Ph.D. COURSE WORK SYLLABUS

(2021)

P. G. DEPARTMENT OF
COMPUTER SCIENCE & APPLICATIONS

UTKAL UNIVERSITY VANIVIHAR,
BHUBANESWAR-751004

SYLLABUS FOR Ph.D. COURSE-WORK

All the scholars of Ph.D. Programme of this Department have to undergo a course work of one semester duration. On successful completion of the course work, the scholars may be eligible for registration for Ph.D. subject to final recommendation of Department Research Committee (DRC). The syllabus structure for coursework is given below.

Papers	Course Title	Credits	Marks	Pass Mark
Paper-I (CS-01)	Research Methodology	4	100	50%
Paper-II (CS-02)	Advances in Computer Science	4	100	50%
Paper-III (CS-03)	Review of Related Literature	4	100	50%
Paper-IV (CS-04)	Research and Publication Ethics	4	100	50%
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PAPER-I: RESEARCH METHODOLOGY

Course Code: CS-01   Credit:4

OBJECTIVES
At the end of this course, the students should be able:
- To identify the importance of research.
- To understand some basic concepts of research and its methodologies.
- To select and define appropriate research problem and parameters.
- To identify appropriate research topics.

LEARNING OUTCOMES
Upon Completing the Course, Students will able:
- To explain key research concepts.
- To read, comprehend, and explain research articles in their academic discipline.

Unit-I: Philosophy and Culture of Research
Introduction to Philosophy of Knowledge: Various aspects of research methodology; Methodological Approaches; the Analytical Approach; Methodological Procedures with Integrated Approaches.
Types of Research: Introduction to Qualitative & Quantitative Research- Need for Qualitative & Quantitative Research, Grounded Theory Approach, Case Studies in Qualitative Research, The Challenges of Reliability and Validity in Qualitative Research.
Hypothesis: Different types, Significant, Development of working hypothesis, Null hypothesis.

Unit-II: Scientific Writing and Presentation Tools
Structure of a Research Manuscript: Paper Title, Abstract, Introduction, Citations, Review of Literature, Identifying/ narrow-down to Problem Statements, Proposed Methods/Problems, Result Discussion, Graphical and Tabular Presentation of Results, Conclusion and Future Directions, Acknowledgement, References Styles and Citation Credits. Structure of Dissertation Preparation. Elements of Good English Writing: Signposts, Paraphrasing—Unity, Coherence, Thesis writing using Latex, Open Source Tools for Figure Preparations.

Unit-III: Data Analysis in Research
Basic statistical methods through the use of linear model theory and regression. Analysis through one-end two-sample t-tests, multiple linear regression, analysis of variance, regression diagnostics, model-building techniques, random effects models, mixed models. Need of Quantitative analysis in Research Methodology, Data collection, Univariate & Bi-variate data analysis and application to various projects.
Procedure for data collection and data analysis techniques using Python.

Unit-IV Research Methods for Computer Science
Formal Methods: Formal Specification, Algorithm, and Complexity; Building Artefacts: Proof of Performance, Proof of Concept, and Proof of Existence; Process Methodology: Methods for Software Engineering and Human-Computer Interaction, Cognitive Processes, Interactive Games, Social Networks, and Web Analytics.

Text Books:
1. Research Methodology: Methods and Techniques, Second Edition, New Age International publishers by C.R. Kothari
2. Mu current presentation tools by Michel Hyatt, International Leadership Groups
3. Morgan, G. and Smircich, L., The Case for Qualitative Research, Academy of Management Review, 5(4): 491-500.
4. 'The Craft of Research' by Wyne C. Booth, Colomb, William, University of Chicago Press. https://press.uchicago.edu/ucp/books/book/chicago/C/bo23521678.html

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Course Code: CS-02   Credit-4

OBJECTIVES

At the end of this course, the students should be able:

- To know the basics of different areas of computer science that is primarily helpful in research.
- To identify various popular research trends in networking and build the insights of the research areas such as IoT, Cloud Computing, Mobile Computing etc.
- To identify basic concepts of soft computing and machine learning.
- To identify basic concepts of algorithm this will be helpful in various research work.
- To identify the basics of different cryptography algorithm.

LEARNING OUTCOMES

Upon Completing the Course, Students will able:

- To explain key research concepts in computer science.
- To identify a research field of their interest among the current research trends.

