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| **ID** | **Topic 1** | **Topic 2** |
| **180041201** | Computer architecture and organization   * + Von Neuman architecture – IAS computer   + Instruction Set architecture   + Layers of a computing system/ computer abstractions   + Computer organization – logic implementation, circuit implementation, physical implementation, design validation   + Different components of a computer | Cache memory   * + Cache write policy   + Cache stalls   + Cache flag bits   + Cache miss   + Victim cache   + Cache replacement policy |
| **180041202** | Multicore computer system   * + Technology and Development   + Advantage and disadvantage of it   + Hardware   + Software effect   + Multicore design: Homogeneous and heterogeneous cores | Pentium 4 cache organization   * + Levels of cache   + Components   + Bandwidth   + Trace cache   + Branch target cache |
| **180041203** | First generation computer   * + Its features   + Design issues   + Components: Software and Hardware   + Advantage and disadvantage   + Examples | Locality of reference   * Spatial locality * Temporal locality * Branch locality * Sequential locality * Examples * Usage |
| **180041204** | Second Generation Computer   * Components: Software and Hardware * Technology and Development * Programming * Memory technology * Advantage and disadvantage | DRAM   * + Design and organization   + Operation   + Array structure   + SRAM vs DRAM   + Error correction and detection |
| **180041205** | Third Generation Computer   * + Design issues   + Components: Software and Hardware   + Technology and Development   + Programming   + Memory technology | SRAM   * + Types   + Applications and usages   + Characteristics   + Design and organization   + Packaging |
| **180041207** | Fourth Generation Computer   * Its features * Programming * Memory technology * Advantage and disadvantage * Examples | ROM   * + Types   + Operation   + Applications   + Examples   + Advantage and disadvantage |
| **180041208** | Fifth Generation Computer   * Components: Software and Hardware * Technology and Development * Programming * Memory technology * Advantage and disadvantage | DDR SDRAM   * + Specification   + Chip characteristics   + Design and organization   + DDR2 SDRAM   + DDR3 SDRAM   + DDR4 SDRAM   + DDR5 SDRAM |
| **180041209** | RISC architecture   * + Instruction set design   + Hardware utilization   + Instruction execution and addressing modes   + Advantage and disadvantage   + Usage and examples | Flash memory   * + History   + Types   + Its application   + Operations and features   + Reliability   + Advantage and disadvantage |
| **180041210** | CISC architecture   * Hardware utilization * Instruction execution and addressing modes * Advantage and disadvantage * Usage and examples * Pipelining in RISC | Cache memory   * + Cache mapping   + Cache replacement policy   + Cache write policy   + Cache stalls   + Cache flag bits   + Cache miss |
| **180041211** | IoT   * + Its Devices, applications, software   + Trends   + Characteristics   + Architecture   + Civilization, Government regularization, Criticism | Pentium 4 cache organization   * + Levels of cache   + Components   + Bandwidth   + Trace cache   + Branch target cache |
| **180041212** | Embedded system   * + Applications   + Basic structure and architecture   + Characteristics and features   + User interface   + Processors of it | Locality of reference   * Spatial locality * Temporal locality * Branch locality * Sequential locality * Examples * Usage |
| **180041213** | Microprocessor   * + Its classification   + Terminologies   + Examples   + Block diagram and structure   + Microprocessor memory | DRAM   * + Operation   + Array structure   + SRAM vs DRAM   + Error correction and detection   + Packaging |
| **180041214** | Microcontroller   * + Terminologies   + Examples   + Comparison with microprocessor   + Block diagram and structure   + Its application | SRAM   * + Types   + Design and organization   + operation   + SRAM vs DRAM   + Packaging |
| **180041215** | ARM architecture   * + Features and functionalities   + Block diagram and structure   + Design philosophy   + ARM license   + Examples | ROM   * + Types   + Characteristics   + Applications   + Examples   + Advantage and disadvantage |
| **180041216** | x86 architecture   * + Its classification   + Features and functionalities   + Block diagram and structure   + Design philosophy   + Examples | DDR SDRAM   * + Specification   + Chip characteristics   + Design and organization   + DDR2 SDRAM   + DDR3 SDRAM   + DDR4 SDRAM   + DDR5 SDRAM |
| **180041217** | Cloud computing   * + What is it?   + Features and functionalities   + Its deployment   + Architecture   + Vertical cloud   + Examples | Flash memory   * + History   + Types   + Its application   + Operations and features   + Reliability   + Advantage and disadvantage |
| **180041219** | Computer architecture and organization   * + Von Neuman architecture – IAS computer   + Layers of a computing system/ computer abstractions   + Computer technology trends - memory, processor   + Computer organization – logic implementation, circuit implementation, physical implementation, design validation   + Different components of a computer | Main memory   * + Brief history   + Memory hierarchy   + Main memory vs virtual memory   + Memory access methods   + ROM as main memory |
| **180041220** | Multicore computer system   * + Hardware   + Software effect   + Multicore design: Homogeneous and heterogeneous cores   + Properties of multicore systems   + Multiprocessor memory types | Cache memory   * + Cache stalls   + Cache flag bits   + Cache miss   + Victim cache   + Trace cache   + Cache coherency |
