



**NETAJI SUBHASH INSTITUTE OF TECHNOLOGY, BIHTA, PATNA**  
**Affiliated to Bihar Engineering University**

Bachelor of Technology  
 Department of Civil Engineering  
 Program Outcome

**Program Outcomes- Competency- Performance Indicator**

**PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems**

Competency	Indicators
1.1 Demonstrate competence in mathematical modelling	1.1.1 Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems
	1.1.2 Apply advanced mathematical techniques to model and solve civil engineering problems
1.2 Demonstrate competence in basic sciences	1.2.1 Apply laws of natural science to an engineering problem
1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply fundamental engineering concepts to solve engineering problems
1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply civil engineering concepts to solve engineering problems

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

Competency	Indicators
2.1 Demonstrate an ability to identify and formulate complex engineering problem	2.1.1 Articulate problem statements and identify objectives
	2.1.2 Identify engineering systems, variables, and parameters to solve the problems
	2.1.3 Identify the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1 Reframe complex problems into interconnected sub-problems
	2.2.2 Identify, assemble and evaluate information and resources.
	2.2.3 Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions
	2.2.4 Compare and contrast alternative solution processes to select the best process.
2.3 Demonstrate an ability to formulate and interpret a model	2.3.1 Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy
	2.3.2 Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required
2.4 Demonstrate an ability to execute a solution process and analyze results	2.4.1 Apply engineering mathematics and computations to solve mathematical models
	2.4.2 Produce and validate results through skilful use of contemporary engineering tools and models
	2.4.3 Identify sources of error in the solution process, and limitations of the solution
	2.4.4 Extract desired understanding and conclusions consistent with objectives and limitations of the analysis

**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 public health and safety, and cultural, societal, and environmental considerations.**

Competency	Indicators
3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.1.1 Recognize that need analysis is key to good problem definition
	3.1.2 Elicit and document, engineering requirements from stakeholders
	3.1.3 Synthesize engineering requirements from a review of the state-of-the-art
	3.1.4 Extract engineering requirements from relevant engineering Codes and Standards such as ASME, ASTM, BIS, ISO and ASHRAE.
	3.1.5 Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societal issues
	3.1.6 Determine design objectives, functional requirements and arrive at specifications
	3.2.1 Apply formal idea generation tools to develop multiple engineering design solutions

3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.2 Build models/prototypes to develop a diverse set of design solutions
	3.2.3 Identify suitable criteria for the evaluation of alternate design solutions
3.3 Demonstrate an ability to select an optimal design scheme for further development	3.3.1 Apply formal decision-making tools to select optimal engineering design solutions for further development
	3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.4 Demonstrate an ability to advance an engineering design to defined end state	3.4.1 Refine a conceptual design into a detailed design within the existing constraints (of the resources)
	3.4.2 Generate information through appropriate tests to improve or revise the design
<b>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.</b>	
Competency	Indicators
4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1 Define a problem, its scope and importance for purposes of investigation
	4.1.2 Examine the relevant methods, tools and techniques of experiment design, system calibration, data acquisition, analysis and presentation
	4.1.3 Apply appropriate instrumentation and/or software tools to make measurements of physical quantities
	4.1.4 Establish a relationship between measured data and underlying physical principles
4.2 Demonstrate an ability to design experiments to solve open-ended problems	4.2.1 Design and develop an experimental approach, specify appropriate equipment and procedures
	4.2.2 Understand the importance of the statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
4.3 Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1 Use appropriate procedures, tools and techniques to conduct experiments and collect data
	4.3.2 Analyze data for trends and correlations, stating possible errors and limitations
	4.3.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions
	4.3.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions
<b>PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.</b>	
Competency	Indicators
5.1 Demonstrate an ability to identify/ create modern engineering tools, techniques and resources	5.1.1 Identify modern engineering tools such as computer-aided drafting, modeling and analysis; techniques and resources for engineering activities
	5.1.2 Create/adapt/modify/extend tools and techniques to solve engineering problems
5.2 Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.2.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
	5.2.2 Demonstrate proficiency in using discipline-specific tools
5.3 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1 Discuss limitations and validate tools, techniques and resources
	5.3.2 Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.
<b>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.</b>	
Competency	Indicators
6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level
	6.2.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public
<b>PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.</b>	
Competency	Indicators
7.1 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1 Identify risks/impacts in the life-cycle of an engineering product or activity
	7.1.2 Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability
7.2 Demonstrate an ability to apply principles of sustainable design and development	7.2.1 Describe management techniques for sustainable development
	7.2.2 Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline

<b>PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice</b>	
Competency	Indicators
8.1 Demonstrate an ability to recognize ethical dilemmas	8.1.1 Identify situations of unethical professional conduct and propose ethical alternatives
8.2 Demonstrate an ability to apply the Code of Ethics	8.2.1 Identify tenets of the ASME professional code of ethics
	8.2.2 Examine and apply moral & ethical principles to known case studies
<b>PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</b>	
Competency	Indicators
9.1 Demonstrate an ability to form a team and define a role for each member	9.1.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
	9.1.2 Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal
9.2 Demonstrate effective individual and team operations--communication, problem solving, conflict resolution and leadership skills	9.2.1 Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
	9.2.2 Treat other team members respectfully
	9.2.3 Listen to other members
	9.2.4 Maintain composure in difficult situations
9.3 Demonstrate success in a team-based project	9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts
<b>PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the 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</b>	
Competency	Indicators
10.1 Demonstrate an ability to comprehend technical literature and document project work	10.1.1 Read, understand and interpret technical and non-technical information
	10.1.2 Produce clear, well-constructed, and well-supported written engineering documents
	10.1.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2 Demonstrate competence in listening, speaking, and presentation	10.2.1 Listen to and comprehend information, instructions, and viewpoints of others
	10.2.2 Deliver effective oral presentations to technical and non-technical audiences
10.3 Demonstrate the ability to integrate different modes of communication	10.3.1 Create engineering-standard figures, reports and drawings to complement writing and presentations
	10.3.2 Use a variety of media effectively to convey a message in a document or a presentation
<b>PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.</b>	
Competency	Indicators
11.1 Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1 Describe various economic and financial costs/benefits of an engineering activity
	11.1.2 Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.2 Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.1 Analyze and select the most appropriate proposal based on economic and financial considerations.
11.3 Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1 Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.
	11.3.2 Use project management tools to schedule an engineering project, so it is completed on time and on budget
<b>PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change</b>	
Competency	Indicators
12.1 Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1 Describe the rationale for the requirement for continuing professional development
	12.1.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.2 Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current
	12.2.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field

12.3 Demonstrate an ability to identify and access sources for new information

12.3.1 Source and comprehend technical literature and other credible sources of information

12.3.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc