School of Mathematical and Computational Science
Dept. of Computer Science and Information Technology (CSIT)
Guru GhasidasVishwavidyalaya, Bilaspur, C.G.
Session 2021-22

Pre-Ph.D. COURSE WORK in Computer Science and Information Technology (CSIT)
Examination Scheme

- There shall be a Course Work Examination for all provisionally admitted students after at least six months from the commencement of classes of Pre-Ph.D. Course Work.
- For Pre-Ph.D. Course Work Examination, there shall be three papers of 100 marks each or such papers as mentioned in Ph.D. regulations/ Ordinances as amended from time to time.
- The duration of examination for each question paper shall be of three hours and there shall be two sections in each question paper in the following manner
  a. There shall be 10 (3 marks each) objective type or short-answer questions in first section/ part of the question paper for 30 marks.
  b. There shall be 05 (14 marks each) descriptive / essay/ interpretable type answer questions in second section/ part of the question paper for 70 marks.
- An Examinee has to secure minimum passing marks as per the ordinance of University in order to become eligible to continue in the program leading to the completion of Ph.D. thesis.
- Examinee of Pre-Ph.D. Course Work has to present a Seminar in the department. No marks shall be awarded for this Seminar presented by examinee; it can be assessed as Qualified / Not Qualified only. This qualifying seminar shall be evaluated by the concerned department only.

COURSE STRUCTURE

There should be **one compulsory paper, two optional papers** and **Seminar evaluations**. Students are required to choose any two (02) optional papers from the given list of five (5) papers approved by BOS. Scheme and syllabus for Ph. D. Course Work in CSIT are given in following table

Code	Subject	Max Marks	Min Passing Marks
PHDCS01 (Compulsory)	Fundamentals of Research in Science	100	As per PhD ordinance
Any two of the following			
PHDCS02	Soft Computing Techniques	100	
PHDCS03	Pattern Recognition	100	
PHDCS04	Nature Inspired Computing	100	
PHDCS05	Machine Vision	100	
PHDCS06	Design Patterns and Frameworks for Software Engineering	100	
PHDCS07	Machine Learning	100	
PHDCS08 (Compulsory)	Seminar	Qualified / Not Qualified	

PHDCS01: Fundamentals of Research in Science

1. PHILOSOPHY AND ETHICS
- Introduction to philosophy : Definition, nature and scope, concept , branches
- Ethics: Definition, moral philosophy, nature of moral judgement and reactions.

2. SCIENTIFIC CONDUCT
- Ethics with respect to science and research
- Intellectual honesty and research integrity
- Scientific misconducts: Falsification, Fabrications, and Plagiarism (FFP)
- Redundant publications: Duplicate and overlapping publications, Salami slicing
- Selective reporting and misrepresentations of data

3. PUBLICATION ETHICS
- Publication ethics: Definition, introduction and importance
- Best practices / Standard setting initiatives and guidelines: COPE, WAME, etc.
- Conflicts of interest
- Publications misconduct: Definition, concept, problems that lead to unethical behaviour and vice versa, types.
- Violation of publication ethics, authorship and contributorship
- Identification of publications misconduct, complaints and appeals
- Predatory publishers and journals.

PRACTICE
4. OPEN ACCESSPUBLISHING
- Open access publications and initiatives
- SHERPA/RoMEO online resources to check publisher copyright & self-archiving policies
- Software tools to identify predatory publications development by SPPU
- Journal finder/ Journal suggestion tools viz. JANE, Elsevier Journal finder,Springer Journal suggester, etc

5. PUBLICATIONS MISCONDUCT
A. Group Discussions
- Subject specific ethical issues, FFP, authorship
- Conflict of interest
- Complaints and appeals: example and fraud from India and Abroad

B. Software Tools
Use of plagiarism software like Turnitin, Urkund and other open source software tools

6. DATABASES AND RESEARCH METRICS

A. Databases
- Indexing and Databases
- Citation databases: Web of Science, Scopus, etc.

B. Research Metrics
- Impact factor of journals as per journal citation report, SNIP,SJR,IPP, Cite Score
- Metrics-index, h-index,g-index, i-10 index, altmetrics

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 Complete Research: Do not scooped; do not get plagiarized , ISBN: 978-9387480865
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 Academy Press.
5. Resnik, D. B. (2011). What is ethics in research & why it is important, National Institute of Environmental Health Sciences, 1-10. Retrieved from http://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
6. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.
7. http://doi.org/10.1038/489179aIndian National Science Academy(INSA), Ethics in Science Education, Research and Governance (2019), ISBN: 978-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Books.pdf

Recommended Books:
Ethics in Science
1. David B. Resnik (1998): The Ethics of Science: An Introduction. Routledge publisher, USA.
2. Callahan D. & Bok S. (1996): Ethics teaching in Higher Education. Plenum Press, New York, USA.
3. Kapur J. N. (1996): Ethical values Excellence in Education and Science. Wishwa
4. Prakashan, New Delhi. Tripathi A. N. (2008) : Human values. New Age International Publishers, New Delhi.`
Science Communication :
1. A. Willson: Handbook of Science Communication, 1998 Institute of Physics Publishing, Bristol, Philadelphia.
2. Stocklmayer, Gore MM, Bryant C.: Science Communication Theory & Practice; (Eds.) 2002, Springer.
3. Laszis P: Communicating Science, A practical Guide, 2006, Springer. Laszis P:Communicating Science: A practical Guide(2006), Springer.

