Syllabus of Pre-Ph.D. Course Work
(w.e.f 08/02/2021)

In

Computer Science & Engineering

Department of Computer Science & Engineering

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

8/2/2021

PROGRAM OUTCOMES

1. Knowledge of the most advanced research in the candidate's specialization area (Track) of Computer Science or Information Security, respectively.

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

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

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 presentation of research in the individual research area

8/2/2021

Revised Syllabus (**Effective from the session 2021-22**)
Gurukula Kangri (Deemed to be University), Haridwar
Faculty of Engineering & Technology
Computer Science & Engineering

Pre Ph.D. Coursework

DSC/ SEC/ AECC	Subject	Periods			Evaluation Scheme				Total Marks	Credits
					Continuous Internal Assessment		CIA Total	ESE		
		L	T	P	CT	TA				
					THEORY					
PCE-C101	Research Methodology and Research Ethics	3	0	0	20	10	30	70	100	6
PCE-C102	Advancements in Computer Science	3	0	0	20	10	30	70	100	6
	TOTAL	6	0	0	40	20	60	140	200	12

PCE-C 101 ⟶ Paper Code
⟶ 0, 5 & 6 stands for Theory, Practical & Seminar / Project respectively
⟶ Semester

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

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PCE-C101
RESEARCH METHODOLOGY AND RESEARCH ETHICS

PREREQUISITE: NIL

OBJECTIVES:

- To produce a well-developed research proposal.
- To select an appropriate methodology with which to conduct the research and defend the methodology of their selection.
- To understand the various tasks required to carry out the research.
- To find the resources needed to perform the research process.
- Documentation of its findings in the individual research area.
- To understand of academic theory and the preparation of high-quality research pertinent to the field of study.
- Appropriately employ methods and existing research results in the development of new knowledge, theories and presentation of research in the individual research area.
- To understand publication ethics.
- To learn open access publications and initiatives.
- To learn the use of plagiarism tools.

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.
- Understand the basic concepts of philosophy and ethics.
- Apply publication and research ethics in their research work.
- Use of Internet in their research.
- Access the plagiarism tools.
- Write a research proposal in well format way.

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PCE-C101
RESEARCH METHODOLOGY AND RESEARCH ETHICS

MM: 100   SESSIONAL: 30
TIME: 3HR   ESE: 70
L T P   PASS MARKS: 40
3 1 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.

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-III

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, Case Study Methods, Guidelines for developing questionnaire, successful interviewing, Survey v/s experiment, Processing and Analysis of Data: Measures of Central Tendency, Dispersion,

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correlation and Regression, Hypothesis testing: Parametric and Non-parametric, Use of Statistical packages like SPSS, SYSTAT, MATLAB and Capital line database.

UNIT-IV

Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches; **Ethics:** definition, moral philosophy, nature of moral judgements and reactions

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.

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 behavior and vice versa, types; Violation of publication ethics, authorship and contributorship Identification of publication misconduct, complaints and appeals; Predatory publishers and journals

UNIT –V

Open Access Publishing: Open access publications and initiatives; SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies, Software tool to identify predatory publications developed by SPPU, Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

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 open-source software tools.

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, Cite Score; **Metrics:** h-index, g index, i10 index, altimetric.

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SUGGESTED READINGS:

1. Kothari C.R., "Research Methodology: Methods and Trends", New AgeInternational (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.

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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.

PCE-C102

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 understand the concepts of machine leaning and to apply them for problem solving.
- 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:

- Define the terms IoT and cloud computing
- Describe the evolution that has led to cloud computing
- Discuss the importance of IoT devices
- Will be familiar with the concepts of parallel processing and understand the particular problems arising in programming of parallel machines.
- Will be familiar with the parallel computing models and the "parallel-way of thinking" required in the design of parallel algorithms.
- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- Explain the core issues of cloud computing such as security, privacy, and interoperability.
- Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
- Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

PCE-C102

ADVANCEMENTS IN COMPUTER SCIENCE

MM: 100	**SESSIONAL: 30**
TIME: 3HR	**ESE: 70**
L T P	**PASS MARKS: 40**
3 1 0	

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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, IaaS, 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.

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