ANNEXURE-I

HIMACHAL PRADESH UNIVERSITY

Ph.D. (Computer Science)

Revised in 2016

The course work for Ph. D. Computer science is as under:

Paper Code	Paper Title	Periods Per Week (Theory/ Practical)	Examination	Internal Assessment	Max. Marks	Exam Duration Hours
Compulsory Subject:						
PhD-CS-01	Research Methodology in Computer Science	4	**50**	**50**	100	3
Elective Subjects:						
PhD-E-01	Algorithm Analysis & Design	4	**50**	**50**	100	3
PhD-E-02	Advanced Software Engineering	4	**50**	**50**	100	3
PhD-E-03	Advanced Database Concepts	4	**50**	**50**	100	3
PhD-E-04	Advanced Network Technologies	4	**50**	**50**	100	3
PhD-E-05	Parallel Processing Architectures	4	**50**	**50**	100	3
PhD-E-06	Advanced Computer Architecture	4	**50**	**50**	100	3

The candidate has to qualify two papers i.e. One compulsory subject and one of the elective subject out of the list of given subjects. The examinations evaluation will be done external. The pass marks in each subject will be 50%.The candidate is required to pass Internal & External examination separately. The internal evaluation will be done on the basses of following:

1. Sessional examination
2. Term papers
3. Seminars
4. Regularity (attendance)
5. Quiz etc.

PhD-CS-01 Research Methodology in Computer Science

4 Hours Per Week

UNIT-I

Research Aptitude: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is done.
Research Process: Reviewing the literature, Formulation of research problem, Nature and type of variables, Hypothesis - meaning, types, development of hypothesis and its testing, Meaning & Functions of Research Design

UNIT-II

Data Analysis: Sources, acquisition and interpretation of data, Quantitative and qualitative data, Graphical representation and mapping of data, Sensitivity Analysis with Data Tables, Optimization with EXCEL Solver, Summarizing Data with Histograms and Descriptive Statistics, Pivot Tables, Summarizing Data with database statistical functions, using correlation, Multiple Regression, Using Sampling to Analyze Data

UNIT-III

Significance of Report Writing : Different Steps in writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report, Art of scientific writing- Steps to better writing, flow method, organization of material and style, Drawing figures, graphs, tables, footnotes, references etc. in a research paper

UNIT-IV

Use of Internet in Research Work : Use of internet networks in research activities in searching material, paper downloading, submission of papers, relevant websites for journals and related research work. Introduction to Patent laws etc., process of patenting a research finding, Copy right, Cyber laws.

References:

1. Kothari, C. R., "Research Methodology Methods and Techniques", Wiley Eastern Ltd.
2. Wayne L. Winston, "Microsoft Excel Data Analysis and Business Modeling" , Microsoft Press.
3. Kumar, "Research Methodology: A Step-by-Step Guide for Beginners", Pearson Education.
4. Dawson, C., "Practical Research Methods" , UBSPD Pvt. Ltd.
5. Sharma, N. K., "Research Methodology" , KSK Publishers.

Note: In each theory paper, total eight questions are to be set, two questions from each of the four units. One question from each of these four units is to be attempted.

PhD-E-01 Algorithm Analysis & Design

4 Hours Per Week

UNIT-I

Introduction: Algorithms, Analyzing Algorithms, Designing Algorithms, Asymptotic Notations.
Data Structures: Elementary Data Structures, Hash Tables, Binary Search Trees, Red Black Trees, Skip lists, Binomial Heaps, Fibonacci Heaps, Perfect Hashing, Cuckoo Hashing

UNIT-II

Design and Analysis Techniques: Divide-and-conquer, Dynamic Programming, Greedy Method,
Amortized Analysis.
Sorting & Searching: Simple Sorting Algorithms, Radix Sorting, Heap sort, Quick sort, Linear and Binary search algorithms.

UNIT-III

Algorithms on Graphs: Elementary Graph Algorithms, Single Source Shortest Paths, All Pairs Shortest Paths, Minimum spanning trees, Steiner trees.

