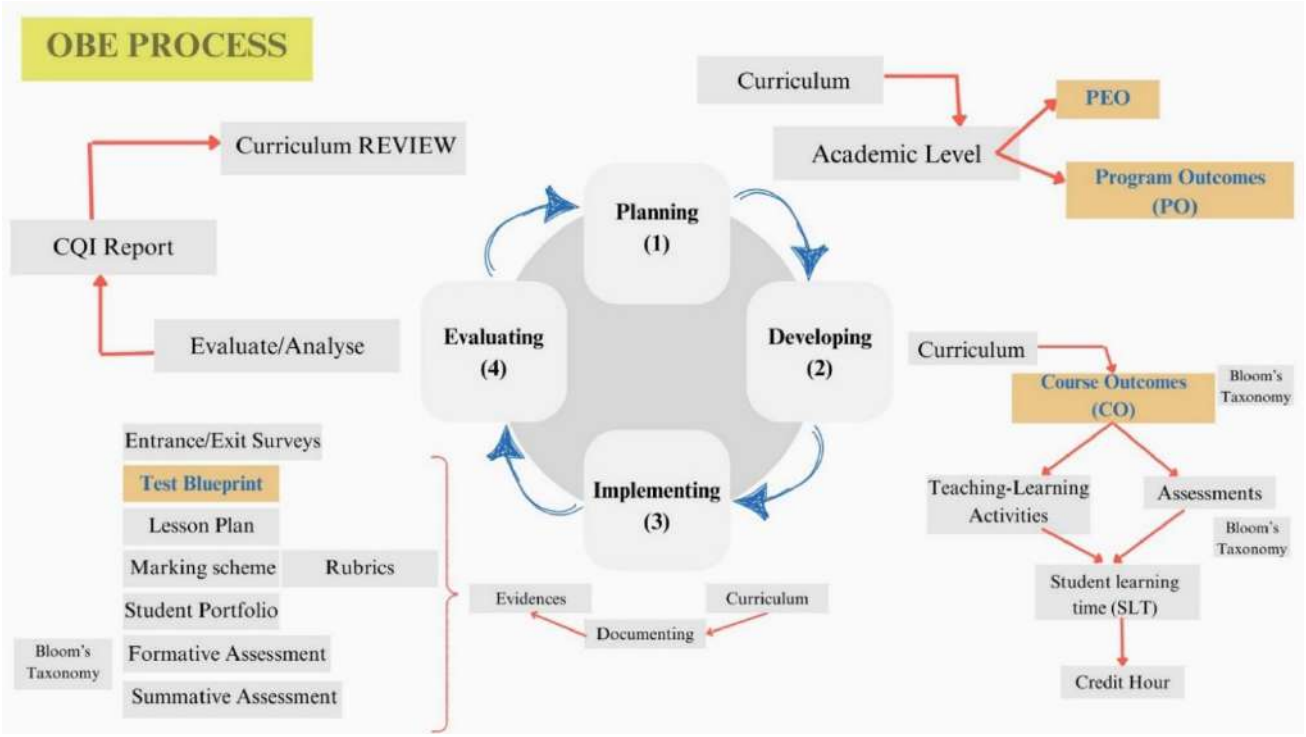
Student Learning Time (SLT): Students must have the quality time for self-improvement. Effective learning time or Student academic load should be allocated in such a way that reflects quality of student's achievement. In course syllabi credit hour calculation should include the student learning time which includes face to face and non-face to face**.**

Mapping: Mapping is the process of representing, preferably in a matrix form, the correlation among the parameters. It may be done for various parameters.

Continuous Quality Improvement (CQI): This mechanism helps teachers to detect ineffective teaching techniques and assessment tools which can help them to prepare course critique report including the feedback from students and all the teachers involved in particular course indicating the performance in each PO attainment for the particular course and further bring up the lacuna to improve through CQI. Continuous Quality Improvement is a dynamic process which can be done periodically to ensure the quality of program while implementing the outcome-based education.



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4 GENERAL GUIDELINES FOR OBE IMPLEMENTATION

4.1 Develop the clear vision and mission based on desired outcomes of education as per NEP 2020. Vision and Mission statements of the University shall be taken as a reference to formulate the Department/School/College Vision and Mission statements.

4.2 All the stakeholders shall take active participation in framing of the Vision and Mission. Internal stakeholders include the management representatives, faculty members, students and external stakeholders include the academicians, professional bodies, industry experts, alumni, employers and parents. **(Annexure A)**

4.3 Develop PEOs based on Vision and Mission statement of University and relevant Faculty/School/College and program outcomes after consultation with various stakeholders. **(Annexure B)**

4.4 Design outcome-based curriculum and assessment methods after consultation and inputs from internal and external stakeholders. The syllabus shall be comprising the clear and defined program outcomes (POs), program specific outcomes (PSOs), and course outcomes (COs). **(Annexure C)**

4.5 SMART approach shall be used while designing the course outcome which is specific, measurable, achievable, relevant and timebound.

4.6 POs, PSOs, COs of all programs and courses shall be aligned with University and Faculty/School/College Vision and Mission.

4.7 Programme outcomes are aligned with course outcomes and fulfilled by achievement of course outcomes likewise lesson learning outcomes/topic learning outcomes are aligned with course outcome and their achievement satisfy the course outcome. **(Annexure D)**

4.8 Bloom's Taxonomy: It is a classification system used to define and distinguish different learning levels. The six levels are remembering, understanding, applying, analyzing, evaluating and creating. Appropriate and suitable action verbs for designing of various outcomes are recommended. Action verbs shall match with difficulty level and outcome. Fundamental concepts shall be under low order thinking (LOT) and advanced learning shall be under high order thinking (HOT) of cognitive dimension of Bloom's taxonomy. To make these course and lesson learning outcomes more clear, the conditions and standards should be added to the COs. **(Annexure E)**

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4.9 Blended learning, flipped classroom, problem/project-based learning, case-based learning, MOOC based learning, inter-disciplinary projects, debate, group discussion and other innovative way of learning shall be included in course teaching and learning methods.

4.10 Collaborative learning shall be promoted to engage students as team on projects, case studies and to share the ideas and resources, and to receive feedback from peers and instructors in order to development of key skills such as teamwork, communication, and critical thinking.

4.11 Course file/instructor manual shall be prepared for each course. Components of course file includes the course name, code, credits, course outcomes, CO-PO mapping/matrix, course content, timetable, teaching schedule/course plan, assessment methods and rubrics. **(Annexure F)**

4.12 Formative and summative assessment shall clearly be defined with appropriate distribution of the marks in midterm/CT and end term examinations. Marks distribution shall be calculated based on number of hours per unit/CO, total hours of the course and its credit.

4.13 Suitable tools of assessment (Blueprints) shall be used while assessing the cognitive, psychomotor skills and affecter domain.

4.14 There shall be constructive alignment of teaching & learning and assessment strategies. Students can also be made the part of the assessment process through both peer and self-assessment.

4.15 Vetted rubrics/marking schemes shall be used, and these rubrics shall be handed out to the students and explained before the assessment so the students will know on which criteria their work will be evaluated. Rubrics can be created in different ways with several levels of complexity.

