Syllabus for Ph.D. Program in CSE for session 2023-2024 (UIET, KUK)

Instructions for the Paper Setter:
(a)   There are two sections of the syllabus for setting up the question paper for the Ph.D. program in CSE.
(b)   All the questions will be of multiple-choice
(c)   Section 1 shall consist of 20 multiple-choice questions and Section 2 shall consist of 80 multiple-choice questions and each question shall carry 02 marks.
(d)   Each sub-section of section 2 shall consist of at least 5 multiple-choice questions.
(e)   In total 100 multiple-choice questions will be set up by the paper setter and each question shall carry 02 marks.

Total Marks: 200 (Section 1: 40 Marks and Section 2: 160 Marks) Time Duration: 02 Hours (without any break)

Section 1

Research Methodology: Motivation and objectives, Types of research criteria of good research, Defining and formulating the research problem, importance of literature review in defining a problem, literature review sources, critical literature review, identifying gap areas from literature and research database, and development of working hypothesis, Collection, processing and data analysis, hypothesis testing with various testing techniques. Interpretation and Report Writing, Layout of the Research Report, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Section 2

2.1   **Digital Logic:** Boolean algebra, Combinational and sequential circuits, Minimization, Number representations, and computer arithmetic (fixed and floating point).

2.2   **Computer Organization and Architecture:** Machine instructions and addressing modes, ALU, data path and control unit, Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; 1/0 interface (interrupt and OMA mode).

2.3   **Programming and Data Structures:** Programming in C, Recursion, Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, and graphs.

2.4   **Algorithms:** Searching, sorting, hashing, asymptotic worst-case time and space complexity, Algorithm design techniques: greedy, dynamic programming and divide-and-conquer, Graph search, minimum spanning trees, shortest paths.

2.5   **Theory of Computation:** Regular expressions and finite automata, context-free grammars and push-down automata, Regular and context-free languages, pumping lemma, Turing machines.

2.6   **Operating System:** Processes, threads, inter-process communication, concurrency and synchronization. Deadlock, CPU scheduling, Memory management, virtual memory, File systems.

2.7   **Databases:** ER-model, Relational model: relational algebra, tuple calculus, SQL, Integrity constraints, normal forms, File organization, and indexing, Transactions, and concurrency control.

2.8   **Computer Networks:** Concept of layering, LAN technologies (Ethernet), Flow and error control techniques, switching. 1Pv4/1Pv6, routers and routing algorithms (distance vector, link state), TCP/UDP and sockets, congestion control, Application layer protocols (DNS, SMTP, POP, FTP, HTTP), Basics of Wi-Fi, Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

2.9   **Compiler Design:** Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation. Local optimization, Data flow analyses: constant propagation, liveness analysis, common sub-expression elimination.