COURSES OF STUDIES

PHD PROGRAM

(UNDER SEMESTER SYSTEM)

(Effective from January 2021)

GANGADHAR MEHER UNIVERSITY, SAMBALPUR, ODISHA

PROGRAM OUTCOMES(POs):

PO1. **Knowledge and Understanding**: Develop an ability to understand the theoretical foundations of computer science for designing efficient methodologies along with the knowledge of limitations of computing.

PO2. **General, Technical and Professional Skills:** An ability to function effectively as an individual with diversified skills or as a part of a multi-disciplinary team setting to accomplish defined goals.

PO3. **Application of Knowledge and Skills**: Developing problem analysis skills and knowledge and applying the same in real life situation.

PO4. **Research Skills:** Explore research based knowledge and carry out academic investigations on the cutting edge technologies in allied subjects of Computer Science.

PO5. **General Learning Outcomes:** Create, select and apply advanced techniques and tools including modelling complex activities related to Computer Science.

PO6. **Constitutional, Humanistic, Ethical and Moral Values:** Design, develop and evaluate new system components or processes of computer science that meet the desired needs with appropriate considerations of industry, society, public health, safety, culture, environment and sustainable development sticking on to the ethics and values.

PO7: Employability Job Skills and Entrepreneur Skills: Prepare the students to take up a career as versatile contributors in industry, academia, research and development or entrepreneurship employing their expertise to advance personal growth while making meaningful contributions to societal progress

PROGRAM SPECIFIC OUTCOMES(PSOs):

PSO1. To shield students from the rapid obsolescence of computer technology, the program focuses on imparting foundational knowledge, fostering critical thinking skills, and cultivating technical expertise.

PSO2. Apply principles of computer science theory and concepts of software development to create effective computing-based solutions.

PSO3. Empowering the students to function as adept computer science professionals across various domains, including industry, advanced studies, research and development, academia, or entrepreneurship.

SEMESTER SYSTEM OF PH.D.

Sl No.	Paper	Semester	Credit	(Marks) Mid Term + Term End	Teaching Hours
1	**611 (Departmental)**	**Sem-1**	**4**	**100 (20+80)**	**60 Hrs**
2	**612(Research Methgodology-1)**	**Sem-1**	**4**	**100 (20+80)**	**60 Hrs**
3	**613(Research Methgodology-2)**	**Sem-1**	**4**	**100 (20+80)**	**60 Hrs**
4	**Teaching Assignment**	**Sem-1**	**4**	**100 (0+100)**	**60 Hrs**
5	**Dissertation**	**Sem-2**	**08**	**200**	**120 Hrs**
	TOTAL		**24**	**600 (60+540)**	**360 Hrs**

Machine Learning and Data Analytics

Objective:

The objective of this course is to learn patterns and concepts from data using various machine learning techniques focusing on recent advances. Students will explore supervised and unsupervised learning paradigms, deep learning technique and various feature extraction strategies.

Pre-Requisites:

Knowledge of algorithms, optimization, and matrix theory is required.

Outcome:

Formulate and solve data analytics problems using linear models of regression and classification. Develop understanding of unsupervised learning models of dimensionality reduction and factor analysis. Understand neural networks and their applications to real-world problems. Apply the tools in cluster analysis, support vector machines and K-nearest neighbors.

UNIT-I:

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares and Multiple linear regression, Ridge regression, and Lasso, Linear Discriminant Analysis, Logistic regression, Bayes decision theory**.**

UNIT-II:

Dimensionality Reduction: Principal Components, Kernel PCA, Feature Selection, Matrix factorization and Collaborative filtering**.**

UNIT-III:
Neural Networks: Model of a neuron, LMS, Perceptron and its learning algorithm, MLP and Back Propagation algorithm, Radial Basis Function , Radial Basis Function Networks**.**

UNIT-IV:

Support Vector Machines (SVM) and Others: SVM for classification and Novelty detection (1-class classification), Decision Tree for Regression, Random Forests, and cluster analysis**.**

Text Books:

1. T. Hastie, R. Tibshirani, and J. Friedman, The Elements of Statistical Learning : Data Mining, Inference and Prediction, 2nd Edition, Springer Verlag, 2009.
2. S. Haykin, Neural Networks : A Comprehensive Foundation, 2nd Edition, Pearson Education, 1999**.**

Reference Books:

1. C. Bishop, Pattern Recognition and Machine Learning, 1st Edition, Springer, 2007.
2. T. Mitchel, Machine Learning, 1st Edition, McGraw-Hill Education, 1997.
3. G. James, D. Witten, T. Hastie, and R. Tibshirani, An Introduction to Statistical Learning with Applications in R, 7th Edition, Springer, 2013.
4. K. P. Murphy, Machine learning : A Probabilistic Perspective, 4th Edition, MIT Press, 2012

	COURSE OUTCOMES:
	After completion of this course successfully, the students will be able to-
CO1	Understand and apply the concept of classification and regression using bayes decision theory, Logistic regression, MLR, and LDA.
CO2	Handle course of dimensionality by applying featire selection and feature extraction technique such as PCA, matrix factorization, collaborative filtering.
CO3	Design neural network and RBF-network to solve machine learning problems.
CO4	Understand the concept of SVM, Decision tree, and RF and able to apply them to solve machine learning problems.
CO5	Understand the overall concepts of machine learning and able to apply them.