4.16 Mapping of CO, PO/PSO and PEO: It is a systematic hierarchical process in which COs are linked with POs and thereby POs are further mapped with PEOs. These mapping for each course shall be conducted. **(Annexure G)**

4.17 Assessments: Course outcomes shall be assessed based on theory, laboratory and the other methods of assessment as applicable to each course. **(Annexure H)**

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4.18 Assessment Blueprint and Model Question Paper: Marks weightage for internal and external assessment shall be as per the assessment blueprint **(Annexure-J)**. Semester wise and course outcome wise Bloom Taxonomy Level shall be in accordance with the assessment blueprint. **(Annexure-J)**

4.19 Course attainment is the sum of direct attainment and indirect attainment. Target levels for attainment of course outcomes with suitable threshold shall be defined by the course coordinator. The course outcome attainment shall be assessed in order to track the graduate performance against the target level of performance. The attainment shall be measured or calculated which will become the basis for program outcome attainment calculation. Thus, the attainment of COs provides evidence of the attainment of POs and PSOs. **(Annexure I)**

4.20 CQI: The course coordinator shall prepare the course attainment and course critique in order to facilitate the continuous improvement and fill the gap. Suitable action shall be taken by course coordinator if case of low, moderate and high attainment. Program coordinator shall take the necessary corrective action to low, moderate and high attainment of POs.

4.21 The CQI report and feedback from stakeholders shall be the guiding documents for corrective measures required in next cycle of curriculum review to fill the gap.

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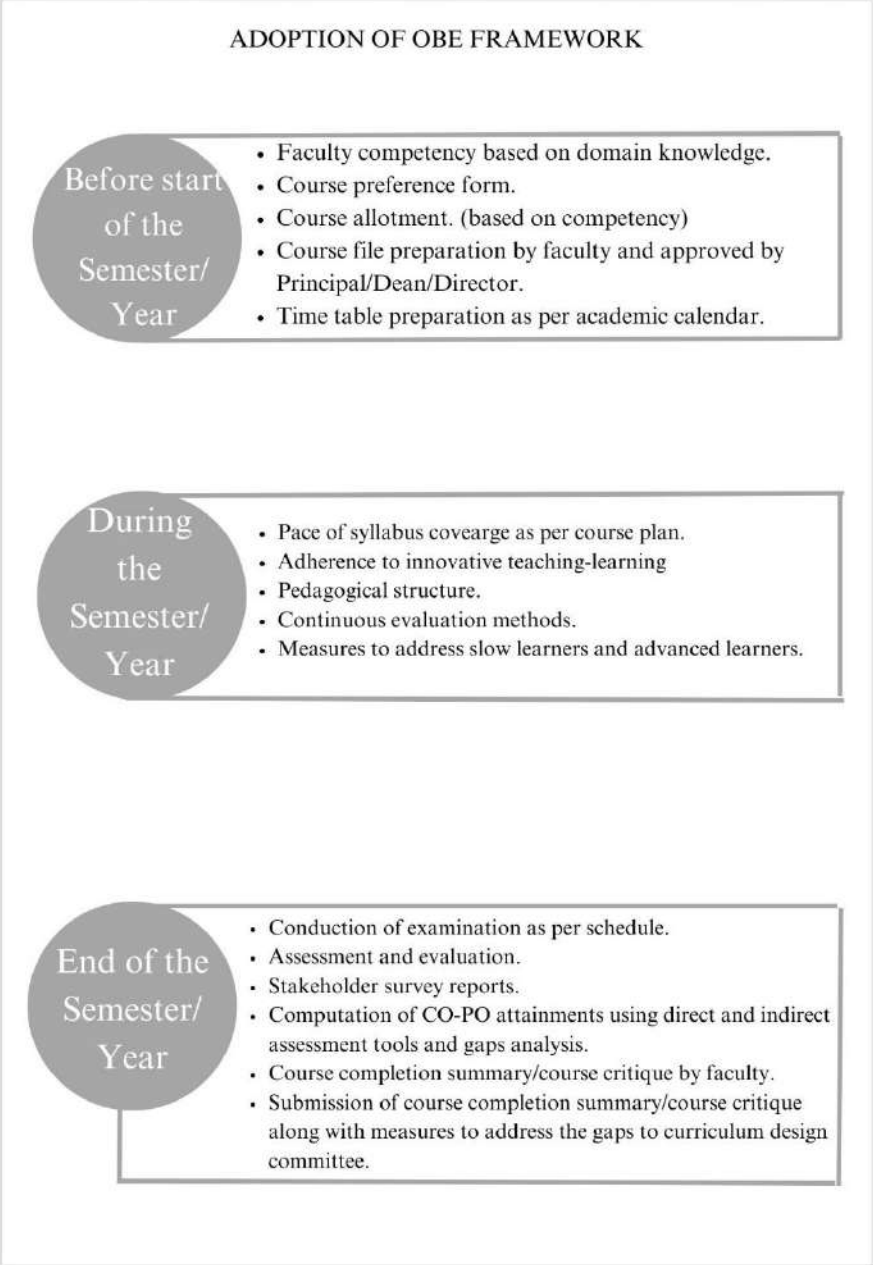
5 THE ADOPTION OF OBE FRAMEWORK IN THE UNIVERSITY



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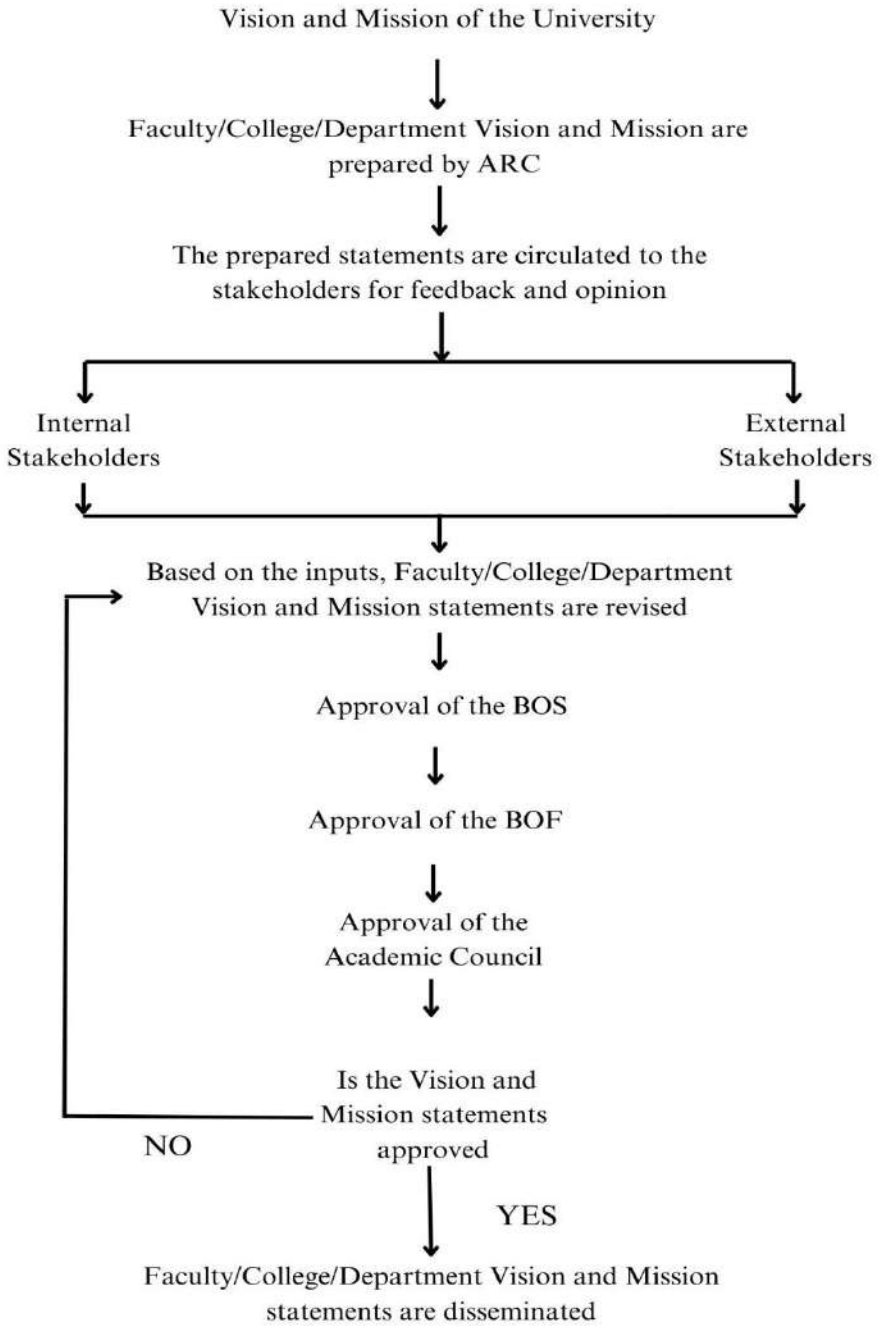
6 ANNEXURES