Instructor has to discuss a latest research paper in each unit based on the content of the unit

Unit I: Advance Networking with Case Studies in IoT/Cloud Computing/ Mobile Computing

Cloud Computing: Virtual Machine Management: Configuration, Placement and Resource Allocation. Creating and Configuring Hyper-V Network Virtualization, Overview of Backup and Restore Options for Virtual Machines, Protecting Virtualization Infrastructure by Using Data Protection Manager. Power efficiency in Virtual Data centers, Fault Tolerance in Virtual Data Centres. Term Papers [as provided].

Networking: Layers and Functions, Switching techniques, Addressing, Routing Protocols, Quality of Services, Network Virtualization, Recent research trends. Performance of Computer Network.

Cloud Concept and their implementations using NS2/NS3 or Cloud Sim. Implementation of Flooding, Link state, Distance Vector routing protocols for mobile ad-hoc network using NS2/NS3

Unit II: Soft Computing with Machine Learning

Artificial Neural Networks: Introduction to Artificial Neural Networks (ANNs), ANN Architectures, Training techniques for ANNs. Single-Layer and multi-layer NN System, Back Propagation Network: Multi-layer feed-forward network, training using back propagation algorithm, Recurrent Neural Networks (RNNs): Elman Network, Jordan Network, The Hopfield network, Boltzmann machines, Deep Learning, Hidden Markov Model and its application in machine learning.

Implementations using Scilab/Matlab/Open Source Software.

Unit III: Advanced Algorithm

.Flow Networks: Max Flow Problem, Min Cut Problem, Equivalence of Max Flow and Min- Cut, Residual Graph, Cut, Idea of Ford Fulkerson, Augmenting Path & Ford Fulkerson.

Randomized Algorithms: Lasvegas and Monte Carlo Randomized algorithms: Randomized Quick sort, Karger Min-cut Randomized algorithm, Application of Randomized algorithm to routing problems, Chernoff bound, Randomized algorithm for closest pair points.

NP-Completeness: Meaning of P and Polynomial time, Polynomial-Time Reductions (Vertex Cover to/from Independent Set, Vertex Cover to Set Cover), Polynomial-Time Verification, NP, NP-Completeness (Example Problems: 3-SAT, Vertex Cover), Reductions (Independent Set to Vertex Cover, Vertex Cover to Set Cover), 3-Colour Problems in graph, Approximation Algorithms. Term Papers on VLSI Design Automation Algorithms.

Implementations using Scilab/Matlab/Open Source Software.

Unit IV: Applied Cryptography

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transportation Techniques. Introduction to Information Hiding, Steganography and Watermarking, Fragile watermarking, Reversible watermarking, Importance of digital watermarking, Applications, Properties, Evaluating watermarking systems. Block Chain concept, quantum cryptography.

Implementations using Scilab/Matlab.

Text Books:

1. Computer Networking *A Top Down Approach* by James F. Kurose and Keith W. Ross, 6th Edition, Pearson.
2. Cloud Computing: Concepts, Technology & Architecture, Thomas Erl, Ricardo Puttini, ZaighamMahmood, Prentice Hall.
3. B Kröse, P Van Der Smagt - An Introduction to Neural Networks, University of Amsterdam, 8th ed., 1996
4. Simon Haykin, Neural Networks and Learning Machines, (3rdEdn.), PHI Learning, 2011.
5. Algorithm Design, Jon Kleinberg, Eva Tardos.
6. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest.
7. Computer and Intractability : A Guide to the theory of NP-Completeness by Michale R Gary, David S Jhonson
8. Approximation Algorithms: Vijay V.Vazirani
9. Randomized Algorithm by Rajiv Motwani and Praphakar Raghavan
10. W.Sta1lings- Cryptography and Network Security Principles and Practice, Person Education Asia, 2000. (3rd Edition).
11. Charu Agarwal, Neural Network and Deep Learning, SPringer
12. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Margan Kaufmann Publishers, New York, 2008.
13. VLSI Design Automation: Theory and Practice by Sadiq M. Sait and Habib Youssef

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PAPER- III: REVIEW OF RELATED LITERATURE

LEARNING OUTCOMES

After completion of the course the students will be able to-

- Conduct review of related literature
- Identify the research gap and write the review in a synchronized manner
- Select a research area of their interest
- Identify variables relevant to the selected research area
- Summarize the findings of different research studies
- Write a thematic paper on any contemporary issue in the subject
- Present thematic paper

CONTENTS

Each student is required to select a problem on which she has to do intensive review of related studies under the supervision of a faculty member of the Department. She has to review adequate research studies related to the problem and prepare a report.

