Ph.D. Entrance Test (PET) Syllabus for Computer Science (Faculty of Computer Studies) W.e.f. 2013

Paper-I Section-B (40 Marks)

Multiple choice Questions on following topics (Based on UG Level)

1. **Computer Fundamentals**
   Type of Computer, Types of Memory, I/O Devices, Language translator (Assembler, Interpreter, Compiler) , Basic logic gates (AND, OR, NOT), Combinational and sequential logic design.
   Suggested Readings:

   1. Personal Computer Interfaces: By Michel Hordeski - McGrow Hill
   2. Microprocessor & Microcomputer based systems Design: By M.Rafiquzzazamal
   3. Computer system & Architecture (3rd Edition)Prentice Hall Of India :Mano m.
   4. Computer Organization & Design : By Pal Chaudhary P
   5. Introduction to Digital Computer Design :By V.Rajaraman & Radhakrishnan
   6. Computer Organization & Architecture :By W.Stalling

2. **Computer Networks**
   A Communication model, Data Communication, Networking types (LAN, WAN, MAN), Types of signals(Analog & Digital.),Data encoding techniques, Bandwidth concepts, Channel capacity, Synchronous and asynchronous transmission. Magnetic media(Twisted Pair, Coaxial cable. Fiber optics. Infrared. Microwave.) Topologies with advantages & disadvantages(Bus, Ring, Star, Tree , Mesh.)
   Suggested Readings:
   1 Computer Networks Third Edition By Andrew S. Tanenbaum.
   2 John Freer Pitman, Computer communication and network,, Computer system series,. (1980)
   3 Sitnie, Computer Network (TCP/IP), Tata McGraw Hill. (1996), India.
   4 Willams Stallings, .Data & computer communications Pearson Education Asia , Sixth Edition –2002
   5 R.S. Rajesh, K.S. Easwarakumar & R. Balasubramanian-Computer Networks - funtamentals andApplications– First Edition , Vikas Publications New Delhi, 2002

3. **Operating System**
   DOS : Booting processing, formatting, directory structure, FAT
   Introduction of Windows O.S.: files and Folders, Architecture of windows O.S ,Study of windows directories. Basics of windows: Desktop, My computer, Recycle bin, my network places, Quick launch tool bar, GUI, Multitasking, multi-user, network etc. Important files of windows and their locations (For e.g. DLL, INI etc.) ,
   Introduction to Linux Operating System,

Main functions of operating systems. Multiprogramming, multiprocessing, and multitasking. *Memory Management* : Virtual memory, paging, fragmentation.
Concurrent Processing : Mutual exclusion, Critical regions, lock and unlock.
Scheduling : CPU scheduling, I/O scheduling, Resource scheduling, Deadlock and scheduling algorithms. Banker's algorithm for deadlock handling.

Suggested Readings:

1. Operating System By Stuart .E. Madnick & John. J. Donovon
2. Operating System By Milan Milenkovic (Ibm Corporation)
3. Operating System By Achyuts Godbole
4. Operating System By H.M. Deitel
5. Operating Systems A Design Oriented Approach By Charles Crowley Tata Mcgraw- Hill Edition

4. Programming Languages

Program Concept, Characteristics of Programming, Various stages in Program Development Programming aids Algorithms, Flow Charts - Symbols, Rules for making Flow chart, Programming Techniques – Top down, Bottom up, Modular, Structured - Features, Merits, Demerits, and their Comparative study. Programming Logic- Simple, Branching, Looping, Recursion, Cohesion & Coupling, Programming Testing & Debugging & their Tools , C Programming, C++ Programming

Suggested Readings:

1. C - The complete Reference Herbert Schildt TMH
2. The C Programming Language Kerningham and Ritchie
3. Understanding Pointers in C - Y.Kanetkar

5. Database Management System

Operational data, Purpose of database system, Views of data, Data models: Relational, Network, Hierarchical, Instances & Schemes, Data Dictionary, Types of Database languages : DDL, DML, Structures of a DBMS, Advantages & Disadvantages of a DBMS,3-level Architecture Proposal : External, Conceptual & Internal Levels, Entity Relationship Model as a tool of conceptual design : Entities & Entity set, Relationship & Relationship set, Attributes, Mapping Constraints, Keys, Entity-Relationship diagram (E-R diagram) : Strong & weak entities, Generalization, Specialization, Aggregation, Reducing ER diagram to tables, Model, Object Oriented Model, Concurrency Control, Database Security. File Organization, Types of file organization, Overview of Indexes, Set theory concepts and fundamentals: Relations, Domains, Attributes, Tuple, Concepts of Keys: Candidate key, Primary Key, Alternate Key, Super Key, Foreign Key, Fundamental integrity rules: Entity integrity, Referential integrity, Extension & Intention