Annexure A: Process flowchart for vision and mission of college/faculty



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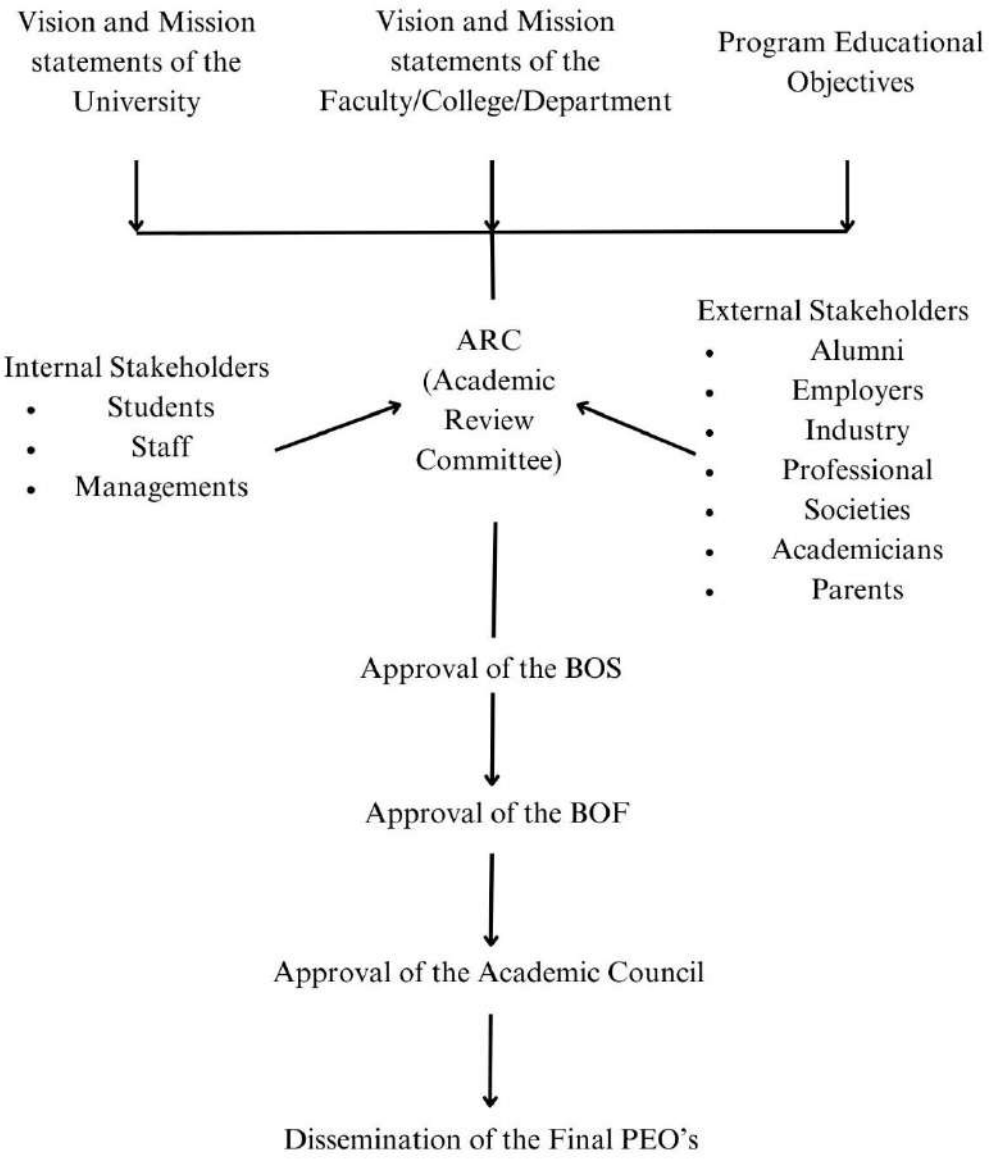
Annexure B: Process flowchart for PEOs



