

**INTEGRAL UNIVERSITY**  
**DEPARTMENT OF CIVIL ENGINEERING**

**PROGRAMME: Ph.D.**

**PROGRAM SPECIFIC OUTCOMES (PSO):**

- PSO-1:** In depth understanding in the area of specialization so as to conceptualize and implement research for real problems.
- PSO-2:** Developing the ability to make acceptable judgments on complex issues in the specialized fields and produce original research work.
- PSO-3:** Capable of contributing to the development of academic and professional skills, techniques, tools, innovative ideas and approaches.
- PSO-4:** Acquire position at top level in industry and research institute.

**PROGRAM EDUCATIONAL OBJECTIVES (PEO):**

- PEO-1:** The main goal of the PhD program is to develop researchers who are well-equipped to undertake research challenges of the future for the benefit of the society. As it is almost impossible to claim that someone has become a researcher without a properly documented record of actual research, an important objective of the PhD program is to extend knowledge about some topic – this knowledge is generated by the PhD scholar with guidance of his/her supervisor.
- PEO-2:** Overall educational objective is to train future scientists who have the capacity to integrate information from multiple domains and competencies and conduct research that can be applied for the improvement of human kind.
- PEO-3:** To create an environment that encourages the student's originality and creativity in their research.
- PEO-4:** To inculcate the skills amongst the research scholars to enable the student to critically examine the background literature relevant to their specific research area.
- PEO-5:** Giving an opportunity to develop skills in making and testing hypotheses, in developing new theories, and in planning and conducting experiments.
- PEO-6:** To give an opportunity to expand the student's knowledge of their research area, including its theoretical foundations and the specific techniques used to study it.
- PEO-7:** Creating an environment where the research scholar learns to develop skills in written work, oral presentation and publishing the results of their research in high-profile refereed journals, through constructive feedback of written work and oral presentations..

**PROGRAM OUTCOMES (PO):**

- PO1- Research and Discipline specific knowledge:** At the end of their PhD course, scholars should have a thorough knowledge of the literature and a comprehensive understanding of scientific methods and techniques applicable to their own research.
- PO2- Problem analysis:** Identifying the overriding problem and establishing the causes and effects related to that problem.
- PO3- Ethics:** Practice and adhere to ethical principles in professional and personal aspects and strive to spread these virtues in the society.
- PO4- Critical Thinking:** Scholar should be able to identify and assess problems and find appropriate long term solutions to them.
- PO5- Design, development of solutions:** On completion of the programme, research students should be able to demonstrate a thorough knowledge of the literature and a comprehensive understanding of methods and techniques applicable to their own research.
- PO6- Self Directed and Life-long learning:** Scholar should be open to adapt to new rules, techniques, procedure as and when required and should be keen to learning.
- PO7- Social Interaction:** Social interaction is important because it enables scholars to enhance their communication skills which in turn help them to deal with various parties during his /her research. The social interaction helps to improve the communication skills of students by enabling them to become good listeners.
- PO8- Effective Communication:** Should be able to speak, write, read and listen clearly in person and through electronic media.
- PO9- Environment and Sustainability:** Understand the outcomes of materials and techniques used in research and minimize its negative impact on environment.
- PO10- Effective Citizenship:** Contribute to the society and human kind through his /her innovative research.

**COURSE: PRINCIPLES OF MEASUREMENTS: ENVIRONMENTAL POLLUTION AND TREATMENT**  
**COURSE CODE: CE705**

**COURSE OBJECTIVES:**

- To impart knowledge of water and waste water quality assessment.
- To impart knowledge of water and waste water treatment from industry.
- To develop the knowledge of indicator organism and different type of bacteria & their growth process.
- To develop knowledge of Air pollution engineering.
- To develop knowledge of municipal solid waste management and vermiculture.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to explain about the physical, chemical and biological characteristics of water and waste water and asses drinking water quality parameter according to IS 10500:2012.
CO2	Learner will be able to design waste water treatment plant for different type of industry.
CO3	Learner will be able to explain the role of PH in growth of microorganism and its effect on chlorination process.
CO4	Learner will be able to explain about air pollution and its causes, consequences, control method of particular & gaseous pollutants.
CO5	Learner will be able to design a best municipal solid waste design system for a township and also can well explain about various capacity.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Learner will be able to explain about the physical, chemical and biological characteristics of water and waste water and asses drinking water quality parameter according to IS 10500:2012.	3	3	2	2	3	1	1	1	2	2
CO2	Learner will be able to design waste water treatment plant for different type of industry.	3	2	3	2	3	2	1	2	2	2
CO3	Learner will be able to explain the role of PH in growth of microorganism and its effect on chlorination process.	3	2	3	2	3	2	1	1	2	1
CO4	Learner will be able to explain about air pollution and its causes, consequences, control method of particular & gaseous pollutants.	3	3	2	3	2	2	2	1	2	2
CO5	Learner will be able to design a best municipal solid waste design system for a township and also can well explain about various capacity.	3	2	2	2	2	2	2	2	2	2

