## M2.8 DevOps

| **Module title** | | | |
|---|---|---|---|
| DevOps | | | |
| **Module NFQ level** (only if an NFQ level can be demonstrated) | **Module number / reference** | **ECTS Value** | **Duration** |
| 6 | M2.8/ CS24L7M208C | 5 | 12 Weeks |
| **Parent programme(s).** Principal programme title, and embedded(s) if relevant | | **Stage of parent programme** | **Semester No.** |
| Bachelor of Science in Computing | | 2 | 2 |

| **Teaching and Learning modes** | **Proportion** (% of Total Directed Learning) |
|---|---|
| Classroom (Lectures & Active Learning) | 29% |
| Directed e-Learning | 30% |
| Independent Learning | 41% |

| **Entry requirements (statement of knowledge, skill and competence)** | |
|---|---|
| No additional requirements beyond those required of the College's QA policies with regards progression. | |
| **Maximum number of learners per instance of the module** | 38 |
| **Average (over the duration of the module) of the contact hours[1] per week** | 3 Hours |
| **Pre-requisite module title(s) (if any)** | N/A |
| **Co-requisite module title(s) (if any)** | N/A |
| **Is this a capstone module? (Yes or No)** | No |

| **Module-specific physical resources and support required per centre (or instance of the module)** |
|---|
| This module will be delivered in a state-of-the-art classroom equipped with Clevertouch Plus screens, Crestron speaker/microphones, and Panasonic PTZ camera technology, providing a seamless conference-style delivery. The room will be equipped with a whiteboard, computer, and cutting-edge audio-visual and media streaming systems, including a Smart TV, projector, and speakers, allowing for interactive and engaging learning experiences. The layout of the room promotes active learning and assessment, ensuring that all module learning requirements are met. In addition to the physical resources, the module also utilizes Moodle, core texts, PowerPoint Presentations, and video content to support student learning. Access to physical and online library facilities and Wi-Fi is also available for student use. |

| **Specification of the qualifications (academic, pedagogical and professional/occupational) and experience required of staff working in this module.** (Staff includes workplace personnel who are responsible for learners such as apprentices, trainees and learners in clinical placements) | | |
|---|---|---|
| **Role e.g. Tutor, Mentor etc** | **Qualifications & experience required:** | **# of Staff with this profile (WTEs[2])** |
| Lecturer | BSc/MSc/MA/PhD and /or professional qualification(s) and/or significant industry experience in a related field and in the following areas:<br>• IT Management<br>• Teaching and Learning<br>Experience of teaching in a Higher Education Institution. | 0.5 |

[1] Effort while in contact with staff

[2] WTE is the whole-time equivalent number. The number 1 indicates a fulltime person fully dedicated to the programme. 0.5 indicates a part-time person available to this programme half of the time.

| | | |
|---|---|---|
| | In addition, the following qualifications and experience would be desirable:<br>A qualification in teaching and learning.<br>Relevant teaching, course design, and/or research experience.<br>Supervision of projects at undergraduate level and possibly postgraduate level. | |

| Analysis of required learning effort | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Hours of Learner effort | | | | |
| Lecture, discussion, group work and demonstrations | | Mentoring and small-group tutoring | | Other (Assessment) | | Directed e-learning | Independent learning | Other (specify) | Work-based learning | Total effort |
| Hours | Minimum ratio teacher / learner | Hours | Minimum ratio teacher / learner | Hours | Minimum ratio teacher / learner | | | | | |
| 36 | 01:12 | | 01:12 | | | 38 | 51 | | | 125 |

| Allocation of Marks | | | | | |
|---|---|---|---|---|---|
| | Continuous Assessment | Supervised Project | Proctored Practical Exam. | Proctored Written Exam | Total |
| **Percentage Contribution** | 100 | | | | **100%** |

### 2.1.1 Module aims and objectives

**Aims**

This module provides an in-depth exploration of DevOps practices, principles, and tools, aiming to equip learners with the knowledge and skills required to bridge the gap between development and operations in the software development lifecycle. The module ensures the learners gain a comprehensive understanding of the DevOps culture, collaboration, and automation, fostering an environment that encourages efficient and high-quality software delivery.

