

Ph.D. Coursework Syllabus

(Academic Year 2022-23)



Faculty of Engineering and Technology

**JIS University
81, Nilgunj Road, Agarpara
Kolkata 700109
West Bengal
India**

Department of Computer Science and Engineering

Syllabus for Ph.D. Coursework

Sl. No.	Course code	Course	Credit points	Full marks	Course type#	Total credits	Total marks
UNIVERSITY PAPER (COMMON)						14	350
1	RPD1001	RESEARCH METHODOLOGY	4	100	C		
2	RPD1002	RESEARCH AND PUBLICATION ETHICS	2	50	C		
FACULTY PAPER (OPTIONAL)							
3	RCS1001	CLOUD COMPUTING	4	100	M		
4	RCS1002	DATA SCIENCE AND ANALYTICS	4	100	M		
5	RCS1003	ARTIFICIAL INTELLIGENCE	4	100	M		

C = COMMON COURSE; M = MAJOR COURSE

COURSE NAME: RESEARCH METHODOLOGY

COURSE CODE: RPD1001

CREDIT POINTS: 4

- I. Research-Definition, Objectives of Research, What Makes People do Research? Qualities of a good Researcher, Limitations of Research, Views of Researchers, Scientific method of Research, Importance of Research, Illustrations of Research.
- II. Process of Research. Research Methods, Research Methods versus Research Methodology. Fundamental or Basic Research and Examples, Applied Research and Examples, Differences between Basic Research and Applied research. Difference between Approach and Validity, Reliability versus Unbiased and objective, Research structured enquiry, Research Design.
- III. Normal, Revolutionary, Quantitative, and Qualitative Research Methods. Learning from Qualitative and Quantitative Research. Data Collection, Generation of Data using Qualitative Methods: (Individual Interviews, Focus groups, Observations, Self-Study, Action Research), Sources of Quantitative Data, Analyzing Quantitative Data, Pros and Cons of Qualitative research, Comparing Quantitative and Qualitative Research, Example and Distinction, Important Difference, Qualitative research, Descriptive Versus Analytical, Conceptual Versus Empirical, Decision-oriented versus Conclusion-oriented,
- IV. Process of literature Survey, Advantages and Pitfalls. The Internet as a Medium for Research, Availability of Scientific Research Information, Problems Encounter, Features of Conducting Research through Internet, New Challenges to Researchers, Potential Advantages of Online Questionnaire, Potential Difficulties, Preservation of References, Assessing the Current Status.
- V. Ethics in Research, Computer Ethics, Some areas of Research Ethics, Essential information required for authority, Author Responsibilities, What is not acceptable? What are Plagiarism and Self-Plagiarism, Other Types of Ethical Violations, How Journals Detect and Handle Problem Papers? Example, Reasons for possible Plagiarism, appropriate authorship.
- VI. Seminar, Oral Report, Quotation, Points to be Remembered in Preparing an Oral Report, Write-up of the oral presentation, Art of writing and layout of Research Paper or Article or Ph. D. Thesis. Main Text, End Matters, Content of work.

References:

1. Ander May, R., Meyer, V., Van Rys, J., Kemper, D., & Sebranek, P. (2016). The College Writer: A Guide to Thinking, Writing, and Researching, MIT Press.
2. Gustavii, B. (2014). How to Write and Illustrate a Scientific Paper. New York, NY: Cambridge.

3. Kothari, C.K. (2015). Research Methodology – Methods and Techniques. New Age International, New Delhi.
4. Krishnswamy, K.N., Shivkumar, Appalyer, & Mathiranjana M. (2013). Management Research Methodology: Integration of Principles, Methods, and Techniques. Pearson Education, New Delhi.
5. G. Vijaylakshmi and C. Sivapragasam (2008). Research Methods: Tips and Techniques. MJP Publishers, Chennai.

COURSE NAME: RESEARCH AND PUBLICATION ETHICS

COURSE CODE: RPD1002

CREDIT POINTS: 2

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

- II. SCIENTIFIC CONDUCT**
 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

- III. PUBLICATION ETHICS**
 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 behavior 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

- IV. 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

- V. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.**

- VI. PUBLICATION MISCONDUCT**
 1. Subject specific ethical issues, FFP, authorship
 2. Conflicts of interest
 3. Complaints and appeals: examples and fraud from India and abroad
 4. Use of plagiarism software like Turnitin, Urkund and other opensource software tools

- VII. DATABASES AND RESEARCH METRICS**
 1. Indexing databases
 2. Citation databases: Web of Science, Scopus, etc.

- VIII. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score Metrics: h-index, g index, il 0 index, altimetric**

References:

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*.
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.
6. Beall, J. (2012). *Predatory Publishers Are Corrupting Open Access*. *Nature*, 489(7415), 179–179.
7. Indian National Science Academy (INSA) (2019). *Ethics in Science Education, Research and Governance*.

