



**UTTARANCHAL  
UNIVERSITY**

# **UTTARANCHALUNIVERSITY**

ArcadiaGrant,P.O.Chandanwari, Premnagar,Dehradun, Uttarakhand-  
248007,INDIA

## **Detailed Course Structure & Syllabus of Pre Ph.D. (Civil Engineering) Course Work (As per CBCS system) W.E.F Session 2022-23**



**Course Structure of the Pre-Ph.D (Civil Engineering) Course Work:  
Applicable for Batch: 2022-23**

**SCHEME OF EXAMINATION**

**Ph.D(Civil Engineering)  
(Effective from Academic Year 2022-23)**

**Under Choice Based Credit System (CBCS)**

## Course Structure of the Pre-Ph.D (Civil Engineering) Course Work:

Applicable for Batch: 2022-23

### Scheme of Pre-Ph.D. Course Work

S.No	Course Code	Subject	Credits	Evaluation - Scheme							
				Period			Sessional			Examination	
				L	T	P	CT- I	CT- II	Total	ESE	Sub. Total
<b>Courses</b>											
1.	RM-101	Research Methodology	4	4	0	0	20	20	40	60	100
2.	RM-102	Computer & Stats Application in Research	2	2	0	0	20	20	40	60	100
3.	RPE-103	Research & Publication Ethics	2	2	0	0	20	20	40	60	100
4.	DSE-104	Discipline Specific Electives	3	3	0	0	20	20	40	60	100
5.	RS-105	Seminar Presentation	2	0	0	4	20	20	40	60	100
		<b>Total</b>	<b>13</b>	<b>11</b>	<b>0</b>	<b>4</b>	<b>100</b>	<b>100</b>	<b>200</b>	<b>300</b>	<b>500</b>

### List of Electives

S. No.	Course Code	Course Name
1	IHOT-104	Industrial Internet of Things
2	CE-104(1)	Advanced Concrete Technology
3	CE-104(2)	Advanced Water and Wastewater Treatment



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## **SYLLABUS**

**of**

**Ph.D(Civil Engineering)**



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Programme Name	<b>Pre-Ph.D. Course Work</b>	Programme Code	23-
Course Code	RM-101	Credit	4
Year/Sem	1/1	L-T-P	4-0-0
Course Name	Research Methodology		

### Objectives of the Course:

1. To Equip the Students with the Concept and Methodology of Research.
2. To provide knowledge about type of research, preparation of reports and thesis, designing of Research using Scientific Methods.

### UNIT I (Total Topics- 7 and Hrs-12)

Introduction to Research: Definition, Nature and significance, Role and Objectives; Types of Research: exploratory, descriptive, experimental and diagnostic research, social and legal research and traditional, analytical, empirical & fundamental research, Doctrinal and non-doctrinal research methods; Various Research Designs; Scientific Research Process: Overview, Problem identification and formulation of research statement.

### UNIT II (Total Topics- 7 and Hrs- 12)

Data Collection: sources, primary and secondary methods, significance of Primary and Secondary Data, questionnaire Vs. schedules; Data Processing: Editing, Coding Organization and Presentation; Attitude Measurement and scaling: Measurement Scales, Sources of Errors in Measurement, Techniques of Developing Measurement Tools, Classification and Testing (Reliability, Verification and Validity) Scales, Designing Questionnaires and Interviews.

### UNIT- III (Total Topics- 5 and Hrs- 10)

Sampling, Sampling Methods, Sampling Plans, Sampling Error, Sampling Distributions: Theory and Design of Sample Survey, Census Vs Sample Enumerations, Objectives and Principles of Sampling, Types of Sampling, Sampling and Non-Sampling Errors, Concept of Permutation, Combination & Probability for research analysis.

### UNIT-IV (Total Topics- 5 and Hrs- 10)

Interpretations and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Steps in Report Writing, Layout of Report and Precautions in Writing Research Reports. Limitations of RM: Ethics in Research, Philosophical Issues in Research.

**CO1.** Acquire in-depth knowledge of various fundamentals, theories and principles related to the research and apply the acquired knowledge in carrying out research studies in the area of interest.

**CO2.** Identify, formulate and critically investigate research problems by applying research-oriented knowledge and analyze relevant data to reach certain conclusions in the form of alternative solutions to these problems.

