RESEARCH METHODOLOGY IN COMPUTER SCIENCE AND ENGINEERING

Code: **PHD3001CS**
Duration of SEE:**3 hours**
Credits: **3**

Instruction: **3 periods per week**
SEE: **100 marks**

Course Objectives :

1. To understand the research process
2. To solve unfamiliar problems using scientific procedures
3. To pursue ethical research
4. To choose appropriate methods to collect the data and implement the problems identified.
5. To use appropriate tools for documentation and analysis of data

Course Outcomes:
On completion of this course, the student will be able to Implement:

CO-1Understand research problem formulation
CO-2 Design experiments
CO-3Analyze research related information
CO-4Write papers and thesis, Follow research ethics
CO-5 Use tools for analysis and thesis writing

UNIT-I

Introduction to Research Methodology:
Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Importance of Research Methodology, Research Process, Criteria and characteristics of good research, challenges encountered by researchers and benefits of research.

Defining the Research Problem:
Defining Research Problem, Problem Formulation, necessity of defining the Problem, Techniques involved in defining a Problem.

Literature Review:
Importance of Literature review, sources of Information, Assessment of quality of Journals and research Articles, Critical appraisal of Literature Review, arriving final problem.

UNIT-II

Research Design:
Meaning of Research Design, need of Research Design, Important concepts related to Research Design, Different Research Designs, Basic Principle of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes.

Research Tools:
Methods to search required information effectively, citation styles, reference management software's (Zotero/ Mendeley /Endnote).

Plagiarism:
Plagiarism & self-plagiarism consequence of plagiarism, unintentional plagiarism, copyright infringement. Software's for detection of plagiarism (Turnitin/iThenticate).

UNIT-III

Data Collection:
data types, collection of primary data, secondary data, Data organization, data validation, methods of data grouping, diagrammatic representation of data, Graphical representation of data, Sample design and population.

Data Analysis:
Mathematical modeling: definition of model, types of models, mathematical model and modeling of engineering systems, Probability and its distribution, hypothesis testing,
Test for significance: Chisquare, Student t-test, Regression modeling, ANOVA, F-test, Time Series analysis. Analysis of Data, role of Statisticsin Data Analysis, Parametric vs non Parametric methods, Descriptive Statistics. Concept of simulation and simulation methods etc.

UNIT-IV

Research Report Writing:
Format of the research report, preparation of Synopsis in an effective manner, thesis writing, arrangements of chapters and finalization of chapter names. Ethics and moral issues related to research and publishing.

Technicalpaperwriting:
Layout of a research paper, impact factor of journals, Research quality indicators (citations/ h-index/i10 index/cite score, etc.), research profile building (Orcid-id/Google Scholar id/ PubMed/ Scopus id/, etc.)
Research Proposal Preparation: Funding agencies in India and across the Globe, writing research proposal, Writing
Research Grant Proposal: Minor and Major Research proposals(UGC,DSTandAICTE).

UNIT V

Research Approaches in Computer Science:
System Building and Proof of Concept, System Modeling, Simulation tools and test beds, Data driven Discovery, Performance Evaluation and Verification tools.

References:

1. C.R Kothari, Research Methodology, Methods & Technique; New Age International Publishers,2004
2. R.Ganesan, Research Methodology for Engineers, MJPPublishers,2011
3. Vijay Upagade and Arvind Shende, Research Methodology, S.Chand & CompanyLtd.,New Delhi, 2009
4. P.Ramdass and Wilson Aruni; Research and Writing across the disciplines; MJP Publishers, Chennai, 2009.
5. Margaret Cargill and Patrick O'Connor; Writing Scientific Research Articles Strategy and Steps, A John Wiley & Sons, Ltd. Publication, 2009.
6. MLA Handbook for Writers of Research Papers, The modern language association of America, New York 2009.

30/6/2026

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Code: PHD3003CS

Instruction: 3 periods per week ***Duration of SEE: 3 hours***

SEE: 100 marks ***Credits: 3***

Course Objectives :

1. To familiarize the principles of Artificial Intelligence
2. To study the techniques for knowledge representation and inference
3. To learn the techniques involved in the creation of intelligent systems
4. To learn various concepts of fuzzy systems and its implementations
5. To study different applications like Game Playing Expert Systems, machine learning and natural language processing

Course Outcomes : At the end of the course the student will be able to:

CO-1 Use different logical systems for inference over formal domain representations.

CO-2 Formalize a given problem in the language/framework of different AI methods

CO-3 Design and perform an empirical evaluation of different algorithms on a problem Formalization.

CO-4 Implement different Machine Learning Algorithms.