Suggested Readings:

1. Database System Concepts By Silberschatz,Korth and Sudershan, McGraw Hill Company
2. Database Management Systems By Raghu Ramakishan, Johannes Gehrke, 2002
3. Principles of Database Systems Vol. I & Vol. II, J.D.Ullman, Rockville

6. Data Structure

Data structure operation, Notation and Concept of algorithm, Complexity, time space tradeoff, Arrays, Stack, Queue, Tree, Linked list Searching and Sorting Algorithm

Suggested Readings:

1. Data Structures, Lipschutz , Tata McGraw Hills

7. Software Engineering

System Development Life Cycle (SDLC): Steps, Water fall model, Prototypes, Spiral model.

Software Metrics: Software Project Management.

Software Design: System design, detailed design, function oriented design, object oriented design, user interface design. Design level metrics.

Coding and testing: Testing level metrics, Software quality and reliability, Clean room Approach, software reengineering.

Suggested Readings:

1. "An Integrated Approach to Software Engineering", Pankaj Jalote, IIIrd Edition, Narosa Publishing House.
2. "Software Engineering: Principles and Practices", Waman S. Jawadekar, Tata McGraw-Hill.
3. "Software Engineering: A Practitioner's approach", Roger S. Pressman, McGraw-Hill.
4. "Software Engineering:, Ian Sommerville, Pearson Education.
5. "Fundamentals of Software Engineering", Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, PHI.

8. E-Commerce

Electronic Commerce-Introduction, E-Commerce Types, Value Added Networks, Electronic commerce over the Internet, E-transition challenges for Indian corporate, the Information Technology Act 2000 and its highlights related to e-commerce. EDI, Electronic payment systems (payment gateway, Internet banking , Secure Electronic Transaction (SET) protocol, E-cash, Electronic Cheque, Elements of Electronic payments, E-security – Security on the internet, network and web site risks for e-business, use of firewalls, secure physical infrastructure.

Suggested Readings:

Suggested Readings:

1. E-commerce (The cutting Edge of Business) by Kamlesh K. bajaj and DebjaniNag. – Ist & IInd Edition (Tata McGraw Hill publication.)

9. Discrete Mathematics

Definition and types of sets, Equal sets, subsets, universal sets, Venn diagram, Set operations, Properties of set union and intersections. (with Venn diagrammatic proofs only) Propositions, Logical connectives and compound statements, Truth values and truth table, Statement pattern and logical equivalence, Tautology, contradiction, contingency, Validity of arguments, Predicates

Suggested Readings:

1. Discrete maths by Tremblay and Manohar.
2. Discrete mathematics, C.L. Liu
3. Text Book of Discrete mathematics. By swapan Kumar sarkar (S Chand and company)

10. Current Trends in IT

Parallel Computing: Parallel virtual machine (pvm) and message passing interface (mpi) libraries and calls. Advanced architectures. Today's fstest computers.

Mobile Computing: Mobile connectivity-Cells, Framework, wireless delivery technology and switching methods, mobile information access devices, mobile data internetworking standards, cellular data communication protocols, mobile computing applications, Mobile databases-protocols, scope, tools and technology, M-business.

DISTRIBUTED SYSTEMS – Introduction, Distributing the processing and storage Function, Advantage and Disadvantage of Distributed System.

E-Supply Chain Management:

Introduction, E-Supply-Chain components, E-Supply-Chain architecture, Major Trends in E-SCM, Some examples of using ESCM.

E-Customer Relationship Management (E-CRM) :

Customer Relationship management concepts, How technology can help in this. E-CRM solutions, advantages, E-CRM capabilities, Data Mining & E-CRM, Some examples of using E-CRM.

Suggested Readings:

1. E-commerce (The cutting Edge of Business) by Kamlesh K. bajaj and DebjaniNag. – Ist & IInd Edition (Tata McGraw Hill publication.)

Paper –II **Section C (30 Marks)**

Select Five Descriptive Question on following Syllabus. Each question will be 10 marks. Attempt any three questions. (Based on P.G. Level)

1. **Operating System**

Introduction to Operating System , Memory management, Support for concurrent process, Scheduling, System deadlock, Multiprogramming system, I/O management, Distributed operating systems, Study of Unix and Windows NT.