**Objectives**

- Understand history and relevance of DevOps within the computing world and the overall context of an organisation.
- Enable the learner to apply DevOps practices regarding software development and deployment.
- Understand the software development lifecycle; development and test to deployment and operations.
- Develop a range of skills not limited to a single function.
- Build the learners understanding of processes and automation to ensure continuous delivery optimising overall organisational performance.

### 2.1.2 Minimum intended module learning outcomes

On completion of this module, the learner should be able to:

| | |
|---|---|
| **MIMLO 1** | Demonstrate knowledge of the fundamentals and objectives of DevOps within organisation. |
| **MIMLO 2** | Apply the principles of DevOps to a software development project. |
| **MIMLO 3** | Appraise DevOps principles and practices including integration, delivery and testing. |
| **MIMLO 4** | Evaluate the DevOps relationship to Agile, Lean and ITSM. |
| **MIMLO 5** | Apply DevOps skills and knowledge to solve a relevant computing challenge. |

### 2.1.3 Rationale for inclusion of the module in the programme and its contribution to the overall IPLOs

The module enables the learner to appreciate the importance of DevOps which improves collaboration across the value stream by developing and automating a continuous delivery pipeline. The module focuses on increasing the frequency and quality of deployments which goes to an innovative and integrated team who manage risks through experimentation and feedback. This module engenders in the learner an understanding of the essential knowledge, skills and competencies to understand key DevOps principles and practices which improve workflows and ensure faster deployment of ICT solutions.
The module is specifically linked to MIPLO 1, 2, 3, 4, 5, 7 and 8.

### 2.1.4 Information provided to learners about the module

Learners will be provided with information about the module's learning outcomes, indicative syllabus, and assessment strategy. This information will be communicated to them via the College's website, the programme document, which will be made available on the College's Moodle system, and on the module's individual Moodle page.

### 2.1.5 Module content, organisation and structure

The indicative syllabus of this module is outlined below:

**Understand DevOps Concepts:**

- History of DevOps
- Define DevOps
- Learn the significance of DevOps in modern software development.
- Explain the key principles, values, and cultural aspects of DevOps
- Understand Value Stream in the context of DevOps

**Collaboration and Communication**

- Emphasize communication and collaboration between development and operations teams.
- Implement collaboration tools and practices for improved teamwork

**DevOps Practices**

- Version Control Systems
- Demonstrate proficiency in using version control systems, such as Git, for collaborative software development.
- Understand branching strategies and best practices in version control.
- Importance of Experimentation
- Comprehend containerization concepts using Docker.
- Explore the benefits of Infrastructure as Code (IaC) in managing and provisioning.

**Processes**

- Introduction to processes
- DevOps in relation to IT Service Management
- Continuous Integration (CI) and Continuous Deployment (CD)
- Continuous integration/delivery/deployment/monitoring and feedback
- Agile and Scrum
- The Agile Manifesto
- Lean: Metrics and Process' Optimisation
- Business Value: Optimisation using story mapping

**Automation**

- Implement CI/CD pipelines using industry-standard tools
- Evaluate the importance of automated testing in the CI/CD process
- Automation enablers and Benefits

**Security Practice in DevOps:**

- Identify security challenges in the DevOps lifecycle.
- Implement security best practices and tools to ensure a secure development and deployment process.

**Improvements**

- Relevance of Measurement
- Metrics
- Monitoring and Logging
- Operationalising improvements

### 2.1.6 Module teaching and learning (including formative assessment) strategy

The module is taught as a combination of lectures and lab sessions. The lecture sessions discuss and explain to learners the theoretical underpinnings of DevOps as well as best practice for a collaborative approach to ICT.

The practical lab sessions give learners an opportunity to interact the processes involved and DevOps practices to ensure learners can engage in automation which is capable of measuring to enable performance improvements on a continuous basis. Work-based learning and practice-placement.