CO-5 Apply NLP techniques to build new models.

UNIT - I

Overview of Artificial Intelligence: Introduction. The Turing Test, Strong AI versus Weak AI, Heuristics, Identifying Problems Suitable for AI, Applications and Methods, Early History of AI, Recent History of AI to the Present, AI in the New Millennium

Uninformed Search: Introduction: Search in Intelligent Systems, State-Space Graphs, Generate-and-Test Paradigm, Blind Search Algorithms, Implementing and Comparing Blind Search Algorithms

Informed Search: Introduction, Heuristics, Informed Search Algorithms – Finding Any Solution, The Best-First Search, The Beam Search, Additional Metrics for Search Algorithms, Informed Search – Finding An Optimal Solution, Informed Search – Advanced Search Algorithms.

UNIT V

Natural Language Understanding: Introduction, History of Natural Language Processing, Syntax and Formal Grammars, Semantic Analysis and Extended Grammars, Statistical Methods in NLP, Probabilistic Models for Statistical NLP, Linguistic Data Collections for Statistical NLP

References:

1. Stephen Lucci, Danny Kopec. Artificial Intelligence iMercury Learning and Information. 2nd Edition. 2016
2. Russell, Norvig: Artificial Intelligence, A Modern Approach, Pearson Education, Second Edition. 2004
3. Rich, Knight, Nair: Artificial Intelligence, Tata McGraw Hill, Third Edition 2009
4. Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011

30/6/2016

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DEEP LEARNING

Code: **PHD3002CS** Instruction:**3 periods per week**
SEE:**100 marks** DurationofSEE:**3 hours**
Credits: **3**

Course Objectives :

1. To introduce basic concepts of artificial neural networks and multilayer perceptrons
2. To understand various optimization techniques and implement the algorithms
3. To introduce basic concepts of CNN and VGG
4. To introduce recurrent neural networks and LSTM's
5. To introduce auto encoders and GAN's

Course Outcomes:

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

CO-1	Understand the problem of XOR separability and activation functions in ANN's
CO-2	Understand the problem of overfitting, underfitting, Gradient Descent and Stochastic Gradient Descent
CO-3	Demonstrate understanding of CNN's and VGG's
CO-4	Demonstrate understanding of RNN's and LSTM's
CO-5	UseautoencodersandGAN's

UNIT–I

Artificial Neural Networks: Introduction, Perceptron, XOR Gate, Perceptron Training Rule, Activation Functions **Linear Neural Networks:** Linear Regression, Implementation of Linear Regression, Softmax Regression, The Image Classification Dataset , Implementation of Softmax Regression

UNIT– II

Multilayer Perceptrons: Multilayer Perceptrons, Implementation of Multilayer Perceptrons , Model Selection, Underfitting and Overfitting, Weight Decay, Dropout, Forward Propagation, Backward Propagation, and Computational Graphs, Numerical Stability and Initialization, Considering the Environment, Predicting House Prices.
Optimization Algorithms: Optimization and Deep Learning, Convexity, Gradient Descent, Stochastic Gradient Descet, Minibatch Stochastic Gradient Descent, Momentum, Adagrad, RMSProp, Adadelta, Adam, Learning Rate Scheduling

UNIT– III

Introduction to Convolutional Neural Networks: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters
Modern Convolutional Neural Networks: Deep Convolutional Neural Networks (AlexNet), Networks Using Blocks (VGG), Network in Network (NiN), Networks with Parallel Concatenations (GoogLeNet), Batch Normalization, Residual Networks (ResNet), Densely Connected Networks (DenseNet).

UNIT–IV

Recurrent Neural Networks: Sequence Models, Text Preprocessing, Language Models and the Dataset, Recurrent Neural Networks, Implementation of Recurrent Neural Networks from Scratch, Concise Implementation of Recurrent Neural Networks, Back propagation Through Time.
Modern Recurrent Neural Networks: Gated Recurrent Units (GRU),Long Short Term Memory (LST), Deep Recurrent Neural Networks, Bidirectional Recurrent Neural Networks, Machine Translation and the Dataset, Encoder-Decoder Architecture, Sequence to Sequence, Beam Search

UNIT–V

Auto encoders: Types of Auto Encoders and its applications
Generative Adversarial Networks: Generative Adversarial Network, Deep Convolutional Generative Adversarial Networks

SuggestedReading:

1	Goodfellow, I., Bengio,Y:, and Courville, A., Deep Learning, MIT Press, 2016
2	Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, Dive into Deep Learning, 2020
3	Dive into Deep Learning — Dive into Deep Learning 0.16.6 documentation (d2l.ai)

26/6/2020

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