

Scheme and Syllabus



Course work for PhD

Department of Civil Engineering

School Engineering

Session- 2018 onwards

**Approved scheme of teaching, examination and syllabus for Course work in PhD
(Department of Civil Engineering) by the members of Board of Studies**

Applicable from session 2018-2022

The scheme of teaching, examination and syllabus are hereby approved by the following members of Board of Studies

OP JINDAL UNIVERSITY

OP Jindal Knowledge Park, Punjipatra, Raigarh-496109

Department of Civil Engineering, School of Engineering

V.C. Nominee (External Experts)	
<p style="text-align: center;">Dr. L. K. Yadu Professor, Department of Civil Engineering, NIT, Raipur</p>	
Internal Experts:	
<p style="text-align: center;">Dr. Ashok Shrivastava Professor-Metallurgical Engineering</p>	<p style="text-align: center;">Dr. S. S. Chakrabarti Professor-Mechanical Engineering</p>
<p style="text-align: center;">Dr. Mahaskti Mahamaya Assitant Professor- Civil Engineering</p>	
<p style="text-align: center;">Dr. P.S. Bokare HOD Civil and Dean SOE</p>	

Syllabus of Course Work for Doctor of Philosophy [Ph. D.] in Civil Engineering

The Ph.D. course work shall involve three papers and a seminar project. These three papers are:

1. Research Methodology,
2. Elective I
3. Elective II

Apart from these courses, there will be a seminar project.

STANDARD OF PASSING:

As prescribed under rules & Regulation for each degree/ programme

Programme Outcomes for Engineering Doctoral Programme

PO_1: Disciplinary knowledge and problem solving: Accomplish in-depth knowledge of a specific domain and apply it to identify, analyze and address the related research problems.

PO_2: Scientific Reasoning and analytical approach: Apply theories, methodologies, knowledge, critical thinking and; inductive and deductive reasoning to design and drive research projects with appropriate hypothesis, experimental design, simulation, survey, case studies etc.

PO_3: Communication and digital skills: Instill oral, written communication skills and life-long digital learning to prepare grant proposals; and publish and present their work.

PO_4: Moral and Ethics: Imbibe moral/ ethical values for research, publications, and patents etc.

PO_5: Project management and finance: Develop and apply knowledge of engineering, finance, and management principles throughout the R&D projects.

PO_6: Leadership Readiness: Interact with people from diverse backgrounds as both leaders/mentors and team members with integrity and professionalism.

Programme Specific Outcome (PSO) for Engineering Doctoral Programme

PSO_1: Develop a deep understanding of at least one core area of civil engineering.

PSO_2: Ability to think critically and creatively in defining research questions and to outline strategies of inquiry.

PSO_3: Ability to communicate research results to scientific audience in conferences & Ability to work collaboratively with other peers.

PSO_4: Ensure the holistic growth through the awareness of effective communication, ethical responsibilities and physical/mental fitness.

Examination Scheme for Ph. D. Course Work in Civil Engineering

Sl. No	Subject Code	Name of Subject	Credit	Examination Scheme				
				Theory		Seminars		TOTAL MARKS
				PRE	ESE	PRE	ESE	
1	SOE-P-CE101	Research Methodology	5	50	50	-----	----	100
2	SOE-P-CE102(1-2)	Elective I	5	50	50	-----	----	100
3	SOE-P-CE103(1-2)	Elective II	5	50	50	-----	----	100
4	SOE-P-CE104	Seminar Presentation	5	-----	-----	50	50	100
		TOTAL	20	150	150	50	50	400

SCHEME OF EXAMINATION:

The examination shall be conducted at the end of coursework. The Theory paper shall carry 100 Marks. The evaluation of the performance of the students in theory papers shall be based on the End Semester Examination of 100 Marks. Question Paper will be set in the view of the / following the entire syllabus and preferably covering each unit of syllabi in the unit pattern.

STANDARD OF PASSING:

As prescribed under Rules & Regulation for each degree/ programme.

Sl No.	Subject code	Name of Subject
1	SOE-P-CE101	Research Methodology
2	SOE-P-CE104	Seminar Presentation
Elective - I		
3	SOE-P-CE101(1)	Material Characterization
4	SOE-P-CE101(2)	Soil Structure Interaction
Elective - II		
5	SOE-P-CE102(1)	Modern Construction Materials and Methods
6	SOE-P-CE102(2)	Sustainable Engineering.