### 2.1.7 Work-based learning and practice-placement

N/A

### 2.1.8 E-learning

Dorset College VLE, Moodle, will be used extensively to distribute material relevant to this module (content of the lectures, readings and other informative readings and supplemental material). Moodle is also used as an integrative teaching tool and enables learners individually and within their teams to post, discuss, and interact with material. Moodle will also be used, where appropriate, as an assessment tool for example though quizzes and it is mandatory for all assignments to be uploaded through Moodle ensuring quality assurance and an automatic Turnitin report.

### 2.1.9 Module physical resource requirements

The physical resource requirements consist predominately of a flat classroom, with the requisite audio and visual technology equipment. The College is cognisant of the need for these resource requirements to be safe and comfortable for its learners, and conducive to a learning environment. Also, the College will provide the necessary technical and administrative support to ensure that both the classroom, and the technological equipment in the classroom are maintained at the requisite standard.

### 2.1.10 Reading lists and other information resources

**Essential Reading Material**

| Author | Year | Title | Publisher | ISBN |
|---|---|---|---|---|
| Kim, G., Humble, J., Debois, P., Willis, J., & Forsgren, N. | 2021 | The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations | IT Revolution. 2nd edition | 978-1950508402 |

**Supplementary Reading Material**

| Author | Year | Title | Publisher | ISBN |
|---|---|---|---|---|
| Kinsbruner | 2017 | The Digital Quality Handbook: Guide for Achieving Continuous Quality in a DevOps Reality | Infinity P; 1st edition | 978-0692885994 |

| | | | | |
|---|---|---|---|---|
| Kim, G., Behr, K., & Spafford, K. | 2014 | The phoenix project: A novel about IT, DevOps, and helping your business win. | IT Revolution. | 978-0988262591 |

**Electronic Resources**
Articles and online resources will be advised through the virtual learning environment. Some relevant sources include:

- EBSCO HOST 'Computer Source' - http://www.ebscohost.com/government/computer-source
- www.sureskills.com
- www.ibm.com

## 2.1.11 Specifications for module staffing requirements

The minimum requirements for a lecturer of this module are outlined above. In addition to this, the College would desire a potential lecturer to have the undertaken some professional development in the area of teaching and learning. However, in an instance where an individual has not acquired such experience in teaching and learning, the College will facilitate such professional development.

## 2.1.12 Module summative assessment strategy

**CA 1 – In-Class Test**– assessing the learners' knowledge of DevOps and its relevance within an organisation as well as the theoretical underpinnings of DevOps practices.
**CA2 – Project – Assessment** will be based on a combination of individual assignments and a final group project where students will apply DevOps practices to a real-world scenario. The learners need to design, Implement and deploy an automation practice including deployment pipelines and DevOps toolchains to a real-life problem.

| No. | MIMLOs | Assessment | Type | Percentage | Week |
|---|---|---|---|---|---|
| 1 | 1, 2, 3 | CA 1 | In-Class Test | 40% | 6 |
| 2 | 1, 2, 3, 4, 5 | CA 2 | Project | 60% | 12 |

**Reassessment Opportunity**: Where the combined marks of the assessment and examination do not reach the pass mark the learner will be required to repeat the element of assessment that they failed. Reassessment materials will be published on Moodle after the Examination Board and will be aligned to the MIMLOs and learners will be capped at 40% unless there are personal mitigating circumstances

## 2.1.13 Sample assessment materials

| | |
|---|---|
| **Module Title:** | DevOps |
| **Assignment Type:** | MCQ |
| **Assignment Title:** | Continuous Assessment 1 |

| | |
|---|---|
| **Issue Date:** | TBC - (Semester 1) |
| **Assignment Compiler:** | TBC |
| **Weighting:** | 40% |
| **Due Date:** | See Moodle |
| **MLO Assessed:** | MIMLO1, MIMLO2, MIMLO3 |

**Introduction**

- Apply the principles of DevOps to a software development project.
- Appraise DevOps principles and practices including integration, delivery and testing.
- Evaluate the DevOps relationship to Agile, Lean and ITSM.
- Apply DevOps skills and knowledge to solve a relevant computing challenge.

