Syllabus of Pre-Ph.D. Course Work
(w.e.f. 2023)

In

Computer Science & Engineering

Department of Computer Science & Engineering

Faculty of Engineering & Technology
Gurukula Kangri (Deemed to be University),
Haridwar, Uttarakhand -249404

Batch 2023 onwards   Revised Syllabus (**w.e.f 2023**)
Gurukula Kangri (Deemed to be University), Haridwar
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Computer Science & Engineering

PROGRAM OUTCOMES

PO-1. Knowledge of the most advanced research in the candidate's specialization area of Computer Science Engineering.

PO-2. In-depth understanding of academic theory and the preparation of high-quality research pertinent to the field of study.

PO-3. Ability to select appropriate research methods and techniques suitable for the candidate's research field.

PO-4. In-depth understanding of the current state of the art in the individual research area, and the ability to appropriately employ methods and existing research results in the development of new knowledge, theories, and/or presentation of research in the individual research area.

PROGRAMME SPECIFIC OUTCOMES

PSO-1. Students would be able to know about the research and development areas in the field of Computer Science & Engineering.

PSO-2. Students would be able to analyze the effectiveness of various solutions for the problems related to research field.

PSO-3. Students would be able to develop their research aptitude and orientation.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO-1. To inculcate the knowledge required for academic writing.

PEO-2. To analyse and develop theoretical and practical foundations of research field.

PEO-3. To present new knowledge, theories, and/or presentation of research work in the form of Thesis.

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COURSE STRUCTURE

Pre Ph.D.-Coursework

DSC/ SEC/ AECC	Subject	Periods			Continuous Internal Assessment		CIA Total	ESE	Total Marks	Credits
		L	T	P	CT	TA				
THEORY										
PCE-C111	Research Methodology	4	0	0	0	0	0	100	100	4
PCE-C112	Research and Publication Ethics	2	0	0	0	0	0	100	100	2
PCE-C113	Advancements in Computer Science	4	0	0	0	0	0	100	100	4
PCE-C114	Literature Survey, Review of Research Paper and Presentation	0	0	4	50	50	100	00	100	4
	TOTAL	12	0	2	50	50	100	300	400	14

L- LECTURE;   T- TUTORIAL;   P- PRACTICAL;   CT- CUMULATIVE TEST;   TA- TEACHER ASSESSMENT;   ESE–ENDSEMESTER EXAMINATION

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PCE-C111
RESEARCH METHODOLOGY

PREREQUISITE: NIL

OBJECTIVES:

- To produce a well-developed research proposal with appropriate research plan.

- To find the resources needed to perform the research process.

- Documentation of its findings in the individual research area.

- To understand research methodology.

COURSE OUTCOMES:

By the end of the course the students will be able to:

- Learn the concept of research, research process, types of research, research models and basics formats of report writing.

- Learn the techniques for collecting information, analysing data and research writing.

- Write a research proposal/Synopsis in well format way.

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PCE-C111
RESEARCH METHODOLOGY

MM: 100
TIME: 3HR   **ESE: 100**
L T P   **PASS MARKS: 55**
4 0 0

NOTE: The question paper shall consist of two sections A and B. Section A contains 10 short type questions of 6 marks each and student shall be required to attempt any five questions. Section B contains 8 long type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus

UNIT-I
Introduction to Research Methodology: Meaning and Importance of Research, Defining the Research Problem, Necessity and Techniques in defining the problem, Types of Research, Motivations in Research, Research Approaches, Research Methods v/s Methodology, Scientific method Vs Arbitrary Methods, Deductive and Inductive Reasoning, Error Analysis and Accuracy, Descriptive Statistics, Probability, Random Variables, Sampling distribution and Probability Distribution, Hypothesis Testing, Regression Analysis, Multivariate Analysis, Testing of Hypothesis: Meaning, Basic concepts, Flow diagram, Power of a hypothesis test, Important parametric tests, Hypothesis Testing of Means, hypothesis testing of Correlation coefficients, Limitations of Tests of hypothesis.