Mapping of COs to POs (1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3		3		3			3	3	3
CO2	3		3		3			3	3	3
CO3	3		3		3			3	3	3
CO4	3		3		3			3	3	3
CO5	3		3		3			3	3	3

PAPER-612/712
RESEARCH METHODOLOGY-I

Unit-I
SCOPE, PHILOSOPHY AND ETHICS OF RESEARCH AND ETHICS
   i)   Introduction and Scope
   ii)   Introduction to philosophy: definition, nature and scope, concept, branches
   iii)   Ethics: definition, moral philosophy, nature of moral judgments and reactions, Research ethics, Institutional ethics committee.
   iv)   Ethics with respect to science and research
   v)   Intellectual honesty and research integrity

Unit-II
SCIENTIFIC CONDUCT
   i)   Research problem: Identification, Selection, Formulation of research objectives
   ii)   Research design: Components, Types and Importance
   iii)   Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
   iv)   Redundant publications: duplicate and overlapping publications, salami slicing
   v)   Selective reporting and misrepresentation of data

Unit-III
TECHNICAL WRITING
   i)   Literature search technique, using SCOPUS, Google Scholar, PUBMED, Web of science, Indian Citation Index, and RG
   ii)   Types of technical documents; Full length research paper, Short/Brief communications, Letters to editor, Book chapter, Review, Conference report, Project proposal Components

of a full length research paper; , Rationale of the paper, Aims and objectives, Hypothesis building, Work plan, Materials and methodology, Results and discussion, Conflict of interest statement,

iii)   Components of a research proposal; Project summary Key words, Origin of the proposal, Major objectives Methodology, Instrument facility available in the PI's department, Overview of status of Research and Development in the subject, Importance of the proposed project in the context of current status.

iv)   Styles of referencing; APA, MLA, Oxford, Harvard, Chicago, Annotated bibliography, Tools for citing and referencing, Grammarly, Endnote etc, How to cite and how to do referencing

Unit-IV
PUBLICATION ETHICS
i)   Publication ethics: definition, introduction and importance
ii)   Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
iii)   Conflicts of interest
iv)   Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
v)   Violation of publication ethics, Subject specific ethical issues, FFP, authorship,
vi)   Identification of publication misconduct, complaints and appeals
vii)   Predatory publishers and journals
viii)   Plagiarism-Pitfall
ix)   Use of plagiarism software like Turnitin, Urkund and other open source software tools, . Complaints and appeals: examples and fraud from India and abroad

PAPER-613/713
RESEARCH METHODOLOGY-II

Unit-I
IPR AND CYBER LAW.
i)   Patents, Patent laws, process of patenting a research finding
ii)   Intellectual property (IP), Intellectual property right (IPR)
iii)   Copyright, Trademarks, GI
iv)   Cyber laws
v)   COPE

Unit-II
QUANTITATIVE DATA ANALYSIS
i)   Types of Data, Data Collection – Methods and Tools
ii)   Hypothesis testing
iii)   Normal and Binomial distributions and their property
iv)   Tests of significance: Student t- test, F- test, Chi-$square$ test
v)   Correlation and Regression
vi)   ANOVA – One-way and Two-way, Multiple-range test

Unit-III
COMPUTER FUNDAMENTALS
i)   Introduction to MS-Office software: MS-Word(Track change)
ii)   MS-Excel
iii)   MS-Power Point
iv)   Features for Statistical Data Analysis Tool Pack, SPSS

v)   Tables, Figures and Pictures using Excel
vi)   Preparation of Posters
vii)   Electronic submission of manuscripts
viii)   Communication skills, oral and poster

Unit-IV

ADVANCED TOOLS & TECHNIQUES IN RESEARCH

i)   Indexing databases
ii)   Citation databases: Web of Science, Scopus, etc.
iii)   Research Metrics
iv)   Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
v)   Metrics: h-index, g index, i10 index, altmetrics
vi)   Open access publications and initiatives
vii)   SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
viii)   Software tool to identify predatory publications developed by SPPU
ix)   Journal finder /journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

SEMESTER –I

Paper –614
Marks –100 (4 CH)

TEACHING ASSIGNMENT

SEMESTER –II

Paper –621

Marks–150+ 25+25 (8 CH)

DISSERTATION
(Thesis + Seminar Presentation of the Thesis + Viva –Voce)