Programme:	PhD	Semester :	I
Name of the Course:	Research Methodology	Course Code:	SOE-P-CE101
Credits :	5	No of Hours :	45
Max Marks:	100		

Course Description:

The Research Methodology provides theoretical and practical knowledge and also the applied skills for research design and related methods and mixed-method research domains.

Course Objective:

1. How research papers are written;
2. How to read such papers critically and efficiently;
3. How to summarize and review them;
4. How to gain an understanding of a new field, in the absence of a textbook;
5. How to judge the value of different contributions;
6. How to identify promising new directions.

Syllabus:

UNIT - I

Meaning and significance of the research; Importance of scientific research in decision making; Types of research and research process; Identification of research problem and formulation of hypothesis.

UNIT - II

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

UNIT - III

Qualitative and Quantitative Research, Measurement: Concept of measurement, Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal.

UNIT - IV

Factor analysis, Multiple Regressions Analysis. Discriminant Analysis, Use of SPS Package, IPR issues. Factor analysis, Multiple Regressions Analysis. Discriminant Analysis, Use of SPS Package, IPR issues.

UNIT - V

Research Report, Types and significance, Structure of research report, Ethical issues in research, Presentation of report. Interpretation of Data and Paper Writing, Journal selection, Impact factor of Journals. Plagiarism and Self-Plagiarism, Software for detection of Plagiarism.

Resources:

Name of Text and Reference Books:

1. Business Research Methods– Donald Cooper & Pamela Schindler, TMGH, 9th ed.
2. Business Research Methods– Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R. Kothari.
4. Research Methodology, Chawla and Sondhi, Vikas Publication
5. Research Methodology, Paneersevam, PHI

Course Outcome:

Students' candidates will be able to:

C01	Identify a research topic in an appropriate scholarly manner.
C02	Place a working hypothesis into a real context.
C03	Use appropriate tools for data collection and analysis.
C04	Match the research method to the research question.
C05	Write up research projects using scholarly norms.
C06	Communicate efficiently and consistently the outcomes of the research before an audience.
C07	Critically review a research paper.
C08	Manage deadlines in the crafting of a research paper.

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CO-PO & PSO Correlation:

Course Name: Research Methodology									
Course Outcomes	Program Outcomes					PSOs			
	1	2	3	4	5	1	2	3	4
C01	1	2				1			1
C02			1				1		
C03		2					2		
C04		3	1						1
C05				1				2	
C06					1			2	
C07				1				1	
C08				1				1	

Note: 1: Low 2.: Moderate 3.: High

Programme:	PhD	Semester :	I
Name of the Course:	Seminar Presentation	Course Code:	SOE-P-CE104
Credits :	5	No of Hours :	45
Max Marks:	100		

Course Description:

This subject has related to the techniques of scientific study and understanding of related research mobility and how to express in a scientific framework. The seminar has its importance in a career of a student to improve the logical communicative skills and confidence.

Objectives:

1. To set out the chosen research methods, including their theoretical basis, and the literature survey;
2. The experimental methods to be performed to reach a logical conceptual conclusion;
3. Aim to test the research methods opted and find the conceptual understanding.

Course Outcomes:

Students will be able to

CO 1	Understand the research methods, interpretation approach and problem-solving skills.
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CO-PO & PSO Correlation:

Course Name: Project Report Writing & Seminar									
	Program Outcomes					PSOs			
Course Outcomes	1	2	3	4	5	1	2	3	4
CO 1	1		3	2		2			

Note: 1: Low 2.: Moderate 3.: High

The scholars will present seminar papers using these tools/concepts.

1. Review of Literature and its Analysis 25 Marks;
2. Research Methodology with reference to the concerned subject, 25 Marks;
3. Report writing 25 marks;
4. References and citation 25 marks.

Programme:	PhD	Semester :	I
Name of the Course:	Material Characterization	Course Code:	SOE-PhD-CE101
Credits :	3	No of Hours :	45
Max Marks:	100		

Course Description: The course on Introduction to Composite materials, its advantages and applications, functional requirement of reinforcement and matrix, effect of reinforcement. Manufacturing of composites.