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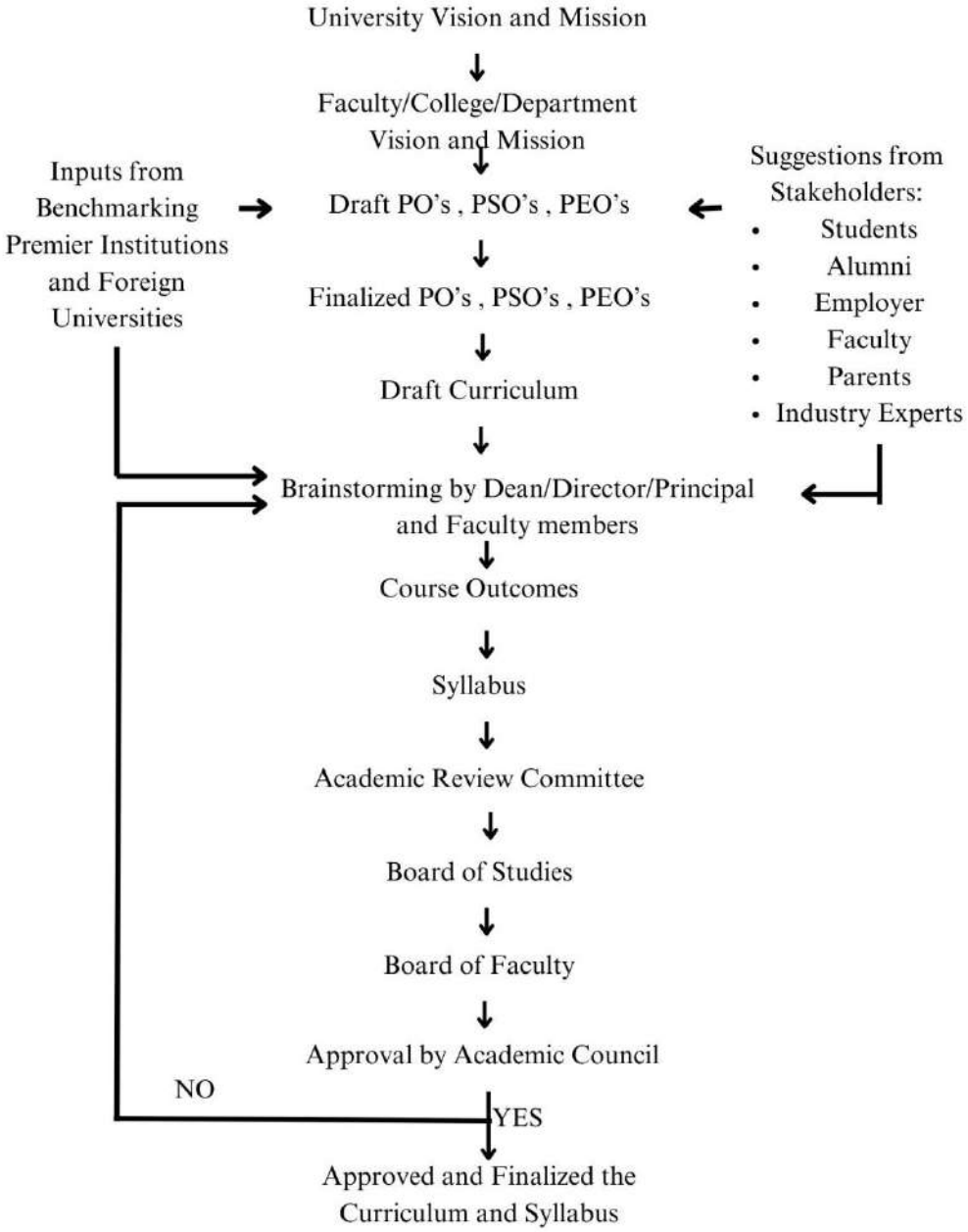
Annexure C: Design of Curriculum and Syllabus flowchart



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Annexure D: Course Outcome-Program Outcome Mapping

Identify Program Outcomes

The first step is to identify the program outcomes that the educational program is expected to achieve.

These program outcomes should align with the mission and goals of the institution.

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Define Course Outcomes

Next, define the course outcomes for each course offered as part of the program. The course outcomes should be aligned with the program outcomes and reflect the skills, knowledge and competencies that students should also be able to develop by the end of the course.

↓

Map Course Outcomes to Program Outcomes

The next step is to map each course outcome to one or more program outcomes. This process helps to ensure that each course contributes to the achievement of the program outcomes.

↓

Assign Weightage

Assign a weightage to each course outcome to indicate it's relative importance in achieving the program outcomes. This weightage can be used to determine the assessment methods and the extent to which each course outcome contributes to the program outcomes.

↓

Choose Assessments Methods

Based on the weightage assigned to each course outcome, choose appropriate assessments methods to measure student attainment of the course outcomes

↓

Measure Student Attainment

Use the chosen assessment methods to measure student attainment of the course outcomes. The results of these assessments can be used to calculate the attainment of the program outcomes.

↓

Analyze Results

Analyze the results of the assessments to determine the extent to which the program outcomes are being achieved. Use this information to identify areas of improvement and make any necessary updates to the CO-PO mapping.

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Continuously Evaluate

Continuously evaluate the CO-PO mapping process to ensure that it remains relevant and effective in achieving the desired program outcomes.

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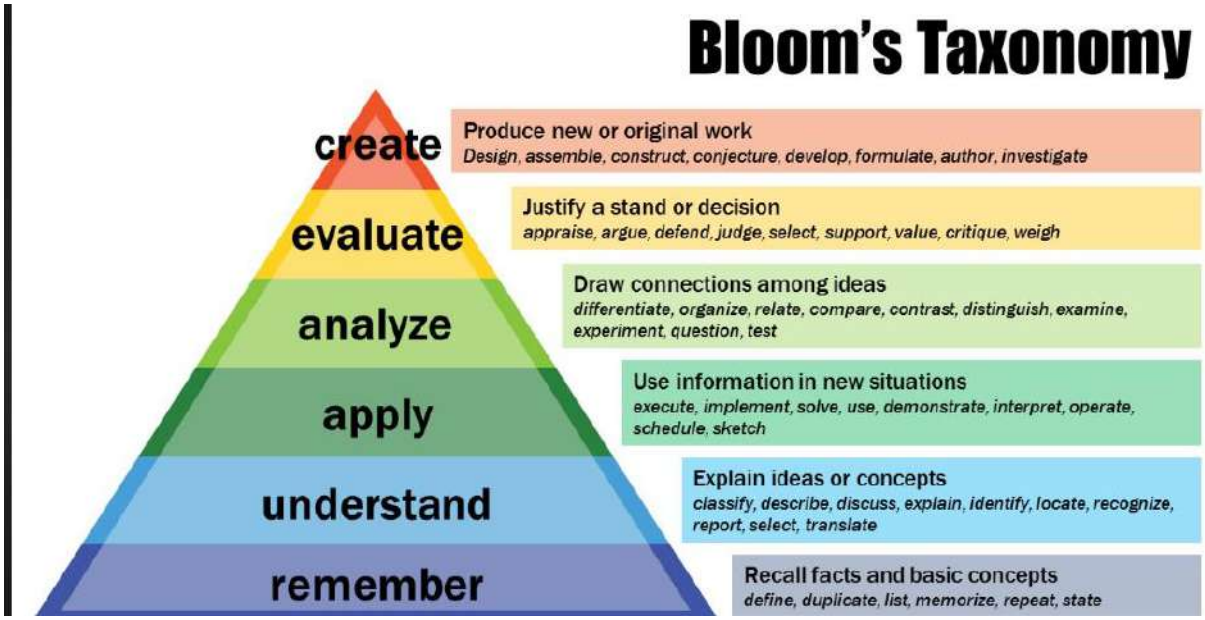
Annexure E: Bloom Taxonomy



The cognitive process dimensions- categories					
Lower Order of Thinking (LOT)			**Higher Order of Thinking (HOT)**		
Knowledge	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
Recognizing (identifying) Recalling (retrieving)	Interpreting Illustrating Classifying Summarizing Inferring (concluding) Comparing Explaining	Executing Implementing	Differentiating Organizing Attributing	Checking (coordinating, detecting, testing, monitoring) Critiquing (judging)	Planning Generating Producing (construct)

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Annexure F

INSTRUCTOR MANUAL/COURSE FILE

NAME OF COLLEGE

NAME OF COURSE

1. **Course Code**
2. **Course Name**
3. **Credits**
4. **Semester**
5. **Course Outcomes**
6. **Lecture Topics**
7. **Contact Hours**
8. **Assessments**
9. **CO-PO Mapping Matrix**
10. **Recommended textbooks and references**
11. **Timetable**
12. **Teaching schedule**
13. **Rubrics for different assessments**

Topic Title (1):

Course Outcomes

Duration: 3 hours

Content:

Topic Title (2):

Course Outcomes

Duration:

Content:

Likewise add more topics, outcome and content.