| **180041221** | First generation computer   * + Its features   + Design issues   + Components: Software and Hardware   + Technology and Development   + Programming | Pentium 4 cache organization   * + Levels of cache   + Components   + Bandwidth   + Trace cache   + Branch target cache |
| **180041222** | Second Generation Computer   * Technology and Development * Programming * Memory technology * Advantage and disadvantage * Examples | Locality of reference   * Spatial locality * Temporal locality * Branch locality * Sequential locality * Examples * Usage |
| **180041223** | Third Generation Computer   * + Its features   + Design issues   + Components: Software and Hardware   + Technology and Development   + Programming | DRAM   * + Types   + Array structure   + SRAM vs DRAM   + Error correction and detection   + Packaging |
| **180041224** | Fourth Generation Computer   * Its features * Design issues * Memory technology * Advantage and disadvantage * Examples | SRAM   * + Types   + Applications and usages   + Operation   + SRAM vs DRAM   + Packaging |
| **180041225** | Fifth Generation Computer   * Technology and Development * Programming * Memory technology * Advantage and disadvantage * Examples | ROM   * + Types   + Characteristics   + Design   + Examples   + Advantage and disadvantage |
| **180041226** | RISC architecture   * + Hardware utilization   + Instruction execution and addressing modes   + Advantage and disadvantage   + Usage and examples   + Pipelining in RISC | DDR SDRAM   * + Specification   + Chip characteristics   + Design and organization   + DDR2 SDRAM   + DDR3 SDRAM   + DDR4 SDRAM   + DDR5 SDRAM |
| **180041227** | CISC architecture   * Features * Instruction execution and addressing modes * Advantage and disadvantage * Usage and examples * Pipelining in RISC | Flash memory   * + History   + Types   + Its application   + Operations and features   + Reliability   + Advantage and disadvantage |
| **180041228** | IoT   * + Trends   + Characteristics   + Architecture   + Civilization, Government regularization, Criticism   + Examples | Main memory   * + Brief history   + Memory hierarchy   + Main memory vs virtual memory   + Memory access methods   + ROM as main memory |
| **180041229** | Embedded system   * + Basic structure and architecture   + Characteristics and features   + User interface   + Processors of it   + Peripherals | Cache memory   * + Cache flag bits   + Cache miss   + Victim cache   + Trace cache   + Micro operation cache   + Cache pollution |
| **180041230** | Microprocessor   * + Terminologies   + Examples   + Block diagram and structure   + Microprocessor memory   + Microprocessor logic | Pentium 4 cache organization   * + Levels of cache   + Components   + Bandwidth   + Trace cache   + Branch target cache |
| **180041231** | Microcontroller   * + Examples   + Comparison with microprocessor   + Block diagram and structure   + Its application   + Its programming language and how to program it | Locality of reference   * Spatial locality * Temporal locality * Branch locality * Sequential locality * Examples * Usage |
| **180041232** | ARM architecture   * + Block diagram and structure   + Design philosophy   + ARM license   + Examples   + Its application | DRAM   * + Types   + Applications and usages   + SRAM vs DRAM   + Error correction and detection   + Packaging |
| **180041233** | x86 architecture   * + Features and functionalities   + Block diagram and structure   + Design philosophy   + Examples   + Its application | SRAM   * + Types   + Applications and usages   + Characteristics   + SRAM vs DRAM   + Packaging |
| **180041234** | Cloud computing   * + What is it?   + Its deployment   + Architecture   + Vertical cloud   + Examples   + Cloud computing security and privacy | ROM   * + Types   + Characteristics   + Design   + Operation   + Advantage and disadvantage |
| **180041235** | Computer architecture and organization   * + Von Neuman architecture – IAS computer   + Instruction Set architecture   + Layers of a computing system/ computer abstractions   + Computer technology trends - memory, processor,   + Different components of a computer | DDR SDRAM   * + Specification   + Chip characteristics   + Design and organization   + DDR2 SDRAM   + DDR3 SDRAM   + DDR4 SDRAM   + DDR5 SDRAM |
| **180041236** | Multicore computer system   * + Technology and Development   + Advantage and disadvantage of it   + Hardware   + Software effect   + Multicore design: Homogeneous and heterogeneous cores | Flash memory   * + History   + Types   + Its application   + Operations and features   + Reliability   + Advantage and disadvantage |
| **180041237** | First generation computer   * + Technology and Development   + Programming   + Memory technology   + Advantage and disadvantage   + Examples | Main memory   * + Brief history   + Memory hierarchy   + Volatile vs non-volatile vs semi-volatile main memory   + SRAM vs DRAM   + ROM as main memory |
| **180041238** | Second Generation Computer   * Its features * Design issues * Components: Software and Hardware * Advantage and disadvantage * Examples | Cache memory   * + Trace cache   + Micro operation cache   + Branch target cache   + Smart cache   + Separate vs shared cache   + Cache manager |
| **180041239** | Third Generation Computer   * + Components: Software and Hardware   + Technology and Development   + Programming   + Memory technology   + Advantage and disadvantage | Pentium 4 cache organization   * + Levels of cache   + Components   + Bandwidth   + Trace cache   + Branch target cache |