Suggested Readings:

1. Operating System By Stuart .E. Madnick & John. J. Donovon
2. Operating System By Milan Milenkovic (Ibm Corporation)
3. Operating System By Achyuts Godbole
4. Operating System By H.M. Deitel
5. Operating Systems A Design Oriented Approach By Charles Crowley Tata Mcgraw- Hill Edition

2. **Computer Networks**

OSI reference Model, TCP/IP reference model, Networking devices(Repeaters, Bridges, Routers, Gateways, Hub and Switch), Protocols(SMTP, PPP, FTP, HTTP.)

Suggested Readings:

1. WilliamStallings, "Data and Computer Communications" (Fifth Edition) Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Andrew S. Tanenbaum, "Computer Networks", (Fifth Edition) Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Peter Hodson, "Local Area Networks" (Third Edition), BPB Publication, New Delhi.
4. Gerd E Keiser, "Local Area Networks" Tata McGraw Hill Edition, New Delhi.

3. **Advanced Data Structure**

Minimum Spanning Trees, Growing a minimum spanning tree, The algorithms of Kruskal and Prim, Graphs : DFS and BFS algorithms associated with Graphs, Single-source shortest Paths, The Bellman-ford algorithm, Divide and conquer, General method, Binary search, Merge sort, Strassen's matrix multiplication, Introduction to Greedy method, The general method, Container loading knapsack problem, Introduction to Dynamic Programming, General method, Introduction to NP Theory

Suggested Readings:

1. How to solve it by Computers, R.G. Dromey , 8th Edition , Pearson Education
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahani, S.. Rajasekaran , 2nd Edition , Universities Press Inc
4. Data Structures, Lipschutz , Tata McGraw Hills
5. Introduction to Algorithms, Corman , Leiserson and others, 2nd edition , PHI

4. Advanced Database Management System

Relation, Tuple, Attribute, Cardinality, Degree, Domain, Keys (Super Key, Candidate Key, Primary Key, Foreign Key), Relational Algebric Operations: Select, Project, Union, Difference, Intersection, Cartesian Product, Natural Join, Anomalies of un normalized database, Normalization, Normal Form: 1NF, 2NF, 3NF, Distributed Database,
DATAMINING – Introduction, Evolution of data mining, Datamining –verification vs. discovery, Advantages of datamining, Technologies used in dataminnig
DATAWAREHOUSE AND DATA MARTS: Metadata, Structure of a datawarehouse, Uses of a data warehouse, Standards reports and queries, Queries against summarised data, Data mining, Interface with other warehouse

Suggested Readings:

1. Raghu Ramakrishnan/Johannes Gehrke, "Database Management Systems", Tata Mc Graw Hill.
2. Silber Schatz. Korth, "Database System Concepts", Tata Mc Graw Hill.
3. ShamKanth B. Navathe, "Fundamental of DataBase System", Pearson Education.
4. Database management System, Bipin desai
5. Oracle by Ivan N. Bayross
6. Oracle PL/SQL Programming by Scott Urmann

5. Compiler Design

Theory of Computation : Formal language, Need for formal computational models, Noncomputational problems, diagonal argument and Russel's paradox. Deterministic Finite Automaton (DFA), Non-deterministic Finite Automaton (NFA), Regular languages and regular sets. Equivalence of DFA and NFA. Minimizing the number of states of a DFA. Non-regular languages and Pumping lemma. Pushdown Automaton (PDA), Deterministic Pushdown Automaton (DPDA), Non-equilvalence of PDA and DPDA.
Context free Grammars : Greibach Normal Form (GNF) and Chomsky Normal Form (CNF), Ambiguity, Parse Tree Representation of Derivations, Equivalence of PDA's and CFG's. Parsing techniques for parsing of general CFG's-Early's, Cook-Kassami-Younger (CKY) and Tomita's parsing. Linear Bounded Automata (LBA) : Power of LBA. Closure properties.
Context free grammars, Parsing and parse trees, Representation of parse (derivation) trees asrightmost and left most derivations. Bottom up parsers-shift-reduce, operator precedence, andLR, YACC package on Unix system. Context free grammars, Parsing and parse trees, Representation of parse (derivation) trees as rightmost and left most derivations. Bottom up parsers-shift-reduce, operator precedence, and
LR, YACC package on Unix system.Topdown parsers-left recursion and its removal, Recursive descent parser. Predictive parser,Intermediate codes-Quadruples, Triples, Intermediate code generation, Code generation, Code optimization Top down parsers-left recursion and its removal, Recursive descent parser. Predictive parser, Intermediate codes-Quadruples, Triples, Intermediate code generation, Code generation, Code optimization