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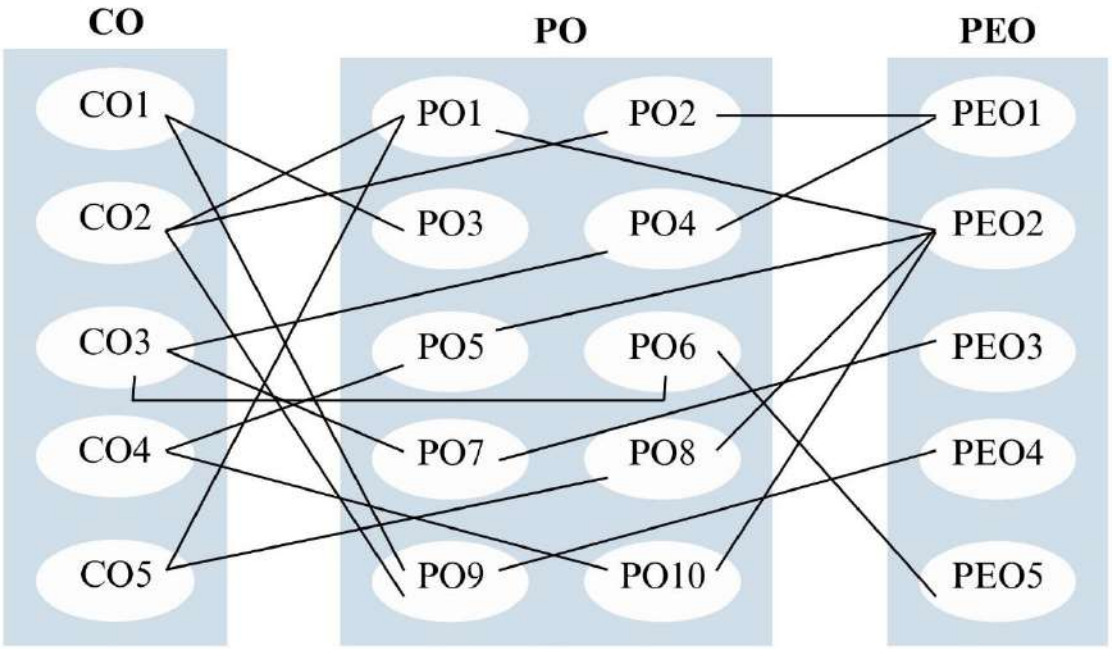
Annexure G: CO-PO and PEOs mapping and its procedure



HOD/Programme coordinator organize the meeting and subject expert, representative from industry is invited to the meeting.

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Extent of correlation of each course to POs is established by mapping each course outcome to the Program outcome with level of emphasis e.g. Strongly corelated (3), Moderately correlated (2), Slightly Correlated (1) and Not corelated (-)

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A particular PO/PSO may be contributed by more than one CO of a particular course. Mapping of CO with specific PO will be with a maximum level of emphasis if CO are significantly satisfying that particular PO.

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Annexure H: CO-PO Assessments

Program Educational Objectives (PEOs): (Example of UG Civil Engineering)

1. PEO1: Graduates will demonstrate all necessary engineering and scientific competence to work effectively in the field of civil engineering and allied fields considering the social and environmental issues.

If any PO/PSO is contributed by very few courses or the syllabus of a course is not attaining the PO/PSO adequately then it is considered that PO is weakly addressed by curriculum and identified.

PO/PSOs then CO to PO and CO to PSO corelation for all the courses are compiled in a matrix form.

2. PEO2: Graduates will show good team-spirit and problem-solving skills so they can lead organizations they join in or initiate their own ventures.
3. PEO3: Graduates will be able to analyze the requirements, understand the technical specifications and design the innovative solutions by applying the principles of Civil engineering.

Writing Program Outcomes (POs)

While writing POs the following questions/points must be addressed properly:

- The quality of a programme is ultimately assessed by the ability of the learner to carry out their expected roles and responsibilities in society. This requires the programme to have a clear statement of its outcomes.
- The specific competencies that the students should demonstrate at the end of the programme should be clearly defined.
- The programme must demonstrate how the component modules/chapters contribute to the fulfilment of the programme's outcomes.
- The programme must show how the student is able to demonstrate the learning outcomes, for example, through assessments.
- The link between competencies expected at the end of the programme and those expected during training and the workplace (such as entrepreneurship) should be clearly specified.

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Program Outcomes (POs)

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to

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comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-Long Learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. PSO 1: Graduates will be able to apply knowledge of civil engineering for analyzing and designing projects in the field of structures, transportation, hydraulics and irrigation engineering.
2. PSO 2: Graduates will design and develop civil engineering projects concerning environment, ecology, energy conservation and safety.
3. PSO 3: Graduates will be able to plan and execute civil engineering projects applying relevant codes of practice for materials and techniques.

Mapping of POs with PEOs

No.	Program Outcomes (PO)	PEOs attained through PO	Program Educational Objectives (PEO)
POI	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2,3	**PEO1:** Graduates will demonstrate all necessary engineering and scientific competence to **work effectively** in the field of civil engineering and allied fields considering the **social and environmental issues.**

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PO2	**Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2,3	**PEO2:** Graduates will show **good team spirit and problem-solving skills** so they can lead organizations they join in or initiate their own ventures.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	1,3	**PEO3:** Graduates will be able to **analyze** the requirements, understand the technical specifications and **design the innovative solutions** by applying the principles of Civil engineering.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2,3	
PO5	**Modern Tool Usage**: Create, Select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	1,3	
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	1	

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PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	1	
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	1,2,3	
PO9	**Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	2	
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	
PO11	**Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	2	
PO12	**Life-Long Learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1,2,3	

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Mapping of POs With PEOs

PO	PEO1	PEO2	PEO3
PO1		Y	Y
PO2		Y	Y
PO3	Y		Y
PO4		Y	Y
PO5	Y		Y
PO6	Y		
PO7	Y		
PO8	Y	Y	Y
PO9		Y	
PO10	Y		
PO11		Y	
PO12	Y	Y	Y

Writing CO:

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

- Specific: Is there a description of precise behavior 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 number 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?
- COs shall be written by the course/subject expert.
- Course outcomes shall contain an action verb from Bloom's taxonomy.

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Example:

COs of Structural Design (Course in UG Civil Engineering)

COs	At the end of the course the student will be able to
CO1	utilize the knowledge of various properties of concrete and structural steel.
CO2	explain the principle of working stress method and limit state methods of design.
CO3	design the beams, slab, stairs, column and footing.
CO4	apply IS code of practice for the design and checks of building.
CO5	draw the structural components based on design.

