

WM392-15 Real Time Operating Systems

27/28

Department

WMG

Level

Undergraduate Level 3

Module leader

Young Park

Credit value

15

Module duration

2 weeks

Assessment

100% coursework

Study locations

University of Warwick main campus, Coventry Primary

Distance or Online Delivery

Description

Introductory description

In the era of digitization, the computing devices are expected to perform complex and critical tasks. The operating systems including embedded operating system (EOS), robot operating system (ROS), real-time operating system (RTOS), etc. are the fundamental software in computer systems that support the devices to perform tasks so it is very important that operating systems should be stable and efficient. In particular, real time operating systems play a vital role in applications where timing predictability, responsiveness, and reliability are paramount, enabling the development of embedded systems that perform critical tasks with precision and efficiency. This module contributes to AHEP 4 learning outcomes for Partial CEng and BCS accreditation criteria for Full CITP as referenced in the learning outcomes.

[Module web page](#)

Module aims

This module aims to understand the concepts of various operating systems such as EOS, ROS, DOS, RTOS, etc. and to cover the core principles of operating systems including process, threads,

scheduling, deadlocks, memory systems and file systems. The fundamental concepts related to time and resource limitation in real time operating systems will also be discussed. In particular, by developing an application practically using a real time operating system, it will further improve the understanding of real time operating system.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Type of operating Systems
- Processes and threads
- Process scheduling and state
- C Programming
- Inter-process communication
- Threads vs. processes
- Kernel vs user threads
- Concurrency and synchronization
- Scheduling
- CPU Scheduler
- Scheduling criteria and algorithms
- Thread scheduling
- Deadlock
- Mutual exclusion
- Critical section
- Priority Inversion
- Priority Inheritance
- Race condition
- Critical section
- Semaphores
- Memory system and virtual memory
- File systems, disk scheduling and I/O
- Design and analysis of real time system software
- Reliability and fault tolerance
- Real time communication
- Real time systems for multiprocessor systems

Learning outcomes

By the end of the module, students should be able to:

- Identify the fundamental principles of an operating system and recognise how it effectively handles file, memory, processes, and device resources [AHEP:4 – C6] [CITP: 2.1.1].
- Critically discuss processor architecture components and how processes work effectively across the components [CITP: 2.1.10].
- Comprehensively evaluate the factors related to race condition and mutual exclusion with time and resource limitations for concurrency management [CITP: 2.2.1].

- Effectively apply the understanding of real time operating system to real application problems by implementing the solutions [AHEP:4 - C5] [CITP: 2.2.5].

Indicative reading list

[Reading lists can be found in Talis](#)

[Specific reading list for the module](#)

Subject specific skills

Contributes to the occupational standard for Digital and Technology Solutions Professional (ST0119):

Identify risks, determine mitigation strategies and opportunities for improvement in a digital and technology solutions project (S2).

Initiate, design, code, test and debug a software component for a digital and technology solution (S4).

Initiate, design, implement and debug a data product for a digital and technology solution (S10).

Research, investigate, and evaluate innovative technologies or approaches in the development of a digital and technology solution (S14).

Identify and define software engineering problems that are non-routine and incompletely specified (S16).

Provide recommendations as to the most appropriate software engineering solution (S17).

Implement software engineering projects using appropriate software engineering methods, approaches and techniques (S19).

Transferable skills

Digital Literacy (Has the capabilities that enable living, learning and working in a digital society. Comfortable with using digital media to communicate, solve problems, manage information, collaborate, create and share content.)

Problem Solving (Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions. Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious. Knows how to learn from failure.)

Critical Thinking (Recognise patterns, themes and key messages from sometimes confused and incomplete data. Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.)

Professionalism (Prepared to operate autonomously. Aware of how to be efficient and resilient. Manages priorities and time. Self-motivated, setting and achieving goals, prioritising tasks)

Information Literacy (Critical awareness of how information is gathered, used, managed and synthesised. Understanding of the relative value of different sources and the importance of provenance. The systematic collection, analysis and evaluation of information in the investigation of a topic.)

Study

Study time

Type	Required
Lectures	10 sessions of 1 hour (6%)
Seminars	5 sessions of 1 hour (3%)
Work-based learning	15 sessions of 1 hour (9%)
Online learning (scheduled sessions)	15 sessions of 1 hour (9%)
Online learning (independent)	5 sessions of 1 hour (3%)
Other activity	5 hours (3%)
Private study	54 hours (32%)
Assessment	60 hours (36%)
Total	169 hours

Private study description

Self-guided study: Reading relevant chapters in the reading list, and other online resources.
Professional development: Reflecting on learning and experience gained.

Other activity description

Online support and consultancy in support of assessments and group project work.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A3

	Weighting	Study time	Eligible for self-certification
Assessment component			
Programming Project Report 1	40%	24 hours	Yes (extension)

Weighting

Study time

Eligible for self-certification

This assessment includes a written report and plus programming development for a couple of missions to find solutions for the given tasks by implementing applications related to operating system file, process, resource, etc. For this reason, the report word length is slightly shorter than a typical report.

Reassessment component is the same

Assessment component

Programming Project
Report 2

60%

36 hours

Yes (extension)

This assessment includes a written report and plus programming development for a couple of missions to find solutions for the given tasks by designing and implementing applications using real time operating systems. For this reason, the report word length is slightly shorter than a typical report.

Reassessment component is the same

Feedback on assessment

Feedback will be given as appropriate to the assessment type:

- Written summative feedback on reports.
- Verbal feedback given during seminar/tutorial sessions.

Availability

Courses

This module is Core for:

- Year 4 of UWMS-H65B Undergraduate Digital and Technology Solutions (Data Analytics)
- Year 4 of DWMS-H652 Undergraduate Digital and Technology Solutions (Data Analytics) (Degree Apprenticeship)
- Year 4 of UWMS-H65D Undergraduate Digital and Technology Solutions (Software Engineering)
- DWMS-H654 Undergraduate Digital and Technology Solutions (Software Engineering) (Degree Apprenticeship)
 - Year 4 of H654 Digital and Technology Solutions (Software Engineering) (Degree

Apprenticeship)

- Year 4 of H654 Digital and Technology Solutions (Software Engineering) (Degree Apprenticeship)

This module is Optional for:

- Year 4 of UWMS-H65E Undergraduate Digital and Technology Solutions (Cyber)
- Year 4 of DWMS-H655 Undergraduate Digital and Technology Solutions (Cyber) (Degree Apprenticeship)
- Year 4 of UWMS-H65C Undergraduate Digital and Technology Solutions (Network Engineering)
- Year 4 of DWMS-H653 Undergraduate Digital and Technology Solutions (Network Engineering) (Degree Apprenticeship)