PHDCS-02: Soft Computing Techniques

Introduction – What is soft computing? Different tools of soft computing and itscomparison, area of application.
Artificial Neural Network and Genetic Algorithm: Overview of biological Neurosystem, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back propagation algorithm, Multilayer perceptron model, RBF (Radial basis function) neural network, Recurrent neural network, Self-Organizing Map (SOM), Introduction to convolution neural network (CNN) and deep learning.
Genetic Algorithm (GA): Basic Terminologies in Genetic Algorithms - Individuals, Genes, Fitness, Populations, Working Principle, Encoding methods, Fitness function, GA Operators-Reproduction; Crossover; Mutation, Convergence of GA.
Fuzzy Logic – Type-1 Fuzzy logic: Basic definitions and terminology, Set theoretic operations, Membership function, Fuzzification and Defuzzification methods, Fuzzy inference System, Fuzzy rule Base, Fuzzy control system.
Hybrid soft computing: Hybrid Systems, Neuro Fuzzy Hybrid System, Neuro Genetic Hybrid System.

Experimental Work: Application of different soft computing tool in different problem domain.

Reference Books:
1. Uncertain rule-based fuzzy logic systems: Introduction and new directions byJerry M.Mendel ,Prentic Hall of India .
2. Intelligent hybrid System : Neural Network ,Fuzzy Logic and Genetic Algorithmby Da Ruan ,Kluwer Academics publishers
3. Neural Network ,Fuzzy logic and Genetic Algorithm :Synthesis and applicationby S. Rajshekhran and G.A. Vijay Laxmi ,PHI publication.
4. Fuzzy logic with engineering applications by Timothy J Ross, Wiley Publication
5. Neural network by Simon Haykins: Prentice Hall of India

PHDCS03: Pattern Recognition

Pattern Classification: Meaning of pattern, patterns classification, pattern recognition
Classification: Meaning of classification, supervised and unsupervised classification, k-nn,. Decision Trees, clustering, k-Means clustering
Data Mining: Meaning, concepts, types of databases for data mining, Dimensionality reduction, feature selection, Principal Component Analysis
Review paper on any ONE topic including research work carried up to currentyear.

Reference Books:
1. Pattern Classification: Duda, R.O., Hart, P.E., Stork, D.G., 2001. John Wiley and Sons (Asia) Pte. Ltd.
2. Data Mining : Concepts and Techniques - Jiawei Han, MichelineKamber,Morgan Kaufmann,Harcourt India 2001.
3. Data Mining Methods for Knowledge Discovery - Cios, Pedrycz, Swiniarski,Kluwer Academic Publishers, London – 1998.

PHDCS04: Natured Inspired Computing

Genetic algorithm: Encoding, fitness function evaluation, selection, crossover, mutation, Real coded GA, Adaptive GA: adaptive crossover probability and adaptive mutation probability. Differential Evolution (DE): Generation of population, mutation, crossover, comparison with GA. Multi-Objective GA(NSGA-II) : Single/multi-objective, domination, non-domination, Pareto front, generation of population, fitness function evaluation, non-dominated sorting, crowding distance, selection, crossover, mutation, flowchart.
Particle swarm optimization (PSO): Generation of population, fitness function evaluation, updation equations, flowchart of PSO, comparison with GA. MultiobjectivePSO(MOPSO) : External repository, archive controller, archive grid, velocity calculation, position update, flow chart. Cat swarm optimization (CSO) : Generation of cat population, seeking mode, tracing mode of cats, algorithm, updation equations.
Ant colony optimization (ACO): Introduction, tabu list, pheromone, symmetrical and unsymmetrical traveling sales man problem. Bacterial foraging optimization (BFO) : Introduction of E-coli bacteria, chemotaxis, swarming, reproduction, elimination and dispersal.

Applications: Parameter estimation, channel equalization, prediction of exchange rates and stock market, classification, Portfolio optimization and forecasting scheme.

Text Books :
1. Fundamentals of computational swarm intelligence by A. P. Engelbrecht, Wiley Publication, 1st Edition, 2005.
2. Differential Evolution : Fundamentals and applications in electrical engineering by Anyong Qing, IEEE Press, 2009.