CO-PO Mapping

COs	The students will be able to	POs attained through concerned CO	POs	Program Outcomes
CO1	utilize the knowledge of various properties of concrete and structural steel	1,2,3,4,5,12	PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
CO2	explain the principle of working stress method and limit state methods of design	1,2,3,4,5,12	PO2	**Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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CO3	design the beams, slab, stairs, column and footing	1,2,3,5,6,7,8,9,10,12	PO3	**Design / Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
CO4	apply IS code of practice for the design and checks of building components	1,2,3,4,5,6,10,12		**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
CO5	to draw the structural components based on design	1,2,5,9,12	PO5	**Modern Tool Usage:** Create, Select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
			PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
			PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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			PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
			PO9	**Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
			PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
			PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
			PO12	**Life-Long Learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Mapping of the COs with POs and PSOs

The student will be able to	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: utilize the knowledge of various properties of concrete and structural steel.	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**
CO2: explain the principle of working stress method and limit state methods of design.	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**1**
CO3: design the beams, slab, stairs, column, and footing	**3**	**2**	**3**	**-**	**3**	**1**	**1**	**1**	**1**	**1**	**-**	**3**	**3**	**1**	**-**
CO4: apply IS code of practice for the design and checks of building components	**3**	**2**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**-**	**3**
CO5: to draw the structural components based on design	**3**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**3**	**3**	**-**	**2**
Average	**3**	**2**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**-**	**3**	**3**	**1**	**3**

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Course Type	Assessment Tool	Assessment Criteria	Data Collection
Theory	CT I, II, Examination	Based on student performance in internal exams	Average from best of two CT (Cover at least two COs)
	Assignments	Based on student performance in Assignment	At-least one assignment per CO
	Semester/Annual Exams for Theory	Based on student performance in end term examination	Once in a semester (Questions from all the COs)
Laboratory	Continuous evaluation	Based on Student performance in experiments, files assessments and Internal Viva-voce	Assessments during laboratory and exams (Covers at least 2 COs from Psychomotor)
	Semester/Annual Exam for Laboratory	Based on student performance in university Exam	Once in a semester/year (Covers all the COs from Psychomotor)
Other Assessment methods	Internship report/Project reports/Visit reports/Presentation/case report/Lab report	Based on student performance as per rubric	Frequency of assessment as per the syllabus

Annexure I: Attainment

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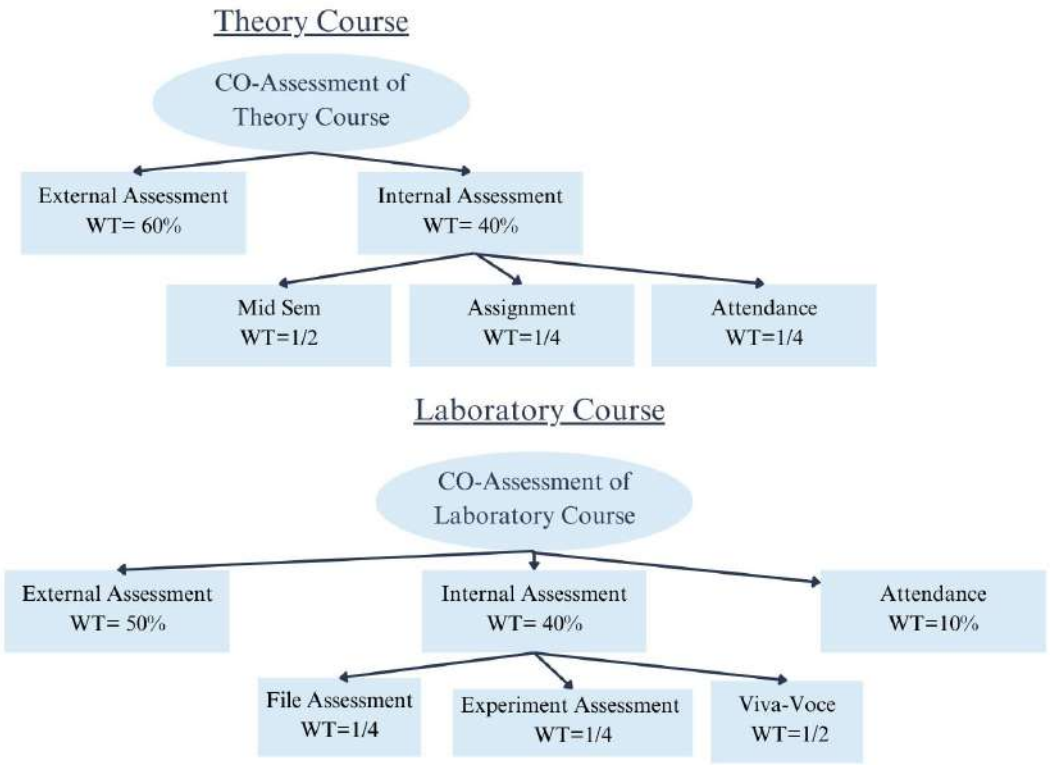
Weightage of different components in Theory and Laboratory Course



Level for Attainment of CO

For Internal Evaluation (IA) (Theory/Practical)		
Level	3	80% Students secure more than 80% Marks
Level	2	70% students secure more than 80% Marks
Level	1	60% Students secure more than 80% Marks

External Attainment (EA) (Theory/Practical)		
Attainment		Rubrics
Level	3	80% Students secure more than 50% Marks
Level	2	70% students secure more than 50% Marks
Level	1	60% students secure more than 50% Marks

Attainment of CO_{XX} = 0.6 x EA + 0.4 x IA

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Criteria for CO-PO Mapping:

1. Based on contact hours: Contact Hours for Theory course (Lecture and tutorial)

Level	Contact Hours in Percentage
No mapping (-)	< 5%
Low (1)	5- 15%
Medium (2)	15- 25%
High (3)	>25%

Theory course:

Description

Number of lectures = 4per week x 12 weeks = 48 Hours

Tutorial = 1Hr x 12 Weeks = 12 Hours

Total Hrs = 48+12= 60 Hrs

Example: Let, CO1 related points explained/engaged in 11 lectures + 1 Tutorial

Then contact hours = 11+1= 12 hours

Therefore, contact hours in percentage (%) = (12/60) x 100 = 20 % → **Medium mapping (2)**

Practical course:

Description

Number of Labs = 1 per week (Each Lab 3 hours) x 12 weeks = 36 hours

Example: Let, CO1 related topic engaged in 4 Labs

Then contact hours = 3x4=12 hours

Therefore, contact hours in % = (12/36) x100 = 33.33 % → **High mapping (1)**

2. Based on number of assessment tools:

Number of Assessment Tools used.

Level	Assessment tools used to assess the CO
No mapping (-)	0
Low (1)	1 or 2
Medium (2)	3
High (3)	4 or more