Course Outcomes:

Students will be able:

CO 1	To understand the fundamentals of material.
CO 2	To understand characterization of material.
CO 3	To understand testing of materials.
CO 4	To understand the particle size, EDX, SEM, XRD .

Syllabus

UNIT- I

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT- II

Characterization techniques for nanomaterials: Introduction, Physical and Chemical Characterization, Characterization of the industrial waste materials
Lab test for characterization like Scanning electron microscope (SEM), EDX, Chemical analysis using SEM, EDS/WDS working principle, construction, spot

UNIT- III

Characterization techniques for nanomaterials II: analysis, line scan and area scan, resolution of EDS/WDS detector, advantages/disadvantages, calibration of EDS/WDS, qualitative and quantitative analysis. X-ray diffraction – Generation of X-rays, characteristic X-ray spectrum, Bragg's Law

UNIT- IV

Characterization for materials selection and design case studies.
Characterization of composites - structural, thermal, mechanical, physical, chemical and environmental.

UNIT- V

Introduction- Classification-General Characteristics-Structure & Properties of Materials-Relevance – Crystal/Molecular Structure Imperfections-Phase Diagrams.

Text Books:

1. Handbook of Materials Behaviour Models, Vol.3- Multiphase Behaviour
2. Composites Material Science and Technology – Vol 13 –by R.W.Cahn – VCH, West Germany.
3. An introduction Materials Science and Engineering, WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W.Tasi.

Assessment:

Assessment includes attendance, class work, tutorials, assignments, quizzes, exams.

CO-PO & PSO Correlation

Course Name: Material Characterization									
Course Outcomes	Program Outcome (PO)					Program Specific Outcome (PSO)			
	1	2	3	4	5	1	2	3	4
CO 1	2	0	1	1	0	3	2	2	3
CO 2	3	1	3	2	1	3	2	1	1
CO 3	2	0	2	3	2	2	2	3	1
CO 4	3	2	3	3	2	1	3	1	2

Note: 1: Low 2: Moderate 3: High

Programme:	PhD	Semester :	I Sem
Name of the Course:	Soil Structure Interaction	Course Code:	SOE-PhD-CE102
Credits :	4	No of Hours :	60
Max Marks:	100		

Course Description: This course is meant primarily for senior undergraduate and post-graduate students in Civil. Major topics covered are: Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction. Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method. Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

Course Outcomes

students will be able to

CO1	Understand soil structure interaction concept and complexities involved.
CO2	Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.
CO3	Prepare comprehensive design-oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.

Syllabus

Unit I:

Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction. Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.

Unit II:

Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.

Unit III:

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.

Unit IV:

Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

Unit V:

Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and termination of Pull-out Resistance

Text Books:

1. Analytical and Computer Methods in Foundation- Bowels J.E., ,McGraw Hill Book Co., New York, 1974.
2. Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.
3. Soil Structure Interaction - The real behavior of structures, Institution of Structural Engineers.
4. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.

Reference Books:

1. Elastic Analysis of Soil-Foundation Interaction, Selvadurai A.P.S., Elsevier Scientific Publishing Company.
2. Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.

CO-PO&PSO Correlation

Course Name: Soil Structure Interaction									
	Program Outcomes					PSOs			
Course Outcomes	1	2	3	4	5	1	2	3	4
CO1	3	2			2	1	2	2	2
CO2	2	0			2		2	2	2
CO3	3	3			3	3		2	2

Note: 1: Low 2.: Moderate 3: High

Programme:	B.Tech.	Semester :	I
Name of the Course:	Modern Construction Materials and Methods	Course Code:	
Credits :	5	No of Hours :	45
Max Marks:	100		

Course Description:

This course gives Introduction about various properties of modern construction materials and methods.

Course Outcomes:

Students will be able to:

CO1	To know the importance and areas of application of modern construction materials and methods.
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Syllabus:

UNIT I

Concretes: High strength and High-performance concrete-Fiber Reinforced concrete. Composites: Plastics-Reinforced polymers-FRP-Cellular cores.

UNIT II

Other Materials: Water proofing compounds-Non -weathering Materials-Flooring and Facade Materials.

UNIT III

Smart and Intelligent Materials: Brief outline and uses.

