MODULE TITLE	**High Performance Computing**	**CREDIT VALUE**	**15**
MODULE CODE	**ECM3446**	**MODULE CONVENER**	**Dr Man Luo (Coordinator)**

DURATION: TERM	**1**	**2**	**3**
DURATION: WEEKS	**0**	**11**	**0**

Number of Students Taking Module (anticipated)	**50**

DESCRIPTION - summary of the module content

The demand for ever-increasing computational power drives the development and exploitation of high-performance computing that underpins leading edge research in computationally intensive scientific and engineering fields. This module is designed to equip you with a solid foundation and useful skills in high-performance computing. In this module you will learn about current high-performance computer architectures and how the computer architecture influences the performance of algorithms and programs. You will also develop skills in parallel algorithm design and parallel programming, and will gain experience of using a high-performance computing system.
PRE-REQUISITE MODULES: ECM1416, ECM2433

AIMS - intentions of the module

This module aims to provide you with a thorough grounding in parallel programming and the architectures used in high-performance computing. After presenting the fundamental ideas and basic concepts of high-performance computing, the module outlines the architectures, components and parallel programming of high-performance computers. The module will introduce you to recent developments and future trends in architecture and algorithms in high-performance computing.

INTENDED LEARNING OUTCOMES (ILOs) (see assessment section below for how ILOs will be assessed)

On successful completion of this module ***you should be able to***:

Module Specific Skills and Knowledge

1. demonstrate an understanding of the fundamental ideas and issues of high-performance computing;

2. demonstrate knowledge of high-performance computer architectures;

3. demonstrate skills in parallel processing algorithm design and the practical implementation of such algorithms;

4. demonstrate knowledge of how to quantitatively assess the performance of parallel programs;

5. demonstrate an awareness of numerical effects and the influence of floating point number representation in high-performance computing applications.

Discipline Specific Skills and Knowledge

6. Understand how computer architectures can influence the performance of algorithms and programs.

7. interpret an informal requirement specification;

8. systematically analyse information and make appropriate design choices.

Personal and Key Transferable / Employment Skills and Knowledge

9. relate reading materials to lecture content and analyse a problem;

10. use technical manuals and books to interpret technical errors.

SYLLABUS PLAN - summary of the structure and academic content of the module

- motivation of and introduction to high-performance computing;

- parallel computer architecture: shared-memory and distributed-memory architectures, multi-core processors, Graphics Processing Units (GPUs);

- interconnection networks in high performance computers: topologies, latency and bandwidth;

- parallel processing algorithm and programming design:, domain decomposition, halo exchange, manager-worker, task-based parallelism;

- parallel programming methods: Message Passing Interface (MPI), OpenMP

- parallel performance: speed-up, efficiency, parallel overheads and scaling;

- floating point arithmetic: floating point model, range, accuracy, exceptions.

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)

Scheduled Learning & Teaching Activities	32.00	**Guided Independent Study**	118.00	**Placement / Study Abroad**	0.00

DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS

Category	Hours of study time	Description
Scheduled learning and teaching	22	Lectures
Scheduled learning and teaching	10	Workshops
Guided independent study	35	Coursework (individual assessed work)
Guided independent study	83	Guided independent study

ASSESSMENT

FORMATIVE ASSESSMENT - for feedback and development purposes; does not count towards module grade

Form of Assessment	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Weekly online quizzes	10 quizzes comprising 5-7 questions	1, 2, 3, 4, 5, 6	Oral feedback

SUMMATIVE ASSESSMENT (% of credit)

Coursework	40	Written Exams	60	Practical Exams	0

DETAILS OF SUMMATIVE ASSESSMENT

Form of Assessment	% of Credit	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Coursework - one coursework worth 40%	40	30 hours	All	Written feedback
Written exam – Closed book	60	2 hours - Summer Exam Period	1, 2, 3, 4, 5, 6, 8	Model answers supplied on request

DETAILS OF RE-ASSESSMENT (where required by referral or deferral)

Original Form of Assessment	Form of Re-assessment	ILOs Re-assessed	Time Scale for Re-assessment
Written Exam	Written Examination (2 hours)	1, 2, 3, 4, 5, 6, 8	August Ref/Def Period
Coursework	Coursework	All	August Ref/Def Period

RE-ASSESSMENT NOTES

Reassessment will be by coursework and/or written exam in the failed or deferred element only. For referred candidates, the module mark will be capped at 40%. For deferred candidates, the module mark will be uncapped.

RESOURCES

INDICATIVE LEARNING RESOURCES - The following list is offered as an indication of the type & level of information that you are expected to consult. Further guidance will be provided by the Module Convener

Basic reading:

ELE: http://vle.exeter.ac.uk/

Web based and Electronic Resources:

Other Resources:

Reading list for this module:

Type	Author	Title	Edition	Publisher	Year	ISBN	Search
Set	Sterling, T., Anderson, M. and Brodowicz, M.	High Performance Computing: Modern Systems and Practices	1st	Elsevier	2018	978-0-12-420158-3	[Library]

CREDIT VALUE	15	ECTS VALUE	7.5
PRE-REQUISITE MODULES	ECM2433, ECM1416		
CO-REQUISITE MODULES			
NQF LEVEL (FHEQ)	6	AVAILABLE AS DISTANCE LEARNING	No
ORIGIN DATE	Tuesday 10 July 2018	LAST REVISION DATE	Monday 11 April 2022
KEY WORDS SEARCH	computer modelling, computer simulation, performance evaluation		