

Department of Civil
&
Environmental Engineering

Outcome-Based Education
(OBE) Booklet

for

Civil Engineering Students



BIRLA INSTITUTE OF TECHNOLOGY
MESRA

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Dear Students,

Welcome to a new chapter in your learning journey!

As you step into the world of Civil & Environmental Engineering, you're not just preparing for a degree,

“you're preparing to build the foundations of tomorrow's world”

This booklet is your friendly guide to understanding **Outcome-Based Education (OBE)**: the educational approach we follow to ensure you **don't just pass courses, but grow into capable, responsible, and industry-ready engineers.**

We know that education can sometimes feel like a checklist. But in OBE, we flip that mindset:

“We first define what kind of engineer you should become, then we design courses, assessments, labs, and training to help you reach that goal.”

In this journey, you are not just a student, you are a collaborator. Your questions, your feedback, and your reflections matter. Every step you take helps us build a better structure, just like every brick in a foundation supports the strength of a building.

Through short questions and civil engineering analogies, this booklet will help you make sense of OBE in your language, with your field in mind.

Faculty Team,

*Department of Civil & Environmental Engineering
BIT Mesra*



What is Outcome-Based Education (OBE)?

I

magine you're building a multistorey building.

The final structure you want should be safe, functional, and long-lasting is like the **Program Outcomes (POs) & Program Specific Outcomes (PSOs)**. It represents the kind of engineer we expect you to become after graduation: skilled in design, ethical, able to communicate, and ready for the profession.

But to build this structure, you first complete each part step-by-step:

You cast the foundation, erect the columns, place the beams, and finish the roof and so on.

These individual parts are like your **Course Outcomes (COs)**, specific skills and knowledge you gain from each course (e.g., Soil Mechanics teaches you about bearing capacity, Surveying teaches you leveling and instruments etc.).

So, in **Outcome-Based Education**, we:

- Start with Long term goals (Program Educational Objectives, PEOs)
- Short term goals POs + PSOs, then design every COs

And ensure that by achieving each CO, you ultimately achieve the POs & PSOs

Just like you can't have a strong building without strong components, you can't become a well-rounded civil engineer without mastering each course outcome.



Why is Outcome-Based Education (OBE) important?

Suppose you're constructing a bridge over a river.

In traditional education, your focus might just be on completing the tasks: pouring concrete, placing girders, following a drawing etc., without fully knowing why or how it performs under load.

In Outcome-Based Education, we don't just want you to follow instructions. We want you to understand:

- ◆ Why you're using M40 concrete instead of M25,
- ◆ How live load and dead load affect the structure,
- ◆ And what happens if there's a design failure.

OBE ensures that:

"You not only pass exams (COs), but also become a capable engineer who can solve real-world problems (POs)."

Your education must lead to real abilities, not just marks. That's the essence of OBE.



What is the Vision and Mission of the Department?

T

hink of the Vision as the master plan of a city — a big-picture dream like:

“To become a sustainable, smart city with world-class infrastructure.”

The Mission is the set of actionable steps to achieve that dream:

- ◆ Build efficient transport systems
- ◆ Ensure clean water supply
- ◆ Promote green buildings
- ◆ Involve community participation

Similarly, in academics:

“The Vision of the Civil Engineering Department describes the long-term aspiration — what kind of engineers and leaders it wants to produce”

“The Mission outlines the concrete strategies — through quality teaching, hands-on training, industry exposure, and ethical practices.”

Just like no city becomes smart without a plan and execution, no department can produce future-ready engineers without a clear Vision and Mission.



What are Program Educational Objectives (PEOs)?

T

hink of PEOs as the project goals you define before starting construction.

For example, before building a township, you ask:

- ◆ Will this serve the population 5 years from now?
- ◆ Will it support economic activity and sustainability?

Similarly, PEOs are long-term goals — what kind of professionals your department wants you to become 3 to 5 years after graduation.

