



झारखण्ड केन्द्रीय विश्वविद्यालय
Central University of Jharkhand
(Established by an Act of Parliament of India, 2009)

Ranchi
Centre for Computer Science & Technology

(Session July 2018/June 2019)

School: School of Natural Sciences

Course Name: Doctor of Philosophy (Ph.D.)

Intake: 2

Eligibility: Masters degree with minimum 55% Marks in Information Technology, Computer Science, Computer Engineering and Computer Applications. (Relaxation in minimum marks as per the GoI norms)

Research Area/ Specializations: Research area /specialization may be decided by the availability of the expertise in the centre however committee members suggested the following major thrust areas.

- Network Security,
- Computer Databases,
- Cloud Computing,
- Soft Computing .



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Ph.D. Course Work for Computer Science & Technology
(Session July 2018/June 2019)

Introduction:

The course work for the doctoral research has been made mandatory by the UGC. Central University of Jharkhand has decided to implement this aspect on the immediate basis for the benefit of the students pursuing Ph.D. The course work is designed in such a way as to support, motivate and encourage quality research. By undergoing this course work, the student will get equipped with fundamentals of research methodology, scientific communication and also recent developments in the field of research. The course work has to be completed by the student in a satisfactory way before submission of his/her dissertation/ thesis.

COURSE STRUCTURE

Based on New Ph.D. ordinance 2018, a Ph.D. student has to complete minimum 12 credits of course work.

Syllabus for Papers in PhD. Course work in Centre for Computer Science and Technology 2018 onwards.						
L – Lecture, T- Tutorial, P – Practical (Lab), Cr – Credits.						
Compulsory Paper						
S. No.	Course Code	Course Title				Cr
			L	T	P	
1	COM916010	Research Methodology	3	1	0	4
Total Credits						
Based on the suggestions of Ph.D. Supervisor, the Ph.D. student has to take at least TWO papers from the following list of Papers.						
S. No.	Course Code	Course Title				Cr
			L	T	P	
2	COM916020	Parallel Processing	3	1	0	4
3	COM916030	Network Security	3	1	0	4
4	COM916040	Computer Databases	3	1	0	4
5	COM916050	Cloud Computing	3	1	0	4
6	COM916060	Introduction to Soft Computing	3	1	0	4
7	COM916070	Programming fundamentals with Python	3	1	0	4
8	COM916080	Object Oriented Programming with Java	3	1	0	4
9	COM916090	Advance Cryptography	3	1	0	4
10	COM916100	Advance Graph Theory	3	1	0	4
11	COM916110	Probability and Statistics	3	1	0	4
12	COM916120	Advance Numerical Methods	3	1	0	4
13	COM916130	Data Structure and Algorithm	3	1	0	4
Total Credits						

Syllabus of PhD Course Work

1. COM916010: Research Methodology

Objective, Scientific methods and its characteristics, Motivation, Utility, Plagiarism, Types of research, Tools of research: Library, The internet, Measurements for Computer Science research, Statistics, ,The research problems: Finding a problem, stating the problem, identifying sub-problems. Research methodology: Quantitative and qualitative approach , current trends in research.

Review of related literature: introduction, including literature in research proposal. Critique, Survey & Peer review process. Formulation of hypothesis,

Planning the research project: Research planning, Data Collection, Interpretation of Data, Data analysis tools,

Conducting research in Computer Science: Software and hardware implementation, debugging, and evaluation. Use of tools / techniques for research.

Writing the research papers: Characteristics of a paper, Weaknesses of proposals, Final paper presentation. Practical implementation of Latex and Beamer

Texts/References

1. R. Pratap: Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Oxford, 2010.
2. Peffers, Ken, et al. "A design science research methodology for information systems research." *Journal of management information systems* 24.3 (2007): 45-77.

2. COM916020: Parallel Processing

Introduction to parallel processing, Types of parallelism Classes of parallel computers, SIMD and MIMD architectures Multicores and GPUs, Scalability Issues, Interconnection networks Routing and communication techniques,

Inter process communications, SIMD, MIMD and SPMD , Computing styles of commercial machines. Performance Analysis Methods, Distributed memory message passing programming (MPI), Shared memory programming (Threads), SIMD and GPU programming, Comparison of programming models, Parallel Algorithms, Resource Management

Heterogeneous systems, Clustering, Cloud Computing, Grid Computing . IoT and IoE

Texts/References

1. Kumar, Vipin, et al. *Introduction to parallel computing: design and analysis of algorithms*. Vol. 400. Redwood City: Benjamin/Cummings, 1994.
2. Quinn, Michael J., and Michael Jay Quinn. *Parallel computing: theory and practice*. Vol. 2. New York: McGraw-Hill, 1994.