COURSE NAME: CLOUD COMPUTING

COURSE CODE: RCS1001

CREDIT POINTS: 4

- 1. Module 1:** Introduction to cloud computing: Cloud computing components, Infrastructure services, storage applications, database services – introduction to SaaS, PaaS, IaaS, IaaS, data storage in cloud
- 2. Module 2:** Virtualization: enabling technologies, types of virtualization, server virtualization, desktop virtualization, memory virtualization, application and storage virtualization-tools and products available for virtualization
- 3. Module 3:** SAAS and PAAS: Getting started with SaaS, SaaS solutions, SOA, PaaS and benefits.
- 4. Module 4:** IaaS and Cloud data storage: understanding IaaS, improving performance for load balancing, server types within IaaS, utilizing cloud based NAS devices, cloud based data storage, and backup services, cloud based block storage and database services
- 5. Module 5:** Cloud Application development: Client server distributed architecture for cloud designing cloud based solutions, coding cloud based applications, traditional Apps vs cloud Apps, client side programming, server side programming overview-fundamental treatment of web application frameworks.
- 6. Module 6:** Cloud Governance and economics: Securing the cloud, disaster recovery and business continuity in the cloud, Managing the cloud, migrating to the cloud, governing and evaluating the clouds business impact and economics,
- 7. Module 7:** Inside Cloud: Introduction to Map Reduce and Hadoop-over view of big data and its impact on cloud

References:

- 1.** Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Kris Jamsa, Jones & Bartlett Publishers, Paperback edition,2013
- 2.** Hadoop Map Reduce cookbook, Srinath Perera and Thilina Gunarathne, Packt publishing
- 3.** Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill Edition

COURSE NAME: DATA SCIENCE AND ANALYTICS

COURSE CODE: RCS1002

CREDIT POINTS: 4

- 1. Module 1: Introduction to Data Science:** Skills required for data science, Applications of data science in different industries, Big Data Analytics, Business intelligence vs. Big data, big data frameworks, Current landscape of analytics.
- 2. Module 2: Python and R for Data Science:** Data Visualization techniques, software, Data Visualization in Python, Introduction to NumPy, Introduction to Matplotlib, Introduction to Pandas, Creation of models in R and Python, Getting and Cleaning Data, Data Processing, Histogram, Seaborn.
- 3. Module 3: Exploratory Data Analysis (EDA):** Exploratory Data Analysis (EDA), Data Sourcing, Data Cleaning, Univariate Analysis, Bivariate Analysis, statistical measures, Basic tools (plots, graphs and summary statistics) of EDA, Data Analytics Lifecycle, Discovery, EDA Case Study.
- 4. Module 4: Inferential Statistics:** Basics of Probability. Discrete Probability, Distributions, Continuous Probability Distributions, Concepts of Hypothesis Testing - I: Null and Alternate Hypothesis, Making a Decision, and Critical Value Method, Concepts of Hypothesis Testing - II: p-Value Method and Types of Errors, Two-Sample Mean and proportion Test, A/B Testing.
- 5. Module 5: Regression Model:** Linear regression, Simple Linear Regression, Simple Linear Regression in Python, Multiple Linear Regression, Multiple Linear Regression in Python, least-squares principle, logistic regression, Multiple correlation, Partial correlation.
- 6. Module 6: Linear Algebra Basics:** Matrices to represent relations between data, Linear algebraic operations on matrices – Matrix decomposition: Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).
- 7. Module 7: Machine Learning and Classifier:** Introduction to Decision Trees, Algorithms for Decision Trees Construction, Hyper-parameter Tuning in Decision Trees, Naive Bayes classifier, k-Nearest Neighbors (k-NN).
- 8. Module 8: Unsupervised Learning and Clustering:** Introduction to Clustering, K-Means Clustering, Hierarchical Clustering, Other Forms of Clustering: K-Mode, K-Prototype, DB Scan, Basics of NLP and Text Mining.

References:

1. Introduction to Data Science a Python approach to concepts, Techniques and Applications, Igual, L;Seghi', S. Springer, ISBN:978-3-319-50016-4
2. Data Analysis with Python a Modern Approach, David Taieb, Packt Publishing, ISBN-9781789950069
3. Python Data Analysis, Second Ed., Armando Fandango, Packt Publishing, ISBN: 9781787127487

COURSE NAME: ARTIFICIAL INTELLIGENCE

COURSE CODE: RCS1003

CREDIT POINTS: 4

- 1. Module 1: Introduction of Artificial Intelligence:** Artificial Intelligence, Philosophy of AI, Goals of AI Contributes to AI, Programming Without and with AI, AI Technique, Applications of AI, History of AI, AI issues.
- 2. Module 2: Intelligence, and Research Areas of AI:** Intelligence, Types of Intelligence, Intelligence Composition, Difference between Human and Machine Intelligence , Real Life Applications of Research Areas, Task Classification of AI
- 3. Module 3: Agents and Environments, Search Algorithms:** Agent and Environment, Agents Terminology, Rationality, Ideal Rational Agent, The Structure of Intelligent Agents, The Nature of Environments, Properties of Environment. Single Agent Path finding Problems, Search Terminology, Brute-Force Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms
- 4. Module 4: Fuzzy Logic Neural Network and NLP:** Fuzzy Logic, Fuzzy Logic Systems Architecture, Example of a Fuzzy Logic System, Application Areas of Fuzzy Logic, Advantages of FLSs, Disadvantages of FLSs, Artificial Neural Networks (ANNs), Basic Structure of ANNs, Types of Artificial Neural Networks, Working of ANNs, Machine Learning in ANNs, Bayesian Networks (BN), Applications of Neural Networks, Components of NLP, Difficulties in NL, NLP Terminology, Steps in NLP, Implementation Aspects of Syntactic Analysis
- 5. Module 5: Expert Systems and Robotics:** Expert Systems, Capabilities of Expert Systems, Components of Expert Systems, Knowledge Base, Inference Engine, User Interface, Expert Systems Limitations, Applications of Expert System, Robots, Robotics, Difference in Robot System and Other AI Program, Robot Locomotion, Components of a Robot, Computer Vision, Tasks of Computer Vision, Application Domains of Computer Vision, Applications of Robotics

References:

- 1. Artificial Intelligence a Modern Approach:** Russel and Norvig, Pearson Education, 3rd Edition.
- 2. Artificial Intelligence – A Practical Approach:** Patterson, Tata McGraw Hill, 3rd Edition.
- 3. Artificial Intelligence and Machine Learning,** By Vinod Chandra S. S, 1st Edition.