**CO3.** Apply the acquired knowledge and skills to develop minds to think out of the box while carrying out research operations to conclude something.

**CO4.** Apply parametric and non-parametric statistical tests to verify the developed hypothesis to suggest innovative solutions to the problem being investigated.



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## Reference Books

1. William G. Zikmund, "Business Research Methods", Orlando: Dryden Press.
2. C. William Emory and Cooper R. Donald, "Business Research Methods", Boston, Irwin.
3. Fred N Kerlinger, "Foundations of Behavioural Research", New Delhi: Surjeet Publications.
4. Naresh Malhotra, Marketing Research : An Applied Orientation, Pearson publication David Nachmias and ChavaNachmias, "Research Methods in the Social Sciences", New York: St.Marlia's Press.
5. Bhattacharya, D. K. (2004) Research Methodology, New Delhi, Excel Books.



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Programme Name	<b>Pre-Ph.D. Course Work</b>	Programme Code	23-
Course Code	RM-102	Credit	2
Year/Sem	1/1	L-T-P	2-0-0
Course Name	Computer & Stats Application in Research		

### Objectives of the Course:

1. To appraise computational skills for research application.
2. To assess statistical method for research analysis.

### UNIT I

Characteristics of Computers, Evolution of computers, computer memory, computer generations, Basic computer organization; System software, Application software, introduction to operating system, single user, multi-user, multi-tasking single tasking, application of computer for business and research, MS-windows, Linux .Application of Internet in research : INFLIBNET, Use of Internet, sights (DOAJ), Use of E Journals, Use of E library, use of EBSCO HOST online database of Academic Libraries. Subject/field specific tools on [www.freeware.com](http://www.freeware.com)

### UNIT II

Computer Application in Research,. Basic concept of Computer, Use of Internet for Research Purpose: E-mail, WWW, Web browsing, technical skills, drawing inferences from data, Research publishing tools-MS Word, Adobe acrobat, Graphics tool-MS Excel, Presentation tool-MS Power, Data Analysis Software and Analysis Techniques point. Creating presentation and adding effects, Introduction to Data analysis software-SPSS: Definition, objectives and features, data analysis using SPSS.

### UNIT- III

Statistical methods for research application in analysis of data, Measurement in Research , data interpretation, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), std deviation, Measures of Relationship, Simple Regression Analysis, Correlation and Regression, Partial Correlation.

### UNIT-IV

Statistical Tools-Hypothesis and Hypothesis Testing: Parametric & Non-Parametric Tests, Important Parametric Tests ,Hypothesis Testing of Correlation Coefficients ,U Test, Chi Square Test, ,T-Test.Analysis of Variance (ANOVA) , The Basic Principle of ANOVA ,ANOVA Technique, Setting up Analysis of Variance Table, Short-cut Method for One-way ANOVA, Coding Method, Two-way ANOVA .

### Course Outcomes:

- CO1.** Acquire knowledge of concept of computer with application in Research.
- CO2.** Apply acquired knowledge of computer for presentation skills.
- CO3.** Acquire knowledge of statistical methods for Research.
- CO4.** Apply acquired knowledge to describe the inductive nature of quantitative data analysis.



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## Reference Books

1. C. R. Kothari, "Research Methodology: Methods and techniques", New Delhi: Vishwa Prakashan.
2. Brymann, Alan and Carmer, D. (1995) Qualitative data analysis for social scientist, New York, Routledge Publication.
3. Jain, Satish: "Introduction to Computer Science and basic Programming." BPB Publications, New Delhi, 1990. •  
Rajaraman, V., "Fundamental of Computers", Prentice Hall of India, New Delhi, 1996.





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Programme Name	<b>Pre-Ph.D. Course Work</b>	Programme Code	23-
Course Code	RPE-103	Credit	2
Year/Sem	1/1	L-T-P	2-0-0
Course Name	<b>Research &amp; Publication Ethics</b>		

## Objectives of the Course:

Its objectives to provide knowledge about ethics and code of research publication with concept of plagiarism.