UNIT-IV

Advanced Algorithms: Matrix operations, String Processing, Approximation Algorithms.

References:

1. Cormen T.H., Leiserson C.E., Rivest R.L., Introduction to Algorithms Prentice Hall India.
2. Horowitz E., Sahni S., Rajasekaran S., Computer Algorithms , Galgotia Publications.
3. Aho A.V., Hopcroft J.E. Ullman J.D., The Design and Analysis of Computer Algorithms , Pearson Education Asia.
4. Knuth D.E., The Art of Computer Programming Volume 1 (Fundamental Algorithms) , Narosa Publishing House.
5. Knuth D.E., The Art of Computer Programming Volume 3 (Sorting and Searching) , Addison- Wesley.

Note: In each theory paper, total eight questions are to be set, two questions from each of the four units. One question from each of these four units is to be attempted.

PhD-E-02 Advanced Software Engineering

4 Hours Per Week

UNIT-I

Software Project Management: Software Project Planning, Conventional Software Management, Evolution of Software Economics, Improvement of Software Economics, Project Metrics.

UNIT-II

Software Configuration Management: Configuration Management, Change Management, Version Management, Build and Release Management.
Software Quality: Introduction, Software Quality Assurance, Quality Models, Study of Quality Metrics.

UNIT-III

Software Reuse: Motivation, Inhibitors, Techniques - Component Based Software Engineering, Process Models, Reuse Metrics

UNIT-IV

Software Re-engineering: Introduction Re-engineering, Restructuring and Reverse Engineering, Re-engineering existing systems, Data Re-engineering and migration, Software Reuse and Reengineering, Reengineering Metrics.

References:

1. Walker Royce, "Software project management", Pearson Education, ISBN: 9780201309584, 2004.
2. Robert S. Arnold, "Software Re-engineering ", IEEE Computer Society.
3. R. Pressman, "Software Engineering : A Practitioner's Approach", McGraw Hill.
4. Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishers, 1992.
5. Ghezzi, Carlo, "Fundamentals of Software Engineering", Prentice Hall India.

Note: In each theory paper, total eight questions are to be set, two questions from each of the four units. One question from each of these four units is to be attempted.

PhD-E-03 Advanced Database Concepts

4 Hours Per Week

UNIT-I

Data Base Analysis and Design Techniques: Database Design Methodologies: Conceptual, Logical, Physical Designs, ER Modeling: Specialization, Generalization, Aggregation, Normalization Theory.

UNIT-II

Distributed Databases Concepts : Functions and Architecture of a DDBMS, Data Allocation, Fragmentation and Query Optimization, Transparencies in DDBMS.

UNIT-III

Object Oriented DBMSS Concepts and Design: Abstraction, Encapsulation, object Identity, Methods, Classification and Inheritance, Overloading, Overriding, Polymorphism, Complex Objects, storing objects in Relational Databases, Pointer swizzling techniques, Persistence schemes, versions and schema evolution, Object Relational Databases and Nested Relational model.

UNIT-IV

Data Warehousing: Introduction, Decision Support, Creating and Maintaining a Warehouse, OLAP, Multidimensional Data Model, Data Warehouse Architecture, OLAP and Data Cubes, Operations on Cubes, Data Preprocessing, Need for Preprocessing, Multidimensional Data Model, Study of Data preprocessing, Need for Preprocessing, Simulating and maintaining a Warehouse, Analysis of Data preprocessing.

Data Mining: Introduction, Data Mining Functionalities, Clustering - k means algorithm, Classification - Decision Tree, Baysian Classifiers, Outlier Analysis, Association Rules - Apriori Algorithm, Introduction to Text Mining, Implementing Clustering - k means algorithm, Analysis of Decision tree.

References:

1. Thomas Conolly, Carolyn Begg, "Database Systems" , Pearson Education, Third Edition.
2. Navathe and Ellmassri, " Fundamentals of Database Systems" , Pearson Education, Fourth Edition.