They may include:

- ◆ Pursuing higher education
- ◆ Working in core civil industries
- ◆ Practicing ethical and sustainable engineering
- ◆ Contributing to society and innovation

Just like a good civil project has a vision beyond just finishing construction, PEOs define your future role as an engineer beyond your degree.



Department Program Educational Objectives (PEOs)?

PEO1: Attain the analytical expertise to create, analyse, formulate, and solve challenging problems in the field of Civil Engineering; and recognize and develop the necessary and suitable tools for the same.

PEO2: Develop technical and management flair to take responsibility for engineering projects and research programs significantly.

PEO3: Uncover multidisciplinary approach and correlate engineering issues to social and human background in broader sense, in which their engineering helping hand will be utilised.

PEO4: Develop attitude of lifelong learning for becoming successful civil engineers.

PEO5: Implant sensitivity towards ethics, public policies and their responsibilities towards the society.



Why should I care about PEOs as a student?

Question 5

Suppose you're part of a metro rail project. Your work might just be piling or slab casting today, but in 5 years, that project will be serving millions of commuters.

Likewise, while you're focusing on a single course or semester now, PEOs reflect where you're heading as a civil engineer in the long run and check your readiness for:

- ◆ Core jobs
- ◆ Higher education
- ◆ Research
- ◆ Public service
- ◆ Startups

If you know your PEOs, you're not just preparing for exams – you're preparing for life after graduation.



What are Program Outcomes (POs)?

T

hink of Program Outcomes (POs) as the functional goals of a completed infrastructure project – like a highway that must be durable, safe, well-drained, and able to handle heavy traffic.

Just as a highway project has performance expectations – smooth ride, proper signage, drainage, and longevity – your engineering program expects you to graduate with key capabilities, such as:

- ◆ Strong technical knowledge, Problem-solving skills, Teamwork and communication, Awareness of safety, ethics, and sustainability

These are not tied to a single subject but are broad attributes that every civil engineer must develop.

There are 12 PO's :

PO1- PO6 are Technical : they cover domain knowledge and analytical, design, experimentation, and tool application skills typically specific to engineering and the technical profession.

while PO7- PO12 are transferable: these include communication, ethics, lifelong learning, teamwork, project management, etc., which are applicable across disciplines and professions.



Program Outcomes (POs)?

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities

relevant to the professional engineering practice.

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

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

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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



What are Program Specific Outcomes

T

hink of Program Specific Outcomes (PSOs) as your specialized roles on a construction site.

Everyone on site is an engineer, but each has a distinct area of expertise:

- ◆ One is skilled in structural detailing,
- ◆ Another excels at transportation design,
- ◆ Another manages water resource planning.

These focused capabilities are like PSOs specific to your department and program.

While POs are universal across engineering disciplines (like communication or ethics), PSOs are tailored to what your Civil Engineering department expects from you as a graduate.

So if your education is a construction project:

POs = the overall safety and strength of the building

PSOs = the custom interior features: elevators, solar panels, smart systems that define your program's unique identity



Program Specific Outcomes (PSOs)?

PSO1: Plan, analyse, and design infrastructural projects and its components in various areas of Civil Engineering like Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Environmental Engineering, and Transportation Engineering.

PSO2: Execute the construction of buildings and other components of various projects in Civil Engineering including its layout, management, and quality control.

PSO3: Implement the provisions made in Indian Standard Codes/ other relevant codes/ specifications/ guidelines and applicable laws including labour laws and environmental laws.



What are Course Outcomes (COs)?

I

magine you're building a residential apartment.

To complete the entire structure, you must finish many individual tasks – laying the foundation, brickwork, plumbing, electrical, plastering, painting, etc.

Each of these tasks contributes to the final building.