3. COM916030: Network Security

Network Security, Service Security, Application Security, Security Architecture, Data Protection on Internet, Introduction to Wireless Internet Security, Wireless Networks Work, Wireless Security Threats, Public Wi-Fi Security, Wireless Network Administration, Security Technology: Firewall and VPNs, Intrusion Detection Systems, Network and Denial of Services Attack, Reconnaissance of Physical Security, Data protection through encryption.

Texts/References

1. Poole, Owen. *Network Security: A practical guide*. Routledge, 2003.
2. Kizza, Joseph Migga. *Computer network security*. Springer Science & Business Media, 2005.

4. COM916040:: Computer Databases

Introduction Database and Database management Systems, **Database Architectures, Designing Databases.** Relational database model: Logical view of data, keys, integrity rules.

Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).

Transaction management: ACID properties, serializability and concurrency control. Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.

Texts/References

1. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill ,
2. Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning

5. COM916050:: Cloud Computing

Distributed Computation, Load Balancing, Heterogeneous systems,

Clustering, Grid Computing, Cloud Computing, IoT and IoE

Management and Security in the Cloud, Virtual Private Cloud (VPC) and Directory Service

Texts/References

1. Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. *Cloud computing: Principles and paradigms*. Vol. 87. John Wiley & Sons, 2010.
2. Wang, Lizhe, et al., eds. *Cloud computing: methodology, systems, and applications*. CRC Press, 2017.

6. COM916060:: Introduction to Soft Computing

Introduction to Soft Computing, Fuzzy System: Fuzzy, Relation, Arithmetic's.

Artificial Neural Networks: Introduction, Neuron Physiology, Artificial Neurons, Artificial Neural Networks, Features of Artificial Neural Networks, Back propagation Training Algorithms. Genetic Algorithms and Evolutionary Programming: Introduction, Genetic Algorithms, Procedures of Genetic Algorithms,

Introduction: Evolutionary Programming, Swarm Intelligent Systems, Ant Intelligent Systems. Introduction to Probabilistic reasoning

Texts/References

1. N. P Padhy: *Artificial Intelligence and Intelligent Systems*, 1st Edition, Oxford University Press India, 2005.
2. Dan W. Patterson: *Introduction to Artificial Intelligence and Expert Systems*, 1st Edition, Phi Learning, 2009.

7. COM916070:: Programming fundamentals with Python

History of Python, Python Features, Basic Syntax

Variable Types, Basic Operators, Decision Making and loops.

Introduction : Strings, lists, Tuples. Basics of Functions and File Input/Output

Texts/References

1. Lutz, Mark. *Learning Python: Powerful Object-Oriented Programming*. " O'Reilly Media, Inc.", 2013.2.
2. Arbuttle, Daniel. *Python Testing: Beginner's Guide*. Packt Publishing Ltd, 2010.

8. COM916080:: Object Oriented Programming with Java

Concepts of OOPS, concepts of classes and objects, features of java, JVM Architecture, Data Types, Operators, Arrays, Command Line Arguments, OOPS in java, Abstract Classes, Interfaces, Packages, Access modifiers, Access Specifiers, Exception Handling.

Texts/References

1. H. Schildt: *The complete Reference*, 8th Edition, Tata McGraw Hill, 2011.
2. K. Sierra, B. Bates; *SCJP Sun certified Programmer for java 6 study Guide*, Tata McGraw Hill, 2008.
3. E. Balagurusamy: *Programming with java*, 4th Edition Tata McGraw Hill 2009.

9. COM916090:: Advance Cryptography

Introduction to basic terminologies associated with Cryptography, DES (Data Encryption Standard) and AES (Advanced Encryption Standard).