**COURSE: ADVANCED TRANSPORTATION SYSTEM ANALYSIS AND PLANNING**  
**COURSE CODE: CE706**

**COURSE OBJECTIVES:**

- Familiarize with the Transportation Systems and how Transportation planning process is carried out.
- Study the methodologies to conduct various transportation surveys for the purpose of accomplishing PhD research.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to <b>understand</b> Transportation Systems and factors influencing transportation planning. They will also be able to understand basic speed flow relationships.
CO2	Learner can understand hierarchy of road system in India and factors affecting the capacity and level of service. The student will develop the <b>ability to organize</b> the collection of primary data by using appropriate sampling techniques.
CO3	Learner will be familiarized with methods to collect data through various traffic surveys. <b>Organize and execute</b> it for conducting traffic studies.
CO4	Learner will develop an understanding of transport planning process and develop the <b>ability to perform</b> an economic <b>evaluation</b> of transport plans.
CO5	Learner will develop an understanding of designing various transport infrastructure like parking facilities, pedestrian facilities, cycle tracks, bus facilities as per IRC Standards and <b>analyzing</b> it for implementation. He will also be able to analyze how various Public Transportation systems are <b>planned/designed</b> .

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Learner will be able to <b>understand</b> Transportation Systems and factors influencing transportation planning. They will also be able to understand basic speed flow relationships.	1	2	0	0	1	2	0	0	1	2
CO2	Learner can understand hierarchy of road system in India and factors affecting the capacity and level of service. The student will develop the <b>ability to organize</b> the collection of primary data by using appropriate sampling techniques.	1	2	0	0	1	2	1	1	1	1
CO3	Learner will be familiarized with methods to collect data through various traffic surveys. <b>Organize and execute</b> it for conducting traffic studies.	0	2	2	0	0	0	2	1	1	2
CO4	Learner will develop an understanding of transport planning process and develop the <b>ability to perform</b> an economic <b>evaluation</b> of transport plans.	1	2	0	2	2	0	1	1	2	1
CO5	Learner will develop an understanding of designing various transport infrastructure like parking facilities, pedestrian facilities, cycle tracks, bus facilities as per IRC Standards and <b>analyzing</b> it for implementation. He will also be able to analyze how various Public Transportation systems are <b>planned/designed</b> .	2	1	2	1	2	2	1	1	1	2

**COURSE: DYNAMIC & NON LINEAR ANALYSIS OF STRUCTURES****COURSE CODE: CE707****COURSE OBJECTIVES:**

- To make learner understand the concept of structural dynamics and non linear analysis of structures
- To develop better understanding on several aspects of dynamic analysis and the nonlinear response of structures.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Learner is familiarized with structural idealization for dynamic analysis.
<b>CO2</b>	Learner will study free and forced vibrations of single degree of freedom system (SDOF) and would be able to determine the response of a SDOF for different dynamic loads.
<b>CO3</b>	Learner will be able to determine the response of multi degree of freedom system (MDOF) subjected to free vibration.
<b>CO4</b>	Learner will be to determine the response of free and forced vibrations of continuous system.
<b>CO5</b>	Learner will be able to do nonlinear static and dynamic analysis of structures and determine response of structures.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	Learner is familiarized with structural idealization for dynamic analysis.	3	2	1	2	2	1	-	-	-	-
<b>CO2</b>	Learner will study free and forced vibrations of single degree of freedom system (SDOF) and would be able to determine the response of a SDOF for different dynamic loads.	3	2	1	3	2	1	-	-	-	-
<b>CO3</b>	Learner will be able to determine the response of multi degree of freedom system (MDOF) subjected to free vibration.	2	3	1	2	2	2	-	-	-	-
<b>CO4</b>	Learner will be to determine the response of free and forced vibrations of continuous system.	2	3	1	2	2	2	-	-	-	-
<b>CO5</b>	Learner will be able to do nonlinear static and dynamic analysis of structures and determine response of structures.	3	2	1	2	2	1	-	-	-	-

**COURSE: ADVANCED CONCRETE AND SUSTAINABILITY**  
**COURSE CODE: CE708**

**COURSE OBJECTIVES:**

- To impart advanced knowledge of concrete technology.
- To develop better understanding on several aspects of concrete technology and the latest developments in the field keeping in view the sustainability aspect.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Learner is familiarized with materials used in concrete and their effect on the properties of concrete
<b>CO2</b>	Learner will study various methods used for proportioning concrete mixtures, role of mineral admixtures and properties of hardened concrete
<b>CO3</b>	Learner will be able to design concrete mix as per IS:10262
<b>CO4</b>	Learner will be made aware about various durability aspects for concrete
<b>CO5</b>	Learner is familiarized with various special concretes that are also sustainable

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	Learner is familiarized with materials used in concrete and their effect on the properties of concrete	3	1	1	1	2	2	-	-	2	1
<b>CO2</b>	Learner will study various methods used for proportioning concrete mixtures, role of mineral admixtures and properties of hardened concrete	2	1	1	2	2	2	-	-	2	1
<b>CO3</b>	Learner will be able to design concrete mix as per IS:10262	2	2	2	2	3	2	-	-	2	1
<b>CO4</b>	Learner will be made aware about various durability aspects for concrete	2	3	2	2	3	2	2	-	2	1
<b>CO5</b>	Learner is familiarized with various special concretes that are also sustainable	2	2	1	2	2	2	1	-	2	1