The basics needed to start studying of the Masters level

(M.Sc. in program Computer and Control Systems Engineering) حاسبات

#	Area
1	Computer Design and Architecture
2	Computer Networks
3	Computers Operating Systems
4	System Analysis and Design
5	Databases Systems

Details and Resources for the requirement of the Masters level

(M.Sc. in program Computer and Control Systems Engineering)

#	Detail material
1	specifications for computer components - operating systems, computer software - infrastructure of the computer - the operating unit, Introduction to processor architecture - performance evaluation - instruction types and formats, information flow and control - dynamic branching prediction - dynamic scheduling, the design of the processor- the structure of memory- design of memory- virtual memory. Factors that depends upon the design of computer systems, the definition and operation of computer systems, analytical methods the arithmetic and logic unit, control unit, micro-programming control, organizing input / output - computer communications, assembly programming language, representation of data, machine calculations, types and formats of instructions - representation of characters, timing, input and output operations, fragmented codes, the concept of complex, structure of instructions and addressing methods - real-time applications - division and linking programs, interrupts. **References:** R. Trobec, B. Slivnik P. Bulić, and B. Robič, *"Introduction to Parallel Computing From Algorithms to Programming on State-of-the-Art Platforms,"* Switzerland, Springer, 2018 A. Elahi, *"Computer Systems Digital Design, Fundamentals of Computer Architecture and Assembly Language,"* New Haven, CT, USA, Springer, 2018
2	A review of the principles of digital data – OSI model – structures of computer networks - topology - examples of networks - local area networks - network management – advanced network technologies - data link layer - protocols - high-speed networking - quality of service - Internet Protocols - local and wide area networks - data transmission - network structures, Links packages - communication protocols - centralized and distributed devices - the basics of network design - networking software - (client / server) system - remote systems - load and balance distribution wireless computer networks - methods of data transformation in networks - . **References:** M. O'Leary, *"Cyber Operations: Building, Defending, and Attacking Modern Computer Networks, 2nd edition,"* Towson, MD, USA, Apress, 2019.
3	Definition and nature of operations - managing concurrent processes - distributed operating systems - systems – processors and processes and their management - design criteria for operations – interfacing of input/output and their organization. - The purposes and functions of an operating systems - the concept of multiple programming - operating multi- management - numbering and memory fragmentation - operational management, prevention of failure, mutual exclusion and use semaphores

	, scheduling work , Device Manager , Files' I/O . **References:** E. Nemeth, G. Snyder, T. Hein, et. al., *"Unix and Linux System Administration Handbook,"* Boston, Addison-Wesley, 2018
4	life cycle of the system - system requirements - data collection and analysis, organizing and documentation of data - practical analysis – logical design – system organization - the design of entrances and exits - the design of data files and databases – designing of computer programs - programming and testing - system maintenance and mangament .. **References:** A. Dennis, B. Wixom, and D. Tegarden, *"Systems Analysis & Design: An Object-Oriented Approach with UML, 7th edition,"* Hoboken, Wiley, 2019
5	the concept of databases - the concept of database systems and its components and types - design database systems - the components of database management systems. Patterns of relational algebra - query language standard - EER model - the study of the application of database management packages. Database models - Database Management Systems - Design rules - normalization – relationships models and entities - queries - confidential and security - overcoming the problems of databases - the simultaneous operation of the procedures in the database applications **References:** Ramez Elmasri , FUNDAMENTALS OFDATABASE SYSTEMS, Fourth Edition , 2018 A. Taylor, "SQL For Dummies, 9th edition," Hoboken, Wiley, 2019

The basics needed to start studying of the Ph. D

(Ph.D. in Computer and Control Systems Engineering) حاسبات

1	Software Engineering
2	Advanced Computer Architecture (1)
3	Distributed Operating Systems (1)
4	Distributed Database Systems (1)
5	Information Systems
6	Computer Networks' Design and Programming
7	Image Processing and Computer Vision

Details and Resources for the requirement of the Masters level (Ph.D. in Computer and Control Systems Engineering)