UNIT-II

Components of Research: Significance of literature review, writing scientific report, structure and components of research report, revision, writing project proposal, writing a Research Paper, Citation counting and Impact factor, Science citation index (SCI)/ Science citation index Expended (SCI-E), H-index, Academic Ethics and Plagiarism, Intellectual Property Rights and Patent law.

UNIT-III

Scientific Writing: Structure and components of Scientific Reports, types of Report: Technical Reports and Thesis, Significance, Different steps in the preparation: Layout, structure and Language of typical reports - Illustrations and tables – Bibliography, Referencing and foot notes – Importance of Effective Communication. Preparing Research papers for journals, Seminars and Conferences, Calculations of Impact factor of a journal, citation Index, ISBN & ISSN. Literature survey, Literature search technique using Google Scholar, Web of Science and Scopus, Methods of citation and referencing, Styles of referencing: APA, MLA, Oxford, Harvard, Chicago. Quality indices of research publication: Impact factor, H-index and other citation indices.

UNIT-IV

Data Collection and Analysis: Sources of Data: Primary, Secondary and Tertiary, Types of Data: Categorical, Nominal & Ordinal. Methods of Collecting Data: Collection of Primary Data, Observation Method, Interview method, Collection of Data through questionnaire and Schedules, Other methods: Collection of Secondary Data, Selection of appropriate method for data collection,

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Computer Science & Engineering

Case Study Methods, Guidelines for developing questionnaire, successful interviewing, Survey v/s experiment, Processing and Analysis of Data: Measures of Central Tendency, Dispersion, correlation and Regression, Hypothesis testing: Parametric and Non-parametric, Use of Statistical packages like SPSS, SYSTAT, MATLAB and Capital line database.

UNIT-V

Introduction to Latex, Installation of Latex, how to write application in Latex, how to write research paper in Latex, Use of Equations in Latex, Writing of Thesis in Latex.
Introduction to plagiarism testing software Urkund and Turnitin.(This work has to be done practically during lab hours)

SUGGESTED READINGS:

1. Kothari C.R., "Research Methodology: Methods and Trends", New Age International (P) Limited, Publishers, New Delhi.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction ",Juta& Co, Ltd.
3. Kumar, "Research Methodology: A Step-by-Step Guide for Beginners", PearsonEducation.
4. Dawson, C., "Practical Research Methods", UBSPD Pvt. Ltd.
5. Sharma, N. K., "Research Methodology", KSK Publishers, New Delhi.
6. Bird, A, "Philosophy of Science", Routledge.
7. MacIntyre, Alasdair , "A Short History of Ethics", London.
8. Chaddah, P., "Ethics in Competitive Research: Do Not Get Scooped; Do Not GetPlagiarized", ISBN:9789387480865.
9. National Academy of Sciences, National Academy of Engineering and Institute ofMedicine, "On Being a Scientist: A Guide to Responsible Conduct in Research",National Academies Press.
10. Resnik, D. B., "What is Ethics in Research & Why is it Important", National Instituteof Environmental Health Sciences", 1—10. (https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfin)
11. Beall, J., "Predatory Publishers are Corrupting Open Access", Nature, 489(7415),179—179. (https://doi.org/10.1038/489179a)
12. Indian National Science Academy (INSA), "Ethics in Science Education, Researchand Governance", ISBN:978-81-939482-1-7. (http://www.insaindia.res.in/pdf/Ethics_Book.pdf)
13. Levin, Richard I and Rubin, David (2007). Statistics for Management, Prentice Hall of India, New Delhi.
14. Levin, David M, Krehbiel, Timothy C, Bereson, Mark L., and Vishwanantham, P.K. (2011). Business Statistics, Prentice Hall of India, New Delhi.
15. Robert H. Carver, DOING DATA ANALYSIS WITH SPSS VERSION 18.0, Cengage Publisher.
16. Lokesh Jasari,Data Analysis Using SPSS, Sage Publication.
17. Rudra Pratap, Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Oxford Publisher.