| **180041240** | Fourth Generation Computer   * Its features * Design issues * Components: Software and Hardware * Advantage and disadvantage * Examples | Locality of reference   * Spatial locality * Temporal locality * Branch locality * Sequential locality * Examples * Usage |
| **180041241** | Fifth Generation Computer   * Its features * Programming * Memory technology * Advantage and disadvantage * Examples | DRAM   * + Types   + Applications and usages   + Characteristics   + Error correction and detection   + Packaging |
| **180041242** | RISC architecture   * + Features   + Instruction execution and addressing modes   + Advantage and disadvantage   + Usage and examples   + Pipelining in RISC | SRAM   * + Types   + Applications and usages   + Characteristics   + Design and organization   + Packaging |
| **180041243** | CISC architecture   * Features * History and Development * Advantage and disadvantage * Usage and examples * Pipelining in RISC | ROM   * + Types   + Characteristics   + Design   + Operation   + Applications |
| **180041244** | IoT   * + Characteristics   + Architecture   + Civilization, Government regularization, Criticism   + Examples   + Standards and framework | DDR SDRAM   * + Specification   + Chip characteristics   + Design and organization   + DDR2 SDRAM   + DDR3 SDRAM   + DDR4 SDRAM   + DDR5 SDRAM |
| **180041245** | Embedded system   * + Characteristics and features   + User interface   + Processors of it   + Peripherals   + Advantage and disadvantage | Flash memory   * + History   + Types   + Its application   + Operations and features   + Reliability   + Advantage and disadvantage |
| **180041246** | Microprocessor   * + History   + Block diagram and structure   + Microprocessor memory   + Microprocessor logic   + Microprocessor instructions | Main memory   * + Brief history   + Memory hierarchy   + Volatile vs non-volatile vs semi-volatile main memory   + SRAM vs DRAM   + Characteristics |
| **180041247** | Microcontroller   * + History   + Comparison with microprocessor   + Block diagram and structure   + Its application   + Its programming language and how to program it | Cache memory   * + Cache miss   + Victim cache   + Trace cache   + Micro operation cache   + Branch target cache   + Cache Mapping |
| **180041248** | Cloud computing   * + What is it?   + History   + Features and functionalities   + Architecture   + Vertical cloud   + Examples | ROM   * + Types   + Characteristics   + Design   + Operation   + Applications   + Examples   + Advantage and disadvantage |
| **180041249** | ARM architecture   * + Design philosophy   + ARM license   + Examples   + Its application   + Comparison with x86 architecture | Pentium 4 cache organization   * + Levels of cache   + Components   + Bandwidth   + Trace cache   + Branch target cache |
| **180041250** | x86 architecture   * + Block diagram and structure   + Design philosophy   + Examples   + Its application   + Comparison with ARM architecture | Locality of reference   * Spatial locality * Temporal locality * Branch locality * Sequential locality * Examples * Usage |
| **180041251** | Cloud computing   * + What is it?   + Architecture   + Vertical cloud   + Examples   + Cloud computing security and privacy   + Types of cloud services | DRAM   * + Types   + Applications and usages   + Characteristics   + Design and organization   + Packaging |
| **180041252** | Computer architecture and organization   * + Von Neuman architecture – IAS computer   + Instruction Set architecture   + Computer technology trends - memory, processor,   + Computer organization – logic implementation, circuit implementation, physical implementation, design validation   + Different components of a computer | SRAM   * + Types   + Applications and usages   + Characteristics   + Design and organization   + Operation |
| **180041253** | Multicore computer system   * + Hardware   + Software effect   + Multicore design: Homogeneous and heterogeneous cores   + Application benefits from it   + Properties of multicore systems | ROM   * + Design   + Operation   + Applications   + Examples   + Advantage and disadvantage |
| **180041254** | First generation computer   * + Its features   + Programming   + Memory technology   + Advantage and disadvantage   + Examples | DDR SDRAM   * + Specification   + Chip characteristics   + Design and organization   + DDR2 SDRAM   + DDR3 SDRAM   + DDR4 SDRAM   + DDR5 SDRAM |
| **180041256** | Second Generation Computer   * Its features * Design issues * Components: Software and Hardware * Technology and Development * Programming | Flash memory   * + History   + Types   + Its application   + Operations and features   + Reliability   + Advantage and disadvantage |
| **180041257** | Third Generation Computer   * + Technology and Development   + Programming   + Memory technology   + Advantage and disadvantage   + Examples | Main memory   * + SRAM vs DRAM   + Characteristics   + Main memory vs virtual memory   + Memory access methods   + ROM as main memory |
| **170041026** | Computer architecture and organization   * + Von Neuman architecture – IAS computer   + Instruction Set architecture   + Layers of a computing system/ computer abstractions   + Computer technology trends - memory, processor,   + Different components of a computer | Main memory   * + SRAM vs DRAM   + Characteristics   + Main memory vs virtual memory   + Memory access methods   + ROM as main memory |