In the same way, each Course Outcome (CO) is a specific skill or knowledge area you are expected to master in a particular subject. For example:

- ◆ In Structural Analysis, a CO might be “Ability to analyze indeterminate beams using slope-deflection method.”
- ◆ In Geotechnical Engineering, a CO might be “Ability to determine shear strength of soil through lab tests.”

Each CO is like completing a floor, a wall, or a system in the building – you can't skip any of them if you want the project (your education) to be complete and strong.

So, Course Outcomes = building blocks. If you master each CO, you're one step closer to achieving the Program Outcomes – becoming a competent civil engineer.



What is the difference between COs and POs?

I

magine you're constructing a multi-span bridge.

Each span is a part of the whole bridge. It has its own reinforcement, casting, and inspection process. These are your Course Outcomes (COs) : focused, subject-specific learning targets. One is skilled in structural detailing,

But the bridge as a whole must meet broader goals:

- ◆ Can it handle the expected traffic load?
- ◆ Is it safe, durable, and sustainable?
- ◆ Does it serve its purpose for the community?

These are your Program Outcomes (POs): broad engineering abilities you are expected to achieve by the time you graduate.

So in simple terms:

- COs are like segments of the bridge – each one must be designed and executed well.
- POs are like the final bridge performance – all spans working together to ensure safe, smooth passage.

If even one span fails, the whole bridge is compromised. Similarly, if COs are not achieved, POs will not be met – your education won't be structurally sound.



What is CO-PO Mapping?

Imagine you're working on a structural drawing, and it's time to prepare the bar bending schedule (BBS).

Every bar in your drawing has a specific role : a stirrup for shear, a main bar for tension, and must be correctly mapped to its function in the structure.

Similarly, in OBE:

- Each Course Outcome (CO) is like a reinforcement bar : it has a specific purpose
- Each Program Outcome (PO) is like the structural element : beam, column, slab – that needs the right bar

CO-PO mapping ensures that:

- Every topic you study contributes to a bigger graduate-level skill
- Nothing is taught or assessed without a clear purpose

Just like incorrect bar placement weakens a structure, poor CO-PO mapping weakens the learning structure. We might be teaching, but not building what the profession actually needs.



How is attainment measured in Outcome-Based Education (OBE)?

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magine you're testing a concrete cube in the lab.

You've designed it to reach 30 MPa strength. After 28 days, you test the cube:

- If it reaches 30 MPa or more → Full attainment
- If it reaches 25 MPa → Partial attainment
- If it's below 20 MPa → Low or no attainment

In OBE, we do something similar — but instead of concrete strength, we're checking how well students have achieved the Course Outcomes (COs).

- Direct assessment: Marks from tests, projects, labs
- Indirect assessment: Student feedback, employer surveys, exit polls

These are compared to a target benchmark (e.g., 60% of students achieving 60% marks).

Just as poor cube strength signals a problem with the mix or curing, low attainment points to gaps in teaching, learning, or assessment — and helps us improve the mix next time!



What is an Attainment Gap, and how do we close it?

Suppose you're supervising the casting of a PCC pavement, and your design specifies a thickness of 150 mm.

After casting, you take core samples and find:

- Some areas are 150 mm : OK
- Some are 130 mm : Deficiency
- Some are just 100 mm: Critical gap

This difference between what was planned and what was achieved is called the Attainment Gap.

In education, it's the difference between the target CO/PO level (say 70% students reaching 60% marks) and the actual result.

To close the gap, we take action just like on site:

- Investigate the cause (poor mix = weak teaching?)
- Strengthen the process (rebar not tied? = improve assignments/ tests)
- Redo or reinforce (recasting slab = remediation classes, tutorials)



Dear Students,

We hope this booklet helped you understand how Outcome-Based Education (OBE) works, and why it matters to your growth as an engineer.

Your participation is key.

Whether it's through honest feedback, active learning, or reflecting on your outcomes. **You are a vital part of this continuous improvement journey.**

— *Faculty Team, Department of Civil & Environmental Engineering
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