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PCE-C112

RESEARCH AND PUBLICATION ETHICS

PREREQUISITE: NIL

OBJECTIVES:

- To learn about the Philosophy and Ethics, Publication Ethics, Open Access Publishing and Publication Misconduct.
- To understand the concepts of h-index, g index, i10 index, alt metrics
- To learn the best practices / standards setting initiatives and guidelines: like COPE, WAME.
- To understand the use of plagiarism software like Turnitin, Urkund and other opensource software tools.

COURSE OUTCOMES:

On completion of the course, student will be able to:

- Define the terms Philosophy and Ethics.
- Discuss the importance of Publication Misconduct.
- Learn the concepts of Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, SpringerJournal Suggested, etc.

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PCE-C112

RESEARCH AND PUBLICATION ETHICS

MM: 100
TIME: 3HR   **ESE: 100**
L T P   **PASS MARKS: 55**
2 0 0

NOTE: The question paper shall consist of two sections A and B. Section A contains 10 short type questions of 6 marks each and student shall be required to attempt any five questions. Section B contains 8 long type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus.

UNIT-I

PHILOSOPHY AND ETHICS: Introduction to philosophy: definition, nature and scope, concept, branches, **Ethics:** definition, moral philosophy, nature of moral judgements and reactions.

UNIT –II

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

UNIT-III

PUBLICATION ETHICS: Publication ethics: definition, introduction and importance, best practices / standards setting initiatives and guidelines: COPE, WAME, etc., Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behaviorand vice versa, types, Violation of publication ethics, authorship and contributorship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals.

UNIT-IV

OPEN ACCESS PUBLISHING: Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright & self-archivingpolicies, Software tool to identify predatory publications developed by SPPU, Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, SpringerJournal Suggester, etc.

UNIT-V

PUBLICATION MISCONDUCT:
Group Discussions: Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad, **Software tools:** Use of plagiarism software like Turnitin, Urkund and other opensource software tools

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DATABASES AND RESEARCH METRICS:
Databases: Indexing databases, Citation databases: Web of Science, Scopus, etc.
Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, CiteScore, Metrics: h-index, g index, i10 index, altmetrics

SUGGESTED READINGS:

1. Bird, A. (2006). *Philosophy of Science.* Routledge.
2. MacIntyre, Alasdair (1967) *A Short History of Ethics.* London.
3. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition.* National Academies Press.
5. Resnik, D. B. (2011). What is ethics in research & why is it important. *National Institute of Environmental Health Sciences,* 1-10. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis /index.cfrn
6. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a
7. Indian National Science Academy (INSA), Ethics in Science Education, Research and Govemance(2019) ,ISBN:978-81-939482-l- 7. httj>://www.insaindia.res.in/pdf/Ethics Book.pdf

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PCE-C113

ADVANCEMENTS IN COMPUTER SCIENCE

PREREQUISITE: Knowledge of discrete mathematics and data structures.

OBJECTIVES:

- To learn about the advancements and recent innovations in computer science.
- To understand the concepts of parallel computing, cloud computing, internet of things, blockchain etc.
- To learn the applications of new technologies like Blockchain, Machine learning in real world.
- To learn and evolve new dimensions of research and advancements.
- To develop a scientific, know-how of the technologies and concepts that are being evolved in recent scenario.

COURSE OUTCOMES:

On completion of the course, student will be able to:

- Describe the evolution in new advances in computer science.
- Learn the concepts of Advance computing and to identify problems related to specific research area.
- Understand and Analyse the concepts and advances in Cloud Computing, Parallel Computing, IoT, Blockchain, Machine Learning etc.

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PCE-C113

ADVANCEMENTS IN COMPUTER SCIENCE

MM: 100
TIME: 3HR   **ESE: 100**
L T P   **PASS MARKS: 55**
4 0 0

NOTE: The question paper shall consist of two sections A and B. Section A contains 10 short type questions of 6 marks each and student shall be required to attempt any five questions. Section B contains 8 long type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus.