Note: In each theory paper, total eight questions are to be set, two questions from each of the four units. One question from each of these four units is to be attempted.

PhD-E-04 Advanced Network Technologies

4 Hours Per Week

UNIT-I

Data Link Layer: Framing techniques, Flow control, Error Control, data link protocols, MAC protocols and IEEE standards.

UNIT-II

Network & Transport layer design Issues: Routing algorithms, Congestion control algorithms, Internetworking, Services and elements of Transport protocols.
Network Security: Authentication & E mail Security, Security attacks and their preventions

UNIT-III

IP Security: IP security overview, IP Security Architecture, Authentication Header Encapsulating Security Pay load.

UNIT-IV

Wireless LANs: Introduction, Benefits, WLANs Configurations and Standards, Security, IEEE 802.11, Wireless LAN Standard, Blue tooth.

References:

1. B.A. Forouzan, "Data Communication & Networking ", McGraw Hill.
2. A.S. Tanenbaum, "Computer Networks", Prentice Hall, 3rd Edition.
3. William Stallings, "Data & Computer Communication", McMillan Publishing Co.
4. Black, "Data Networks ", Prentice Hall India, 1988.
5. Fred Halsall, " Data Communications, Pearson Education.

Note: In each theory paper, total eight questions are to be set, two questions from each of the four units. One question from each of these four units is to be attempted.

PhD-E-05 Parallel Processing Architectures

4 Hours Per Week

UNIT-I

Introduction to Parallel Processing: Flynn's classification, SIMD and MIMD operations, Shared Memory vs. message passing multiprocessors, distributed shared memory, Hybrid multiprocessors

UNIT-II

Shared Memory Multiprocessors: SMP and CC-NUMA architectures, Cache coherence protocols, Consistency protocols, Data pre-fetching, CC-NUMA memory management, SGI 4700 multiprocessor, Network Processors

UNIT-III

Interconnection Networks: Static and Dynamic networks, switching techniques, Routers, Internet techniques

UNIT-IV

Message Passing Architectures: Message passing paradigms, Grid architecture, Workstation clusters, User level software
Scheduling: Multiprocessor Programming Technique, Scheduling and mapping, Internet web servers, P2P, Content aware load balancing

References:

1. Michael J. Quinn, "Parallel Computing: Theory and Practice", Tata McGraw-Hill.
2. C. Xavier and S. S. Iyenger, "Introduction to Parallel Algorithms", Wiley-Interscience Publication.
3. Wilkinision, "Parallel Programming" , Prentice Hall India.

Note: In each theory paper, total eight questions are to be set, two questions from each of the four units. One question from each of these four units is to be attempted.

PhD-E-06 Advanced Computer Architecture

4 Hours Per Week

UNIT-I

Parallelism in Uniprocessor Systems: Trends in parallel processing, Basic Uniprocessor Architecture, Parallel Processing Mechanism.
Parallel Computer Structures: Pipeline Computers, Array Computers, Multiprocessor Systems

UNIT-II

Architectural Classification Schemes : Multiplicity of Instruction-Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining
Pipelining: An overlapped Parallelism, Principles of Linear Pipelining, Classification of Pipeline Processors, Superscalar Pipeline Design, Superpipelined Design

UNIT-III

Structures for Array Processors : SIMD Array Processors, SIMD Computer Organizations, Inter-PE Communications
SIMD Interconnection Networks: Static versus Dynamic Networks, Mesh-Connected Illiac Network, Cube Interconnection Networks

UNIT-III

Multiprocessor Architectures: Functional Structures: Loosely Coupled Multiprocessors, Tightly Coupled Multiprocessors
Interconnection Networks: Time Shared for Common Buses, Crossbar Switch and Multiport memories.

References:

1. Faye A. Briggs, "Computer Architecture and Parallel Processing" , McGraw-Hill International Editions
2. John D. Carpinelli, "Computer Systems Organization & Architecture" , Addison Wesley.

Note: In each theory paper, total eight questions are to be set, two questions from each of the four units. One question from each of these four units is to be attempted.