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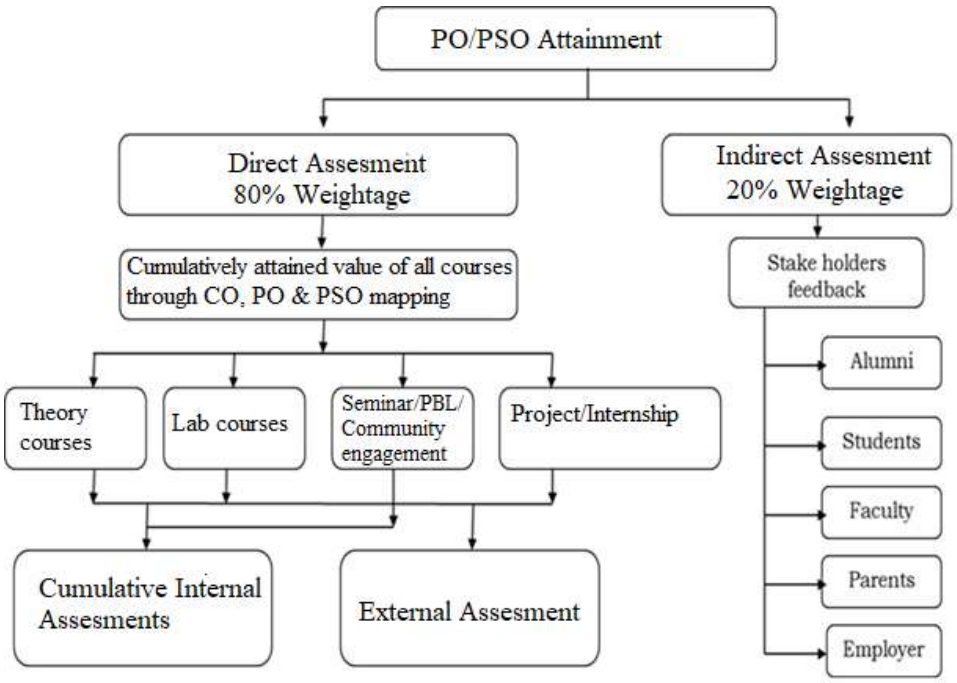
For example, if CO1 is assessed by more than 4 different assessment tools then it will qualify to have **high mapping (3)**



Assessment tools used for indirect attainment of POs and PSOs:
a) Graduate Exit Survey: End of the program
b) Faculty Survey: End of the program
c) Employer Survey: After one year of graduation
d) Alumni Survey: After one year of graduation
e) Parents Survey: End of the program

MATRICES required for calculating the attainments

Matrix - CO Assessment of a Theory course

	CO Attainment		Course Name for Theory		
CO	External Attainment (EA)	Internal Attainment (IA)	Final =(0.6xEA+0.4xIA)	Target	GAP
CO1					
CO2					
CO3					
CO4					
CO5					

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Matrix- CO Assessment of a Laboratory Course

	CO Attainment Course name Laboratory				
CO	External Attainment EA	Internal Attainment IA	Final = (0.5xEA+0.5xIA)	Target	GAP
CO1					
CO2					
CO3					
CO4					
CO5					

Note: Matrix may vary depending upon the structure of the assessment scheme of respective program

Attainment of PO/PSO

PO/PSO attainment= 0.8xDirect PO/PSO attainment + 0.2x indirect PO/PSO attainment

Direct PO Attainment: Attainment of Program Outcome through Course Outcomes.

a. Direct PO attainment is calculated using CO attainment with the help of the mapping table for CO-PO.
b. For each course, the number of COs mapped to each PO are identified.
c. PO attainment due to one course is calculated by average sum of product of weightage and CO attainment.

$$\text{Direct PO Attainment} = \frac{\Sigma (\text{CO-PO Mapping} \times \text{CO Attainment})}{\Sigma \text{CO -P O Mapping}}$$

Example: (Course name)

CO	EA	IA	Final=(0.6xEA+0.4xIA)
COI	2	3	2.4
CO2	3	2	2.6
CO3	1	1	1
CO4	1	0	0.6
CO5	2	3	2.4

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Theory Course CO-PO mapping

CO	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
COI	3	2	3	-	-	-	-	-	1	-	-	-
CO2	3	2	3	-	-	-	-	-	1	-	-	-
CO3	3	2	3	-	-	-	-	-	1	-	-	-
CO4	3	2	3	-	-	-	-	-	1	-	-	-
CO5	3	2	3	-	-	-	-	-	1	-	-	-
PO Attainment	3	2	3						1			

Indirect PO Attainment

Tools Used (Percent Weightage)	POI	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Exit Survey (30%)	3	2	3	2	2	3	3	2	2	2	2	2
Faculty Survey (20%)	3	2	3	2	2	3	3	2	2	2	2	2
Employer Survey (20%)	3	2	3	2	2	3	3	2	2	2	2	2
Alumni Survey (15%)	3	2	3	2	2	3	3	2	2	2	2	2
Parents Survey (15%)	3	2	3	2	2	3	3	2	2	2	2	2
Final Indirect PO	3	2	3	2	2	3	3	2	2	2	2	2

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Final PO & PSO Attainment

Sem/Year	Course	PO1	PO2	PO3	PO4	P05	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I																
II																
III																
IV																
Direct PO-PSO Attainment (DA)																
Indirect PO-PSO Attainment (IA)																
Final PO & PSO Attainment (0.2xIA+0.8xDA)																
Target																
Gap in attainment																

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Annexure- J

ASSESMENT BLUEPRINT:

College shall conduct two Internal assessments each test carrying 20 marks for theory courses and best of two shall be calculated for CT.

External assessments in the form of theory examinations carrying 60 marks shall be conducted at end of the semester.

Assignments and attendance will carry 10 marks each for each course.

Continuous Assessment: 40 Marks
CT examination: 20 Marks
Assignments: 10 Marks
Attendance: 10 Marks
End Semester Examination: 60 Marks
TOTAL: 100 Marks

Semester Wise recommended difficulty levels

S.N.	Semester	Bloom Taxonomy Level (BTL)
1.	I, II	Up to 3
2.	III, IV	Up to 4
3.	V, VI	Up to 5-6
4.	VII, VIII	Up to 5-6

Course Outcome Wise recommended difficulty levels

S.N.	Units in course	COs and Bloom Taxonomy Level (BTL) Maximum Level
1.	Unit 1	CO1: Questions up to level 2
2.	Unit 2	CO2: Questions up to level 2
3.	Unit 3	CO3: Questions up to level 3 & 4
4.	Unit 4	CO4: Questions up to level 3, 4 and 5
5.	Unit 5	CO5: Questions up to level 3, 4, 5 and 6

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GENERAL FORMAT FOR CT 1 EXAMINATION

TEERTHANKER MAHAVEER UNIVERSITY
Name of the College/Faculty/Department
Program_____ Session: 2024-25

Semester:	Time: 1.00 Hr	Max. Marks: 20
Course Name:		Course Code:

General Instructions: This question paper contains **two** sections. Answer **all** questions in Section A and B.

Section A

Instructions: Choose the **Single Best Answer (Alphabet)** for each question. **(1 x 6 = 6 Marks)**

MCQ 1.	Select the plant growth regulator used in ripening of fruits.		Unit 1	CO: 1	BTL: 1
	A	Abscisic acid			
	B	Ethylene			
	C	Indole acetic acid			
	D	Cytokinin			
MCQ 2.	Identify the micro-constituents found in the fennel fruit.		Unit 1	CO: 1	BTL: 1
	A	Aleurone grain			
	B	Starch grain			
	C	Aerenchyma			
	D	Oleoresin			
MCQ 3.	Find the test used to identify the saponin glycosides.		Unit 2	CO: 2	BTL: 1
	A	Froth formation test			
	B	Baljet test			
	C	Keller- killiani test			
	D	Dragendorff's test			
MCQ 4.	Select the method used in the elucidation of biosynthetic pathway.		Unit 2	CO: 2	BTL: 1
	A	Sublimation			
	B	Tracer techniques			
	C	Distillation			

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	D	Stas-Otto process			
MCQ 5.	Find the method used to extract volatile oil from citrus fruit.		Unit 3	CO: 3	BTL: 1
	A	Rectification			
	B	Cohobation			
	C	Enfleurage			
	D	Ecuelle			
MCQ 6.	Select the plant hormone that normally found in senescent leaves.		Unit 3	CO: 3	BTL: 1
	A	Gibberellin			
	B	Kinetin			
	C	Abscisic acid			
	D	Ethylene			