The student is required to submit a report on the review carried out by her and need to give a power point presentation before the RAC. Assessment shall be made on the basis the following criteria:

1) Relevance of the reviews.
2) Finding the research gap.
3) Standard and quality of writing the review.
4) Style of presentation.
5) Answering the question

Distribution of Marks for Evaluation

1) Report writing and submission   : 40 Marks
2) Implementation of a Research paper submitted in the Report : 40 Marks
3) Presentation of Implemented Paper   : 20 Marks
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Total: 100 Marks

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PAPER- IV: RESEARCH AND PUBLICATION ETHICS

Course Code: CS-04   Credits: 04

Full Marks: 100 (Theory-50) + (Practical-50)

BACKGROUND

This Paper has been incorporated in the Ph.D. course work under this University as per the UGC correspondence in December 2019 vide its 543rd Meeting held on 09 August 2019. The main aim of this course is to create awareness about publication ethics and publication misconducts. It is an interdisciplinary course with 02 credits (Theory) and 2 credits (Practical). The course transaction modes shall be classroom teaching, guest lectures, group discussions and practical sessions. The evaluation of the course will be through continuous assessment processes such as tutorials, assignments quizzes, etc. Final examination will be conducted at the end of the course.

LEARNING OUTCOMES:

On completion of the course, the scholars will be able to:
1. Understand the basics of philosophy of science and ethics, research integrity, publication ethics.
2. Identify research misconduct and predatory publications.
3. Comprehend indexing and citations, open access publications, research metrics (citations, h-index, impact factor etc).
4. Use plagiarism tools for a valid and ethical research report.

COURSE STRUCTURE:

A: THEORY

Unit-I: Philosophy and Ethics
- Introduction to Philosophy: Definition, nature and scope, concept, branches.
- Ethics: definition, moral philosophy, nature of moral judgment and reactions.
- Intellectual honesty and research integrity
- Conflict interest

Unit-II: Scientific Conduct
- Ethics with respect to science and research
- Scientific misconduct: Falsification, Fabrication, and Plagiarism (FFP)
- Redundant Publications: Duplicate and overlapping publications.
- Selective reporting and misrepresentation of data.

Unit-III: Publication Ethics
- Publication ethics: Definition, introduction and importance
- Violation of publication ethics, authorship and contributor-ship
- Publication misconduct: Definition, concept, problems that lead to unethical behavior, types, identification of publication misconduct, complaints and appeals
- Predatory publishers and journals

B: PRACTICAL

Unit-I: Open Access Publishing
- Open Access Publications and initiatives
- Online resource to check publisher copyright and self-achieving policies (SHERPA/ RoMEO)
- Journal finder/ journal suggestion tools viz. Elsevier finder, Springer, Journal suggested etc.

Unit-II: Publication Misconduct
- Use of plagiarism software like Turnitin, Urkund and other open source software tools
- Software tools to identify predatory publications developed by SPPU
- Indexing databases

Unit-III: Database and Research Metrics
- Citation databases: Web of Science, Scopus. etc.
- Impact Factor of journal as per Journal Citation Report.
- Metrics: h-index, g-index, i10 index, altmetrics

Unit-IV: Group Discussion/Seminar
- Subject Specific ethical issues, FFP, authorship
- Conflict of interest
- Complaints and appeals: examples and fraud from India and abroad

REFERENCES:

1. Bird, A. (2006). Philosophy of Science. Rutledge. MacIntyre, A. (1967). A short history of ethics. London.
2. P. Chaddah (2018). Ethics in competitive Research: Do not get scooped; do not get plagiarized. National Academy of Sciences (2009). On being a scientist: A guide to responsible conduct in Research (3rd Ed.), National Academics Press.
3. Resnik, D.B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10.
4. Beall, J. (2102). Predatory publishers are corrupting open access. Nature, 489 (7415), 179-179. Indian National Science Academy (INSA). Ethics in science education, research and governance (2019).

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