**Specific Tasks and Marking Scheme**

(SAMPLE QUESTIONS – Full test has 40 MCQ random questions from question bank.)

| Task Description | Marks |
|---|---|
| What is the Three Ways?<br>A. Methodology for identifying and removing constraints<br>B. The key principles of DevOps<br>C. Disciplined, data-driven approach for reducing waste<br>D. A methodology for performing continuous improvement | |
| What is DevOps?<br>A. DevOps is the union of People, Process, and Tools to enable continuous delivery of value to our end users.<br>B. DevOps is a programming language.<br>C. DevOps is Operational staffs doing Development work.<br>D. DevOps is a software development model | |
| What is the full form of DevOps?<br>A. Development And Operations<br>B. Digital and Operations<br>C. Drive and Operations<br>D. None of the above | |
| What challenge(s) does DevOps resolves?<br>A. Increasingly complex virtualized IT environment<br>B. The need for rapidly timed software releases; sometimes many in one day<br>C. The traditional siloed approach to app development and deployment<br>D. All of the above | |
| What are the benefits of adopting DevOps?<br>A) Faster time to market<br>B) Increase end-user satisfaction<br>C) Increase in productivity<br>D) All of the above | |
| Which of these statements are correct about DevOps?<br>A. DevOps won't work in regulated industries.<br>B. DevOps won't work with Outsourced Development.<br>C. You must use cloud technologies.<br>D. None of the above | |
| What are the factor(s) required to deliver value faster to customer ? | |

| | |
|---|---|
| A. Business<br>B. Dev Teams<br>C. Ops Team<br>D. All of the above | |
| DevOps can be interpreted as an outgrowth of ____ .<br>A) Agile<br>B) Waterfall model<br>C) Promise-based algorithms<br>D) Test-driven development and model-driven development | |
| A small group of individuals recently returned from a conference where they learned about DevOps. They cannot agree on how to get started. Where should an IT organization start when adopting DevOps practices?<br>A. Understand why the organization exists<br>B. Pick the right applications to pilot<br>C. Develop a long-term strategy<br>D. Identify tools and training needed | |
| Which statement about Kanban is CORRECT?<br>A. Pushes work through a process<br>B. Requires a workflow management tool<br>C. Pulls work through a process<br>D. Enables more work in progress | |
| What is the Agile Manifesto?<br>A. Values and principles to guide an iterative and people-centric approach to software development<br>B. Methodology that focuses on making sure software is always in a releasable state throughout its lifecycle<br>C. Declaration of the benefits and intentions of DevOps<br>D. Intentions and motives of being an agile enterprise | |
| An organization is trying to overcome the challenges of their legacy silo culture where teams have been organized by subject matter expertise. What is this organization suffering from?<br>A. Cultural debt<br>B. Change fatigue<br>C. Organizational change<br>D. Low trust | |
| **TOTAL** | **100%** |

**Notes:**

- Assignment must be submitted to Moodle on or before the deadline stated.
- Failure to submit by the deadline will incur 10% penalty per day up to 5 days post submission date.
- Plagiarism software will automatically review your submission, pleasure ensure you have used the Harvard Referencing system throughout your submission.
- Please ensure your use the Dorset College cover page including your name, student number and assignment title.

| | |
|---|---|
| **Module Title:** | DevOps |
| **Assignment Type:** | Individual Project |
| **Assignment Title:** | Project |
| **Issue Date:** | TBC - (Semester 1) |
| **Assignment Compiler:** | TBC |
| **Weighting:** | 60% (Part 1: 30% + Part 2: 30%) |
| **Due Date:** | See Moodle |
| **MLO Assessed:** | MIMLO1, MIMLO2, MIMLO3 |

**Introduction**

- Apply the principles of DevOps to a software development project.
- Appraise DevOps principles and practices including integration, delivery and testing.
- Evaluate the DevOps relationship to Agile, Lean and ITSM.
- Apply DevOps skills and knowledge to solve a relevant computing challenge.

In the first class, the students were introduced to the setup of a typical software/IT solution organization. The students then need to research what are the responsibilities of the following four functional departments in such organization/company:

- Business Analysis
- Development
- Quality Assurance (QA)
- IT Operations

For example, a good resource for researching this is the recruitment websites. Later, the students discuss their findings with the lecturer and finalize the responsibilities for each department.