Section B

	Answer all questions	**Marks**	**Units**	**CO**	**BTL**
Q. 1	Classify the essential oils with one example of each. **OR** Describe the different methods used for the extraction of volatile oils.	4 4	1 1	1 1	2 2
Q. 2	Distinguish unsaturated and saturated fatty acids. **OR** Illustrate the microscopical features of Ipecacuanha.	4 4	2 2	2 2	2 2
Q. 3	Illustrate the shikimic acid pathway. **OR** Differentiate between MUFA and PUFA.	6 6	3 3	3 3	3/4 3/4

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GENERAL FORMAT FOR CT 2 EXAMINATION

TEERTHANKER MAHAVEER UNIVERSITY
Name of the College/Faculty/Department
Program_____ Session: 2024-25

Semester:	Time: 1.00 Hr	Max. Marks: 20
Course Name:		Course Code:

General Instructions: This question paper contains **three** sections. Answer **all** questions in Section A and B. Answer only **one** question from Section C.

Section A

Instructions: Choose the **Single Best Answer (Alphabet)** for each question. **(1 x 5 = 5 Marks)**

MCQ 1.	Select the plant growth regulator used in ripening of fruits.		Unit 1	CO: 1	BTL: 1
	A	Abscisic acid			
	B	Ethylene			
	C	Indole acetic acid			
	D	Cytokinin			
MCQ 2.	Find the test used to identify the saponin glycosides.		Unit 2	CO: 2	BTL: 1
	A	Froth formation test			
	B	Baljet test			
	C	Keller- killiani test			
	D	Dragendorff's test			
MCQ 3.	Find the method used to extract volatile oil from citrus fruit.		Unit 3	CO: 3	BTL: 1
	A	Rectification			
	B	Cohobation			
	C	Enfleurage			
	D	Ecuelle			
MCQ 4.	Identify the test used to detect the artificial invert sugar in honey.		Unit 4	CO: 4	BTL: 1
	A	Vitali-Morin test			
	B	Thalleoquin test			
	C	Fiehe's test			

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	D	Raymond's test			
MCQ 5.	Find the method that uses the carbon dioxide gas as solvent.		Unit 5	CO: 5	BTL: 1
	A	Fractional liberation			
	B	Supercritical fluid extraction			
	C	Sublimation			
	D	Fractional crystallization			

	Section B				**(2 x 5 = 10 Marks)**
	Answer all questions	**Marks**	**Units**	**CO**	**BTL**
Q. 1	Classify the essential oils.	2	1	1	2
Q. 2	Distinguish between volatile oil and fixed oil.	2	2	2	2
Q. 3	Classify the lipids.	2	3	3	2
Q. 4	Describe the pharmaceutical uses of pectin.	2	4	4	2
Q. 5	Explain any two methods of adulteration of crude drugs.	2	5	5	2
	Section c				**(5 x 1 = 5 Marks)**
	Answer any one question	**Marks**	**Units**	**CO**	**BTL**
Q. 1	Illustrate the microscopical features of clove.	5	4	4	3
Q. 2	Outline the supercritical fluid extraction method.	5	5	5	4

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GENERAL FORMAT FOR SEMESTER EXAMINATION

TEERTHANKER MAHAVEER UNIVERSITY
Name of the College/Faculty/Department
Program_____

Semester:	Time: 3.00 Hrs	Max. Marks: 60
Course Name:		Course Code:

Instructions:
1. This question paper contains **four** sections.
2. Answer **all** questions in Section A, B and C.
3. Answer any **two** questions in Section D.
4. Each question in Section A, B, C carries 1 Mark, 1 Mark, 6 Marks and 10 Marks respectively.

Section A

Instructions: Choose the **single best answer (alphabet)** for each question. **(1 x 5 = 05 Marks)**

MCQ 1.	Select the plant growth regulator used in ripening of fruits.		Unit 1	CO: 1	BTL: 1
	A	Abscisic acid			
	B	Ethylene			
	C	Indole acetic acid			
	D	Cytokinin			
MCQ 2.	Identify the micro-constituents found in the fennel fruit.		Unit 2	CO: 2	BTL: 1
	A	Aleurone grain			
	B	Starch grain			
	C	Aerenchyma			
	D	Oleoresin			
MCQ 3.	Find the test used to identify the saponin glycosides.		Unit 3	CO: 3	BTL: 1
	A	Froth formation test			
	B	Baljet test			
	C	Keller- killiani test			
	D	Dragendorff's test			

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MCQ 4.	Select the method used in the elucidation of biosynthetic pathway.	Unit 4	CO: 4	BTL: 1
	A Sublimation			
	B Tracer techniques			
	C Distillation			
	D Stas-Otto process			
MCQ 5.	Find the method used to extract volatile oil from citrus fruit.	Unit 5	CO: 5	BTL: 1
	A Rectification			
	B Cohobation			
	C Enfleurage			
	D Ecuelle			

	Section B			**(1 x 5 = 5 Marks)**
	Very Short Answer Questions (Maximum 30 words)	**Units**	**CO**	**BTL**
Q. 1	Classify the essential oils.	1	1	2
Q. 2	Describe the essential oil.	2	2	2
Q. 3	Classify the lipids.	3	3	2
Q. 4	Describe the pharmaceutical uses of pectin.	4	4	2
Q. 5	Outline any two methods of adulteration of crude drugs.	5	5	2

	Section C			**(5 x 6 = 30 Marks)**
Questions	**Short Answer Questions (Maximum 250 words)**	**Units**	**CO**	**BTL**
Q. 1	Classify the essential oils with one example of each.	1	1	2
	OR			
	Describe methods used for the extraction of volatile oils.	1	1	2
Q. 2	Distinguish between unsaturated and saturated fatty acids.	2	2	2
	OR			
	Differentiate between MUFA and PUFA.	2	2	2
Q. 3	Illustrate the shikimic acid pathway.	3	3	3/4
	OR			
	Illustrate the microscopical features of Ipecacuanha.	3	3	3/4
Q. 4	Classify the Carbohydrates with one example of each.	4	4	3/4

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	OR Outline the Stas-Otto technique for extraction of glycosides.	4	4	3/4
Q. 5	Illustrate the Soxhlet methods of extraction.	5	5	3/4
	OR Elucidate the biosynthesis of phenylalanine via shikimic acid pathway.	5	5	3/4
	Long answer questions **Section D**			**(2 x 10 = 20 marks)**
Questions	**Answer any TWO questions** **Each question carries 10 marks**	**Units**	**CO**	**BTL**
Q. 1	Classify the crude drug with a detailed note on chemical classification.	3	3	3/4/5/6
Q. 2	Compare the role of HPTLC and HPLC in separation of phytoconstituents.	4	4	3/4/5/6
Q. 3	Differentiate the pharmacokinetic and pharmacodynamic drug-herb interactions with an example of each.	5	5	3/4/5/6

Note: Questions for semester I and II shall be limited to BTL 3 (bloom taxonomy level), for semester III and IV questions shall be limited to BTL 4 whereas for semester V-VIII questions shall be limited up to BTL 6.

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