Public Key cryptosystems, Description of RSA, Rabin cryptosystem, Diffie-Hellman key exchange, ElGamal cryptosystem, Cryptanalysis of Public Key cryptosystem, Digital signatures, Mathematical problems related to cryptography, Division Algorithm and extended Division Algorithm, Fast Exponentiation, Factoring problem, Different factorisation Algorithm, Discrete Log Problem, Discussion of different algorithm for finding discrete log.

Texts/References

1. J. A. Buchmann: *Introduction to Cryptography*, Springer, 2004.
2. N. Koblitz: *A Course in Number Theory and Cryptography*, Springer, 1994.
3. M. Welschenbach: *Cryptography in C and C++*, 2nd edition, Apress, 2002.

10. COM916110:: Advance Graph Theory

Introduction to Graphs and Sub graphs, Graph isomorphism, The incidence and adjacency matrices, Application: The Shortest path problem, Dijkstra algorithm, Warshall Algorithm.

Trees:- Trees, Cut Edge and Bond, Cut vertex, spanning trees, Prim's Algorithm, Kruskal's Algorithm. Euler tour and Hamilton's Cycles, characterization of Eulerian graphs, a necessary and some sufficient characterizations of Hamiltonian graph.

Matchings: Theorem of Berge, Matchings and coverings in Bipartite graphs, Application: Hall's marriage theorem,

Connectivity: m-connectivity and blocks, Construction of Reliable Communication Networks.

Coloring: Chromatic Number, Brook's Theorem, 4-color theorem.

Texts/References

1. F. Harary: *Graph Theory*, Westview Press, 1994.
2. R.J. Wilson: *Introduction to Graph Theory*, 4th edition, Pearson, 2002.
3. J. Clark and D. A. Holton: *A First Look at Graph Theory*, World Scientific, 1991.
4. D.B. West: *Introduction to Graph Theory*, 2nd edition, PHI Learning, 2009.
5. N. Deo: *Graph Theory with Applications to Engineering and Computer Science*, Prentice-Hall of India, 2004.

11. COM916110:: Probability and Statistics

Probability as a measure of uncertainty, probabilities for events, axioms, probability rules, Fail time data analysis, Hazard models, conditional probability, Bayes' rule, random variables, probability distributions, discrete and continuous distributions, univariate and multivariate distributions, joint, marginal, conditional distributions, expected values (mean, variance, covariance), sampling/simulation, study of a population or distribution, System reliability, Stochastic process, Software tools for Mathematical and statistical analysis.

Text/References

1. Rohatgi, Vijay K. *An introduction to probability and statistics/by Vijay K. Rohatgi, AK Md. Ehsanes Saleh*. No. 519.2 R6..
2. Baisnab, A. P., and AP Baisnab Manoranjan Jas. *Elements of probability and statistics*. Tata McGraw-Hill Education, 1993.
3. Mendenhall, William, Robert J. Beaver, and Barbara M. Beaver. *Introduction to probability and statistics*. Cengage Learning, 2012.

12. COM916120: Advance Numerical Methods

Nature of numerical computations: errors and their propagation, convergence and stability of numerical algorithms; efficiency and arithmetic, complexity.

Numerical solution of systems of linear equations: Direct methods for solving linear systems.

Interpolation: Interpolating polynomial and its construction using Lagrange methods and methods of differences, iterated interpolation, method of divided differences,

Numerical Integration: Newton-Cotes integration formulas. Gaussian Quadrature. Asymptotic error formulas and their applications. Numerical Differentiations.

Ordinary differential equations: Numerical solutions of IVP, Runge-Kutta method, finite difference methods, shooting methods.

Texts/References

1. Hildebrand, Francis Begnaud. *Introduction to numerical analysis*.
2. Suli, Endre, and David F. Mayers. "Solution of equations by iteration." *An Introduction to Numerical Analysis* (2003).

13. COM916130:: Data Structure and Algorithm

Data structures: Elementary Data Structures, Linked lists, Stacks, Queues, Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Search Trees ,Binary search trees, Red Black Trees.

Advanced Data Structures: B –Trees, Binomial Heaps, Fibonacci Heaps, Data Structures for Disjoint Sets

Introduction to Algorithms, algorithms as a technology, Analyzing algorithms , Designing algorithms, Asymptotic notations, standard notations, common functions, Recurrences substitution method, master method. Elementary graph algorithms

Texts/References

1. Introduction to Algorithms, second edition, T. H. Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, PHI Pvt. Ltd./ Pearson Education