UNIT IV

Sub-structure Construction Techniques Box jacking -Pipe Jacking-Under Water Construction of diaphragm walls and basement caisson-sinking cofferdam-cable anchoring and grouting-driving diaphragm walls, sheet piles-laying operations for built up offshore system-shoring for deep cutting-Large reservoir, well points Dewatering and stand by Plant equipment for underground open excavation

UNIT V

Super Structure Construction Vacuum Dewatering of concrete flooring-Concrete paving technology-Techniques of construction for continuous concreting operation in Tall buildings of various shapes and Varying sections-Launching Techniques-Suspended from work-erection techniques of tall structures, Large span structures-Launching techniques for heavy decks in situ prestressing in high rise structures.

Text Books:

1. Civil Engineering Materials (2nd Edititon) – Shan Somayaji (Prentice Hall Inc., 2001)
2. Materials for Civil and Construction Engineers – Mamlouk, M.S. and Zaniewski, J.P. (Prentice Hall Inc., 1999)

Reference Books:

1. Materials for Civil and Highway Engineers (4th Edition)–Derucher,K.Korfiatis. G. and Ezeldin, S. (Prentice Hall Inc., 1999).
2. High Performance Concrete – Aitkens (McGraw Hill, 1999)

Assessment:

Assessment can vary from course to course and can include a combination of class work, tutorials, assignments, laboratory work, quizzes, surprise test, online test, project work and exams.

PO-CO-PSO mapping:

	Course name: Modern Construction Materials and Methods											
	Program outcome								PSOs			
Course Outcomes	1	2	3	4	5	6	7	8	1	2	3	4
CO 1	2	1	0	1	1	1	2	1	1	0	1	1

Note: 1: Low 2.: Moderate 3: High

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AND MANAGEMENT

Programme:	PhD	Semester:	I
Name of the Course:	Sustainable Engineering	Course Code:	SOE-P-CE102(2)
Credits:	3	No of Hours:	45
Max Marks:	100		

Course Description:

The course aims at the principles of sustainability, sustainability metrics and tools, and best engineering practices to achieve sustainability. Apply the tools to assess and/or design various sustainable engineering applications, with special focus on civil and environmental engineering materials and systems.

Course Outcomes:

Students will be able:

CO 1	Need of sustainability. Concept of Sustainable Engineering.
CO 2	To know the metrics and tools for measurement of sustainability.
CO 3	Application of the sustainability concept and its application to Engineering projects.
CO 4	Get acquainted with the tools and metrics of sustainability in a project and its applications.
CO5	Confidence in using the sustainable engineering.

Syllabus

UNIT-I

Emerging challenges, sustainability, and sustainable engineering: Environmental concerns, Social and economic issues. Availability and depletion of natural resources, Disaster resiliency.

UNIT-II

Sustainability metrics and assessment tools:

Material flow analysis and material budget, Carbon footprint analysis, Life cycle assessment, Economic input output-life cycle analysis.

UNIT-III

Sustainable Engineering Practices:

Sustainable waste management, Green and sustainable buildings and infrastructure, Sustainable civil infrastructure, Sustainable remediation of contaminated sites.

UNIT-IV

Sustainable Engineering Applications:

Environmental engineering projects, Materials engineering projects, Infrastructure engineering projects.

UNIT-V

Recent developments and Case studies.

Text Books:

1. Reddy, K.R., Cameselle, C., and Adams, J.A., Sustainable Engineering: Drivers, Metrics, Tools, and Applications, John Wiley & Sons, Inc., Hoboken, New Jersey, 2019, 544p (ISBN: 978-1-119-49393- 8).

Reference Books:

1. Graedel, T.E., and Allenby, B.R., Industrial Ecology and Sustainable Engineering, Prentice Hall, New Jersey, 2010.
2. Theis, T., and Tomkin, J. (Editors) (2015). Sustainability: A Comprehensive Foundation, Open-Source E-Text, University of Illinois.

CO-PO & PSO Correlation

	Course Name: Sustainable Engineering.									
	Program Outcome (PO)						Program Specific Outcome (PSO)			
Course Outcomes	1	2	3	4	5	6	1	2	3	4
CO 1	3	2	1	2	2	2	2	2	1	1
CO 2	1	1	1	1	1	1	3	2	1	1
CO 3	3	0	1	3	2	2	3	3	2	3
CO 4	1	2	2	1	2	1	3	2	1	2
CO 5	3	2	3	3	2	3	3	2	1	3

Note: 1: Low 2: Moderate 3: High