Suggested Readings:
THEORY OF COMPUTATION:

1. Theory of computation: Peter linz, J.d. ullman, Papadimitriau
2. K.L.P Mishra & N. Chandrasekharan – "Theory of Computer Science", PHI

COMPILER DESIGN:

1. Compilers: Principles, Techniques, and Tools (2nd Edition) – Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman

6. Computer Architecture

Register Transfer and Micro operations: Register transfer language, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Bus and memory transfers. Computer Organization and Design: Instruction cycle, computer registers, common bus system, computer instructions, addressing modes, design of a basic computer
Central Processing Unit: General register organization, stack organization, Instruction formats, Data transfer and manipulation, program control. RISC, CISC characteristics. Pipeline and Vector processing: Pipeline structure, speedup, efficiency, throughput and bottlenecks. Arithmetic pipeline and Instruction pipeline
A comprehensive study of architecture and performance for real world computers
Suggested Readings:
1. "Modern Digital Electronics": -by R.P. Jain
2. MICROPROCESSOR -by B.Ram

7. Network Security and Cryptography

Network Security : Network security issues, common threats, security barriers in the network pathways, Official levels of computer security, types of security controls, approaches to network security, Ethical hacking. Encryption and Decryption – Cryptography, Type of encryptions, encryption keys, single/ secrete/ private key encryption, Public/Private key encryption. Overview of Digital Signature and Digital Certificates technology,

Suggested Readings:
1. Atul Kahate, Cryptography and Network Security, McGraw Hill.
2. Kaufman, c., Perlman, R., and Speciner, M., Network Security,Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002.
3. Stallings, W.,.Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR.,2003.

8. Artificial Intelligence

Definitions, AI approach for solving problems.
Automated Reasoning with propositional logic and predicate logic-fundamental proof procedure, refutation, resolution, refinements to resolution (ordering/pruning/restriction strategies). State space representation of problems, bounding functions, breadth first, depth first, A, A*, AO*, etc. Performance comparison of various search techniques.
Frames, scripts, semantic nets, production systems, procedural representations, Prolog programming. Components of an expert system, Knowledge representation and Acquisition techniques, Building expert system and Shell. RTNs, ATNs, Parsing of Ambiguous CFGs. Tree Adjoining Grammars (TAGs).

Suggested Readings:

1. Introduction to Artificial Intelligence, Shinji Araya, KYORITSU SHUPPAN, ISBN4-320-12116-3 (in Japanese)
2. New Artificial Intelligence (Fundamental), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13179 (in Japanese)
3. New Artificial Intelligence (Advanced), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13198-X (in Japanese)
4. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall, ISBN0-13-080302-2

9. Mobile communication

Introduction to Cellular Mobile Systems: A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, overview of generations of cellular systems.
Elements of Cellular Radio Systems Design and Interference: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems, Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects.

Cell Coverage for Signal & Antenna Structures: General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model – characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation, Characteristics of basic antenna structures, antenna at cell site, mobile antennas.

Frequency Management & Channel Assignment, Hand Off & Dropped Calls: Frequency Management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment, Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

Suggested Readings:

1. Mobile communications 2nd Edition by **Jochen Schiller**

10. Design and Analysis of Algorithm

Algorithm Analysis – Time Space Tradeoff – Asymptotic Notations – Conditional asymptotic notation – Removing condition from the conditional asymptotic notation - Properties of big-Oh notation – Recurrence equations – Solving recurrence equations – Analysis of linear search.

Mathematical Analysis of Non-recursive Algorithm – Mathematical Analysis of Recursive Algorithm – Example: Fibonacci Numbers – Empirical Analysis of Algorithms – Algorithm Visualization.

ALGORITHM DESIGN METHODS

Backtracking – n-Queen's Problem – Hamiltonian Circuit problem – Subset-Sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman *problem.Coping with limitations of Algorithmic Power*:- Backtracking, Branch and Bound, Approximation Algorithms for NP – hard problems

Suggested Readings:

1.Awad, EM: System Analysis and Design, Galgotia Publications Pvt. Ltd
2. Gane and Sarson: Structured System Analysis and Design.
3. Silver, GA, Silver, ML: System Analysis and Design, Addison-Wesley Publishing Co