UNIT-I

Parallel Computing: Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts of Clustering –Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues –Semantic Issues In Parallel Programs**.**

UNIT-II

Cloud Computing: Definition, private, public and hybrid cloud .Cloud types; Cloud Computing model, laaS, PaaS, SaaS, Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility :Benefits and challenges to Cloud architecture .Application availability, performance, security and disaster recovery; next generation Cloud Applications .Difference between mainframe computing, distributed computing, cloud computing, grid computing, and green computing .Limitation of cloud computing, Issues on cloud computing.

UNIT- III

Internet of Things: Internet of Things Definition **:**Definition and characteristics of IoT, concepts behind the Internet of Things **.**Internet of Everything, industrial IoT, smartness in IoT, IoT paradigm, smart objects; Reference Architecture **:**IoT architecture, reference model and architecture, IoT reference model, IoT reference architecture, functional view, information view, deployment and operational view, other relevant architectural view**.**

UNIT-IV

Introduction to Machine Learning and Artificial Intelligence: Overview of Machine Learning; Definition, Components of a learning problem, Applications, choosing a Model Representation, Types of learning :Supervised Learning, Unsupervised Learning, Semi-supervised learning, Reinforcement Learning, Inductive Learning or Prediction.

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Computer Science & Engineering

UNIT-V

Block Chain: Definition, Evolution of Bit Coin, Crypto Currency, Advantages of Block chain, Hyperledger, Ethereum, Security Issues in Block Chain, Distributed Ledger Technology, Consensus Algorithm, Proof of Work.

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SUGGESTED READINGS:

1. Parallel Computing Architecture: A Hardware/Software Approach, David E. Culler and Jaswinder Pal Singh, Morgan Kaufman, 1999.

2. Advanced Computer Architecture, Kai Hwang, Tata McGraw-Hill, New Delhi, 2003.

3. Cloud Computing: Principles and paradigms, Buyya K, R., Broberg J. and Goscinski M. A., MIT Press, 2011.

4. Puttini R. and Mahmood Z., Cloud Computing: Concepts, Technology & Architecture, Service Tech press. 2013.

5. Internet of Things: Architectures, Protocols and Standards, Simone Cirani, Gianluigi Ferrari, Marco Picone and Luca Veltri, Wiley Publishers, 2018

6. The Internet of Things: From Data to Insight, Carolina Fortuna, John Davies, Wiley Publishers, 2020

7. Introduction to Machine learning, Nils J. Nilsson, Nils Johan Nilsson, Morgan Kaufmann Publishers 1998.

8. Machine learning for dummies, IBM Limited, by Judith Hurwitz and Daniel Kirsch, 2019.

9. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Gold feder, Princeton University Press, 2016.

10. Blockchain For Dummies, Tiana Laurence, Wiley, 2019

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PCE-C114
LITERATURE SURVEY, REVIEW OF
RESEARCH PAPER AND PRESENTATION

PREREQUISITE: NIL

OBJECTIVES:

- To Develop research skills for conducting literature surveys and critically evaluating research papers.

- Enhance analytical abilities to identify gaps in existing research and propose future investigation areas.

- Improve communication skills for presenting research findings effectively in written and oral formats.

- Promote ethical research practices and academic integrity in literature survey and paper review.

COURSE OUTCOMES:

By the end of the course the students will be able to achieve :

- Proficiency in conducting thorough literature surveys and gathering relevant resources.

- Ability to critically evaluate research papers, assess methodologies, and interpret findings.

- Skill in writing comprehensive research paper reviews with constructive feedback.

- Abilities to communicate research findings clearly and engagingly through presentations.

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PCE-C114
LITERATURE SURVEY, REVIEW OF
RESEARCH PAPER AND PRESENTATION

MM: 100   **CIA : 100**
L T P   **PASS MARKS: 55**
0 0 4

Note: The candidate has to present the topic and progress in front of Research Advisory Committee

- Presentation will be held in front of RAC to review the work.
- Effective presentation design, organization, and delivery.
- Presenting research findings with visual aids and storytelling techniques.
- Preparing for academic conferences and professional presentations.
- Synopsis to be written in Latex to be presented before Departmental Committee