#	Detail material
1	Software Development processes: Waterfall models, Agile methods, Rapid application development - System modeling using UML: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering - System architecting and design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures – Testing: Making changes to operational software systems, Legacy system management, Making decisions about software change - Quality Assurance & Configuration **References:** R. Mall, *"Fundamentals of Software Engineering, 4th edition,"* Haryana, PHI Learning, 2014
2	Synchronous logic circuits – sequential digital circuits – CPU and its theory of operation – memory structure – SRAM and DRAM - Bus system - control unit – Microprogram control - input/output control - assembly language programming - types of commands- program linking – interrupt – DMA – cache memory. performance of multicore processors using SPEC benchmarks -the several advanced optimizations to achieve cache performance-virtual memory and virtual machines -storage systems, RAID, I/O performance, and reliability measure **References:** H. El-Rewini and M. Abd-El-Barr, *"Advanced Computer Architecture And Parallel Processing,"* Hoboken, New Jersey, Wiley Interscience, 2005
3	Basics of distributed operating systems - deadlock protection, multiprocessor scheduling, computer system modeling, and virtual memory management from the operating systems viewpoint. structural building of distributed systems - operating systems that are based on tracks and switches – distribution processes and tasks - process in distributed systems – scheduling – communication between processes on distributed systems – synchronization – communication protocols in distributed systems. **References:** Silberschatz, G. Gagne, and P. Galvin, *"Operating System Concepts, 10th edition,"* Palatino, Wiley, 2018. J. Schönwälder, *"Operating Systems - Computer Networks and Distributed Systems,"* JACOBS University, 2013.

4	centralized systems and distributed systems – systems based on networks – basics of distributed database systems - relationship between database systems - important considerations in distributed database systems – handling inquiries – monitoring synchronization techniques - methods in supporting the transactions and how to recover them – Security and privileges Emerging data management issues including parallel and streaming data management, NoSQL and New SQL data management on the cloud will also be covered. - Experimental DDBMS. design and implement a distributed database query processing and optimization engine, capsulated into a web service to meet the requirements of the remote service call- The delivered service is subject to the benchmark **References:** (1) M. Özsu and P. Valduriez, *"Principles of Distributed Database Systems, 4th edition,"* Switzerland, Springer, 2020. (2) S. Rahimi and F. Haug, *"Distributed Database Management Systems: A Practical Approach,"* Hoboken, Wiley, 2010
5	Organizations and Information Technology - Concepts of Enterprise Information Systems, Concepts of Business Processes - Types of Enterprise Information Systems - Building and Management of Enterprise Information Systems - Procurement Processes - Fulfillment Processes - Production Processes - Integrated Processes - issues and trends in managing information systems infrastructure and services -. the Information Systems and processes involved in utilizing the Internet for interacting with consumers - Information Systems as they relate to enhancing business intelligence and processes - the processes involved in developing and securing Information Systems **References:** J. Świątek, L. Borzemski, and Z. Wilimowska (edits), *"Information systems architecture and technology- Part II,"* Proceedings of 38th International Conference on Information Systems Architecture and Technology (ISAT-2017), Switzerland, Springer, Volume 656, 2018. L. Borzemski, J. Świątek, and Z. Wilimowska (edits), *"Information Systems Architecture and Technology- Part I,"* Proceedings of 39th International Conference on Information Systems Architecture and Technology (ISAT 2018), Switzerland, Springer, Volume 852, 2019
6	Control protocols in transmission - architecture of computer networks – OSI protocols - (TCP / IP) protocols - Integrated Services Digital Networks (ISDN) - Broadband Integrated Services Digital Network (B-ISDN) – ATM networks peer-to-peer networks, the client-server model, network operating systems, and an introduction to wide-area networks-The network and implementation tools may vary to meet current development trends **References:** . Olivier Bonaventure , "Computer Networking : Principles, Protocols and Practice Release 0.25 " , 2018
7	digital image representation-mathematical tools for image processing-image enhancement-image processing in frequency domain-image denoising-image segmentation - Image formation-image processing-feature detection-segmentation-feature based alignment-structure from motion-stereo correspondence-3D reconstruction -Image Enhancement, Image Restoration, Wavelets and Multiresolution Processing, Image Compression, Morphological Image Processing, Image Segmentation, Representation and Description, and Object Recognition **References:** H. Singh, *"Practical Machine Learning and Image Processing: For Facial Recognition, Object Detection, and Pattern Recognition Using Python,"* New York, Apress, 2019