References: Research papers

PHDCS05: Machine Vision

Machine Vision: Introduction of Machine Vision, Applications, Algorithms.

Image Formation and Image Analysis: Image enhancement, Frequency analysis, Segmentation, Morphology and Object analysis, Augmented Reality and Virtual Reality, Construction of 3D model from images, Image Processing and Feature Extraction, Image Watermarking, Motion Estimation.

Camera Technology, Systems For Machine Vision and Digital Imaging: Analog and digital Camera, Pinhole camera model, Perspective geometry , Simple Lens Model ,Selection of Lens, Camera Parameters. Calibration: Perspective Projection, Calibration Matrix, Orthographic projection, Calibration Procedure, Solving for Calibration Matrix, Solving for Camera Parameters.

Graphics and 2D Measurement Methods: Introduction of Graphics and Its applications, Modelling transformation, Coordinate systems, Clipping, Windows and Viewports, Wireframe models, Models for illumination (Diffused, directed, structured, and polarized light), Optics, Animation Techniques.

3D Measurement Methods: Visual Reconstructions and Image Recognition, Object/scene/activity categorization, Object detection and algorithms, Supervised and Unsupervised classification algorithms, Probabilistic models for sequence data, learning to rank , Active learning , Dimensionality reduction and manifold learning, Nonparametric methods and big data, Deep learning, convolution neural networks, Scene Recognition with Bag of Words, Shading and smoothing techniques, Crowd sourcingand dataset creation.

Reference Books:
1. Carsten Steger Markus Ulric, Christian Wiedermann, Machine Vision Algorithms andApplications,Wiley-VCH,978-3-527-40734-7.
2. Faugeras, O. Three Dimensional Computer Vision. The MIT Press, 1993.
3. Gonzales/ Woods/ Eddins, Digital Image Processing using MATLAB, 2nd edition,
4. Gatesmark Publishing, ISBN 9780982085400.
5. N.Efford, Digital Image Processing, Addison Wesley 2000, ISBN 0-201-59623-7.
6. M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS1999, ISBN 0-534-95393-X.
7. W K Pratt, Digital Image Processing, John Wiley and Sons, 1991, ISBN 0-471-85766-1.
8. R Jain, R Kasturi and B G Schunck, Machine Vision, McGraw-Hill, 1995, ISBN 0-07-113407-7.
9. Goodfellow, Bengio, and Courvill, Deep Learning, 2016.
10. http://www.deeplearningbook.org/
11. Hearn and Baker, Computer Graphics, C Version, 2nd ed. ISBN 0-13-530924-7.
12. Alan Watt, 3D Computer Graphics, 3rd ed. ISBN 0-20-139855-9.
13. Understanding Virtual Reality, interface, Application and Design, William R.Sherman, AlanCraig, Elsevier(Morgan Kaufmann).

Additional reading: Research Papers

PHDCS06: Design Patterns and Frameworksfor Software Engineering

Introduction: What is Design Pattern and Framework, Describing Design Patterns and Frameworks, Catalog of Design Patterns and Frameworks, Organizing the Catalog,
Design Patterns Problems and Solutions: Solving Design Problems by with Design Patterns, How to select a Design Pattern or a Framework, How to use a Design Pattern or a Framework.
Creational Patterns: Abstract Factory, Builder, Factory Method.
Structural Patterns: Adapter, Bridge, Composite.
Behavioural Patterns: Chain of Responsibility, Command, Interpreter

References:

1. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, 1942, Design Patterns: Elements of Reusable Object-Oriented Software, Addifson-Wisley.
2. Eric Freeman, Elisabeth Freeman, Kathy Slera and Bert Bats, 2004, Head First Design Patterns, O'reilly.

PHDCS07: Machine Learning

Introduction: What is Machine learning, Types of Machine Learning, Learning from Examples, Learning agents, Inductive learning, Decision tree learning. Data sets for machine learning, data normalization.
Classification: Meaning of classification, supervised and unsupervised classification, K-NN, Decision tree, support vector machine, clustering, K-mean clustering, and Ensemble techniques.
Introduction to Image Processing and Classification: Image Processing,Goals and Tasks, Image Enhancement,Edge Detection, Segmentation,Image classification using CNN.
Machine Learning Tools: Different machine learning tools for analysis of data in different domains.

Reference Books:

1. Data mining concepts and techniques by J. Han and M. Kamber, Morgan Kaufmann, San Francisco, 2006.
2. Artificial Intelligence by Elaine Rich – Mc. Graw Hill, 2009.
3. Introduction to Machine Learning by Ethem Alpaydin, Fourth Edition.
4. Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods,Third Edition.

PHDCS08: Seminar
There shall be a Seminar presentation for each pre Ph. D. course work student. An Examinee shall be awarded either "Qualified" or "Not Qualified". Marks shall not be allotted for it.