London South Bank University

EST 1892

Module Guide

Advanced Computer Engineering

ENG_6_538

School of Engineering

Level: 6

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1. MODULE DETAILS

Module Title:	Advanced Computer Engineering
Module Level:	6
Module Reference Number:	ENG_6_538
Credit Value:	20
Student Study Hours:	200
Contact Hours:	52
Private Study Hours:	148
Pre-requisite Learning (If applicable):	Principles of Electronic and Computer Engineering (ENG-4-532)
Co-requisite Modules (If applicable):	None
Course(s):	BEng/MEng CSN
Year and Semester	2019-20, S2
Module Coordinator:	Ya Bao
MC Contact Details (Tel, Email, Room)	020 78157588, baoyb@lsbu.ac.uk T812
Teaching Team & Contact Details (If applicable):	Ya Bao
Subject Area:	Electricals & Electronics Eng
Summary of Assessment Method:	Exam + Coursework
External Examiner appointed for module:	Prof. Mahdi Mahfouf, The University of Sheffield

2. SHORT DESCRIPTION

In the present climate of a vibrant activity in computer and communications research and development there is a need for students to become aware of the architectures that underpin the vast array of diverse computer based applications. The emergence of multimedia applications which require fast response times over long distance computer networks add pressure to computer hardware and software engineers to further enhance the already high specification of computer architectures.

This module is designed to teach students the advanced concepts of computer organisation and to describe ways that software and hardware are used to enhance computer performance.

3. AIMS OF THE MODULE

To provide students with a knowledge of the structure and function of modern computer system components and their integration. Current and future developments in computer systems are also described in this module.

4. LEARNING OUTCOMES

4.1 Knowledge and Understanding

After completing this module the student will understand and be able to apply the following concepts:

- How computer performance is measured and how it can be improved by architecture design.
- Mathematical operations that must be supported by computer architectures
- Memory management for advanced performance computers.
- Know how to deal with concurrency in the design of parallel architectures

4.2 Intellectual Skills

The student will be able to learn advanced concepts in the design and specification of advanced computer architectures. This knowledge will enable the student to produce good designs based on the understanding of the large number of inter related issues that must be considered in a high performance computer systems and networks.

4.3 Practical Skills

Students will design and produce computer simulations of performance based on the lectures that are delivered to them. These simulations will provide them with the skill to test their design before it proceeds to the production phase.

4.4 Transferable Skills

Students will consolidate their programming skills that are transferable. Additionally the module encourages the student to undertake literature survey and to follow research publications. These are skills that would be of much use in a research and development environment that the student may be involved in after graduation.

5. ASSESSMENT OF THE MODULE

There are two main components for assessment:

- 2-hour written examination (70%)
- Assignment (30%)

You MUST submit your assignments before the deadline (published on the VLE) and keep soft copy of your report. Late submission will be penalized in accordance with the University regulations.

6. FEEDBACK

Feedback will normally be given to students 15 working days after the final submission of an assignment or as advised by their module leader.

General feedback, applying to all students, will also be placed on the module VLE site within 15 working days.

7. INTRODUCTION TO STUDYING THE MODULE

7.1 Overview of the Main Content

The module begins by considering the predictive and empirical performance measures as well as the technological and architectural approaches to high performance. The module looks at high-performance and novel architectures such as pipelining, vector, array, superscalar and VLIW architectures. The associated memory support is also considered and memory techniques for high-speed main memory, memory hierarchies and caching technology as well as virtual memory management form a major part of the module. The memory hierarchy is discussed with special emphasis on CPU cache design. Furthermore the module incorporates consideration of I/O techniques for improving latency and throughput. We will cover concepts such as DMA, I/O processors, buses for system and I/O data transfer as well as bus standards.
The very topical subject of parallel processing and concurrency is also covered as is the concept of shared and distributed memory and interconnection networks

The relationship between computer components and the ALU and the ALU implementation of number representations and operations is covered from an engineering perspective.

7.2 Overview of Types of Classes

Teaching is organised in four hour sessions. The sessions will be used for lectures, tutorials and workshops. The main points of the subject will be covered in the lectures. Tutorials/Workshops will be held at various points in the timetabled sessions. Students will be expected to carry out independent study to consolidate their understanding of the subject.

7.3 Importance of Student Self-Managed Learning Time

The breadth of material covered and the inherent complexity of some topics mandates that the students plan for a substantial period of self-study. The Internet in particular will afford the student the opportunity to survey each topic and researching publications in academic journals and published proceedings in international conferences can follow this up. (i.e. IEEE Transactions on Computers, IEEE/ACM Transactions on Networking, IEEE Computer Architecture Letters). Practical assignments and/or design exercises carried out during the non-contact hours.

7.4 Employability

The student will be able to work in research and development of computer architecture. In the commercial sector the knowledge gained will enable the students to seek employment in computer networking and IT infrastructure design where their knowledge of computer performance issues including specifications will help them to evaluate advanced server solutions in high performance networks.

8. THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

SEMESTER 2		
WEEK	**TOPIC**	**READING (CORE TEXT)**
1	Introduction and performance Issues	Stallings W. Computer Organisation and Architecture,10th Ed.
2	Computer memory hierarchy, CPU memory cache systems and design	
3	Workshop1: Computer performance	
4	Input/Output, Computer components and the ALU	
5	Arithmetic and logic unit; CPU: instruction sets	
6	Workshop 2: Evaluation of Cache system performance	
7	Processor structure and function	
8	Parallel processing	
9	Workshop 3: Assembling and upgrading a PC	
10	Multicore computers units	
11	Graphic processing	

12	Control Unit; Limits and new directions in computing	

9. STUDENT EVALUATION

The analysis appears to suggest that the contents and the assessments of this module should be appropriate for students. Students have very good comments to the practical lab work which introduced from this year. General comments are positive. Students generally engaged.

10. LEARNING RESOURCES

Reading List

- Core Materials

  Stallings W, Computer Organisation and Architecture, 10th Ed. Pearson Education, ISBN-13: 978-1292096858, 2016

- Optional Materials

  Andrew S. Tanenbaum, Structured Computer Organization, 6th Ed. Pearson Education, ISBN-13: 978-0273769248, 2013

  Researching publications in academic journals and published proceedings in international conferences can follow this up. (i.e. IEEE Transactions on Computers, IEEE/ACM Transactions on Networking, IEEE Computer Architecture Letters)