### UNIT I (Total Topics- 2 and Hrs-8)

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions

### UNIT II (Total Topics- 5 and Hrs- 5)

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

### UNIT- III (Total Topics-7 and Hrs-7)

1. Publication ethics: definition, introduction and importance
2. Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

### UNIT- IV (Total Topics-4 and Hrs-4)

#### Practice

#### Open Access Publishing

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/ Journal suggestion tools viz. JANE, Elsevier Journal finder, Springer Journal Suggester, etc.

**CO1.** Recognize the basics of philosophy of science & ethics, research integrity, publication ethics and theories of research ethics.

**CO2.** Familiarize with important issues in research ethics, research integrity, scientific misconduct and misinterpretation of data.

**CO3.** Analyze the best practices for publications, publication ethics and identify the predatory publishers & journals.

**CO4.** Demonstrate & use plagiarism software tools, open-source software tools, citation databases and



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research metrics.

**CO5.** Publish credible & scholarly publications in reputed peer-reviewed journals.

## **References-**

Research and Publication Ethics, Dr Sumanta Dutta, Bharti Publications, 2021

Research and Publication Ethics, Dr Santosh kumar Yadav, Anne Publications, 2020



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Programme Name	<b>Pre-Ph.D. Course Work</b>	Programme Code	23-
Course Code	RS- 105	Credit	2
Year/Sem	1/1	L-T-P	0-0-4
Course Name	<b>Seminar Presentation</b>		

## **Objectives of the Course:**

Main objective of this course is to develop presentation skills in the scholars and knowledge about review of literature so that they can review properly for utilisation in their research work.

**Seminar** Presentation-Candidate/Research Scholar has to go through the review of literature in the concerned field of research. Review of literature guidelines will be given by the concerned faculty/Dean of Department/School/College. Research Scholar has to prepare presentation on review of literature in the concerned field/ topic assigned by the department (DRC) periodically during course work. There will be minimum 3 presentations of review of literature during pre-Ph.D. course work.

- First presentation will be required in DRC/FRC for review of literature with concerned Department focus on area of research. It will be evaluated and assessment sheet will be sent from Department to Dean Research & Studies office.
- Similarly second presentation will be required by research scholar with extension of first presentation and more number of references would be added.

Internal & end term examination marks will be as per scheme. Each presentation is to be assessed by the department as per instructions from Dean-Research & Studies.

Final presentation would be required at the time of end term/sem. examination on proposed synopsis. General guidelines would be issued by Dean-Research for seminar presentation.

## **Course outcomes**

**CO1.** Research Scholar would be able to develop & explore the review of literature in concerned area.

**CO2.** Analyze review of literature critically for finding the research gap.

**CO3.** Apply acquired knowledge in making systematic seminar presentations.

**CO4.** Apply acquired knowledge for improving development of all-round research.



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Programme Name	<b>Pre-Ph.D. Course Work</b>	Programme Code	23-
Course Code	IIOT-104	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Industrial Internet of Things		

## Objectives of the Course:

1. Its objectives to provide knowledge about Basics of IoT and its applications in different domains

## UNIT I (Total Topics- 8 and Hrs- 8)

### Introduction to Internet of Things

1. Introduction to embedded system, Challenges and design issues in embedded systems
2. Types of microcontrollers, General introduction of Arduino, NodeMCU, Raspberry Pi
3. Selection of microcontrollers
4. Definition of IoT, Components of IoT
5. Levels of IoT
6. Evolution of IoT, Challenges in IoT Design challenges
7. Introduction to Python
8. Introduction to AI & ML

## UNIT II (Total Topics- 7 and Hrs- 7 )

### Communication Protocol

1. Machine to Machine, Difference between IoT and M2M
2. Software define Network Communication Protocols : ZigBee, RFID, Wi-Fi, Bluetooth
3. LoRA, CAN, Cellular network
4. NFC, SPI protocol, I2C protocol
5. Communication with Bluetooth devices: Bluetooth standard, AT commands, Setting Bluetooth in command mode
6. Cloud platforms : Overview of cots cloud platforms
7. Cloud services business models: SaaS, PaaS, IaaS.