Based on the understanding of the responsibilities of the different departments, the students are assigned to one of the four department as a team member of that functional department. A team leader is elected for teach team, and she/he is in charge of collaborating the team members and report to the lecturer. From then on, a temporary company is formed. The lecturer is acting as the DevOps advisor and director of the company.

In the second class, the software project is selected by the students and the lecturer. Once the project is kicked off, in the subsequent classes, the class is collaborating as a real-life company to deliver this project, and in the process, gradually implement DevOps practice into the daily work to transform the way development, operations and testers collaborate during the development and delivery processes

**Specific Tasks and Marking Scheme**

| Task Description | Marks |
|---|---|
| PART 1: Work diary 30% (10 entries required, Approximate 150-200 words for EACH entry)<br><br>You are required to submit 10 pieces of work diaries, one from each of the class that you have attended. If you have more than 10 diaries, please select the best 10. You can NOT submit a diary entry on the day unless you have attended the class and contributed to the team. If you have not attended enough classes, you can submit an optional self-evaluation form as one of your diary entry.<br><br>Name: | |

Role:

Date:

| Topic | Details |
|---|---|
| What is my team working on today? | |
| What have I contributed to the team today? | |
| What are the challenges (technical and non-technical) that my team is facing? | |
| What challenge we have conquered, and how? | |

[3 marks x 10]

***Sample Diary:***

Name: Joe Doe

Role: QA

Date: 27/02/2022

| Topic | Details |
|---|---|
| What is my team working on today? | *Today my team is working to learn the product features, and bases on the product features to create the test cases we need. We met the BA team and discuss the requirements specification, and we also decide to create a central test case repository so that all our team member can access.* |
| What have I contributed to the team today? | *I working on creating the test case template, in this template we list the important* |
| What are the challenges (technical and non-technical) that my team is facing? | *We are waiting for the BA team to provide clear requirements document so that we can create accurate test cases. Right now the requirement document is not very clear and we need to spend more time to go back to BA team to confirm. We also need a better communication and collaborate platform for our team.* |
| What challenge we have conquered, and how? | *We discussed among our team, and my team has some good experience using Slack. It is allows us to work in the same* |

| | |
|---|---|
| | *workspace, communicate without the use of email and it integrated with Dropbox and Google Drive. It has improve our team efficiency.* |

***Optional Performance Self-evaluation form:***

Role:

| Topic | Details |
|---|---|
| List the top three highest priorities of your position as you understand them. | |
| List what you consider to be your greatest strengths or accomplishments in this class. | |
| Identify factors that impacted your role – either positive or having challenges. | |
| What were you most important effort in this class at collaboration with other people? | |

**PART 2: DevOps Design and Implementation Essay**
**30% (1200 — 1500 words)**

Write an essay to discuss the application of best DevOps practices in our classroom case study above. Your essay should include:

1. Describe five problems and the impacts it causes in the company.

   **[Mark 5%]**

2. For each problem described above, select a DevOps practice that can be used to address this problem, and discuss the reason why you have chosen the practice, what is the theory behind of using it.

   **[Mark 10%]**

3. If a DevOps practice has been implemented in the class, discuss the implementation and the impact. If a practice has not been implemented in the class case study, describe how it should be implemented and the expected impact.

| | | |
|---|---|---|
| **[Mark 10%]**<br><br>4. Conclusion: discuss what you have learned from the DevOps module.<br><br>**[Mark 5%]** | | |
| | **TOTAL** | **60%** |

**Notes:**

- Assignment must be submitted to Moodle on or before the deadline stated.
- Failure to submit by the deadline will incur 10% penalty per day up to 5 days post submission date.
- Plagiarism software will automatically review your submission, pleasure ensure you have used the Harvard Referencing system throughout your submission.
- Please ensure your use the Dorset College cover page including your name, student number and assignment title.

**Marking Rubric**
**Part 1**
**Each diary is 3 marks out of the 60 (5% of the project), the 10 diaries is 30 marks out of the 60 (50%) (approximately 200 words for each entry).**