## UNIT- III (Total Topics- 6 and Hrs- 7 )

### Introduction to Computing Platform

1. Getting Started with Arduino : Setting up Arduino board
2. Using the Integrated Development Environment (IDE) to prepare an Arduino Sketch

3. Uploading and Running the Blink Sketch
4. Creating and saving a Sketch, Installing Arduino IDE
5. Raspberry Pi
6. Edge & Fog Devices

## **UNIT- IV** (Total Topics- 7 and Hrs- 7 )

### **Interfacing of I/O Devices**

1. Interfacing with LEDs
2. 7-segment interfacing
3. Interfacing LCD
4. Getting Input from Sensors : Detecting movement
5. Interfacing with ultrasonic sensor
6. Temperature and humidity sensor
7. Actuators : Interfacing DC motor, Controlling direction and speed of DC motor

## **UNIT- V** (Total Topics- 4 and Hrs- 8 )

### **Case Studies**

1. Energy Management 4.0- Smart Metering, Smart Grid
2. Manufacturing
3. Agriculture 4.0
4. Automotive Applications

CO-1 Understand the concepts of Internet of Things

CO-2 Analyze basic protocols in wireless network

CO-3 Implement IoT in different domains and innovation

### **Reference Books**

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", University Press, 2015
2. Raj,kamal, Internet of Things : Architecture and Design Principles, Mcgraw Hills,2017
3. Rajesh Singh, Anita Gehlot, Bhupendra Singh, Chimata, Raghuvveer Internet of Things in Automotive Industries and Road Safety. River Publishers, 2018.
4. Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushabhan Choudhury, Internet of Things Enabled Automation in Agriculture, New India Publishing Agency (NIPA)



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Programme Name	<b>Pre-Ph.D. Course Work</b>	Programme Code	23-
Course Code	<b>CE-104(1)</b>	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	<b>ADVANCED CONCRETE TECHNOLOGY</b>		

## Objectives of the Course:

1. To learn about the processing, hydration and microstructure of cements and characterizing the engineering properties of cement-based materials.
2. To gain specialized knowledge of the mechanical performance of, and how to manage, cement-based materials.
3. To recognize the construction and engineering characteristics of unique concrete mixtures such as high-performance concrete, self-consolidating concrete, fiber-reinforced concrete, sprayed concrete, etc.
4. To bridge the gap between the science of materials and structural engineering in order to better use concrete in structural concrete projects.

## UNIT I (Total Topics-12 and Hrs- 10)

Review of properties of cement, their physical and chemical properties, special purpose cements, Classification and properties of aggregates, soundness of aggregates, alkali aggregate reaction, thermal properties of aggregates, Importance of shape and Surface area and grading, gap graded and aggregates. Admixtures & construction chemicals, Use of Fly Ash, Silica Fumes, Metakaolin & GGBS in concrete.

## UNIT II (Total Topics- 10 and Hrs- 8 )

Rheological behavior of concrete, requirements of workability of concrete, Effect of environmental conditions, Strength properties of hardened concrete, Impact, Dynamic and fatigue behavior of concrete, shrinkage and creep of concrete, behaviour of concrete under fire.

## UNIT- III (Total Topics- 12 and Hrs- 10 )

Permeability and Durability of concrete, Parameters of durability of concrete, chemical attack on concrete, Production of concrete; batching mixing, transportation, placing, compaction of concrete. Special methods of concreting and curing of concrete, Hot weather and cold weather concreting, Guniting (Shotcreting).

## UNIT IV (Total Topics- 15 and Hrs- 10 )

Concrete mix design, Basic considerations and choice a mix proportions, various methods of mix designs including IS Code method. Quality control and quality assurance of concrete, Acceptance criteria, Quality management in concrete construction, Inspection and testing of concrete. Non-destructive testing of concrete, core test and load test. Prestressed concrete construction-Principle, methods, materials, Tools and equipment for the construction of a prestressed bridge.

## UNIT V (Total Topics- 15 and Hrs- 10 )

Special concrete such as high strength, Lightweight, heavy weight, vacuum processed concrete. Mass concrete, high performance concrete, Pumpable concrete, Self Compacting concrete, Air entrained concrete,



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Ferro cement, fiber reinforced concrete, Polymer impregnated concrete. Jet concrete. Deterioration and repair technology of concrete, Distress and type of repairs, crack sealing techniques. Special construction methods: Construction in Marine environments, High rise construction.

## Course Outcomes (CO)

**CO1:** Assess the importance of cement, aggregates and admixtures in concrete production.

**CO2:** Study the role of workability, strength and fatigue behavior of concrete.

**CO3:** Justify the impact of Permeability, durability and Special methods of concreting.

**CO4:** Design a concrete mix as per Indian standards.

**CO5:** Distinguish the different types of concrete like light weight concrete.

## Reference Books:

1. Neville A.M., J.J. Brook Properties of Concrete Addison Wesley 1999.
2. Gambhir M.L: Concrete Technology Tata McGraw Hill (Second Edition) 1995.  
M.S. Shetty, Concrete Technology S.Chand & Company New Delhi 2005.
3. Edward Nawy , Concrete Construction and engineering Handbook , CRC Press.
4. Orchard D.F.; Concrete Technology -Vol I. & II Applied Science Publishers (Fourth Edition) 1979.

Programme Name	<b>Pre-Ph.D. Course Work</b>	Programme Code	23-
Course Code	<b>CE-104(2)</b>	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	<b>ADVANCED WATER AND WASTEWATER TREATMENT</b>		

### Objectives of the Course:

1. To investigate various socio-technical issues related to the selection of suitable water and wastewater treatment technologies.
2. To create a requirement analysis, system design and detailed design for an advanced water and wastewater treatment system.
3. To design the membrane processes for water purification, desalination and wastewater treatment including general and specific membrane problems.
4. To apply recommendations for appropriate treatment processes for upgrading water and wastewater treatment efficiency for environmental sustainability using prototype

### UNIT I (Total Topics- 12 and Hrs- 8)

Introduction, Conventional water treatment, rapid mixing, coagulation-flocculation, sedimentation, filtration and disinfection.

### UNIT II (Total Topics- 15 and Hrs- 10 )

Natural purification of water, filtration systems for water treatment, membrane systems, microfiltration, nanofiltration, ultra filtration, reverse osmosis. Ion exchange and demineralization, adsorption, different types of adsorption, adsorption isotherms, adsorption kinetics in batch reactors, breakthrough curve and design of fixed absorber.

### UNIT- III (Total Topics- 12 and Hrs- 10 )

Disinfection and advanced oxidation processes, advanced disinfection techniques. Removal of nitrate, fluoride, iron, manganese, arsenic etc. from water. Introduction to conventional aerobic and anaerobic methods of sewage treatment.

### UNIT IV (Total Topics- 15 and Hrs- 10 )

Wastewater treatment for carbon and nitrogen removal, biological nitrification and de-nitrification, activated sludge process, design for nutrient removal, process operation, food to microorganism ratio (F/M), mean cell residence time, oxygen requirement. Biological and chemical phosphorus removal, process design and operation.

### UNIT V (Total Topics- 10 and Hrs- 10 )

Bio-membrane processes for wastewater treatment, types of membrane bioreactors, design,





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operation and maintenance. Downstream wastewater treatment for reuse and recycle, need for down stream processing, guidelines for wastewater recycling, small and package plants for water and wastewater treatment.

## Course Outcomes (CO)

**CO1:** Identify numerous socio-technical problems related to the selection of suitable technologies for handling water and wastewater.

**CO2:** Measure a criteria review for comprehensive system design for an advanced water and wastewater treatment facility,

**CO3:** Model membrane processes including general and particular membrane problems for water purification, desalination, and wastewater treatment.

**CO4:** Provide sound knowledge of recommendations for appropriate treatment processes to upgrade water and wastewater treatment efficiency for environmental sustainability using prototype.

## Reference Books:

1. "Wastewater Engineering – Treatment and Reuse", Metcalf and Eddy, Tata McGraw Hill
2. "Theory and Practice of Water and Wastewater Treatment", Droste, R.L., John Wiley.
3. "Water Treatment Processes : Simple Options", Vigneswaran, S. and Visvanathan, C.,CRC.
4. "Introduction to Environmental Engineering", Davis, M.L. and Cornwell, D.A., McGraw Hill.
5. "Environmental Engineering Science", Nazaroff, W.W. and Alvarez-Cohen, L., John Wiley.
6. "Water and Wastewater Technology", Hammer, M.J. and Hammer, M.J. Jr., PHI.