# Module Definition Form (MDF)

| Module code: MOD009726 | **Version:** 1 **Date Amended:** 27/Feb/2024 |
|---|---|

| 1. Module Title |
|---|
| Human Motion Biomechanics |

| 2a. Module Leader |
|---|
| Adil Mustafa |

| 2b. School |
|---|
| School of Engineering and the Built Environment |

| 2c. Faculty |
|---|
| Faculty of Science and Engineering |

| 3a. Level |
|---|
| 6 |

| 3b. Module Type |
|---|
| Standard (fine graded) |

| 4a. Credits |
|---|
| 15 |

| 4b. Study Hours |
|---|
| 150 |

| 5. Restrictions | | | |
|---|---|---|---|
| **Type** | **Module Code** | **Module Name** | **Condition** |
| Pre-requisite: | MOD007035 | Applied Engineering Mathematics | Compulsory |
| Pre-requisite: | MOD009161 | Structural Mechanics | Compulsory |
| Co-requisites: | None | | |
| Exclusions: | None | | |
| **Courses to which this module is restricted:** | | | |

**LEARNING, TEACHING AND ASSESSMENT INFORMATION**

**6a. Module Description**

In this module, you will learn about Engineering Dynamics (the study of objects in motion) and apply your new skills within human motion biomechanics. The module has a large emphasis on experimental data collection via motion analysis. You will learn about the walking cycle, with the help of Baker's classical textbook. You will then create your own Verne model and use the model to re-create and analyse the walking cycle. You will then progress onto modelling non-walking motion. You will choose a particular motion to independently analyse. You will explain the motion in words, model the motion in simulations, and analyse the motion using first principles of dynamics.

In this module, you will also learn practical motion analysis skills, such as lab calibration, marker placement, and intra- and inter-reliability marker placement tests. You will collect and analyse data of level walking, a sports activity, and another activity of daily living. Kinetic and kinematic data are analysed in Vicon, OpenSim, and Matlab.

This module also discusses ethical concerns and health and safety risks associated with collecting human data. You will write up your findings as a mock research grant proposal.

## 6b. Outline Content

Topics specific to Biomechanics:

- Understanding and applying the fundamentals of Engineering Dynamics
- Describing, modelling, and analysing human motion
- Collecting motion analysis data (calibration, marker placement) during a variety of activities
- Analysing and interpreting motion analysis data using Vicon, OpenSim, and Matlab
- Considering potential sources of error/uncertainty in motion analysis data

Topics not specific to Biomechanics:

- Practicing keeping a logbook detailing weekly activities and project progress
- Writing ethics applications and risk assessments associated with the motion analysis laboratory
- Creating oral presentation/video explaining project
- Communicating with different audiences (research grant committee)
- Working effectively autonomously (time management, project organization, etc)

## 6c. Key Texts/Literature

The reading list to support this module is available at: https://readinglists.aru.ac.uk/

## 6d. Specialist Learning Resources

Motion Analysis Laboratory

BodyWorks Kinematics Tool: http://articlesbyaphysicist.com/body_angles.html

OpenSim Software: https://simtk.org/frs/?group_id=91

| 7. Learning Outcomes (threshold standards) | | |
|---|---|---|
| **No.** | **Type** | **On successful completion of this module the student will be expected to be able to:** |
| 1 | Knowledge and Understanding | Discuss why biomechanical data may be incomplete or uncertain, and how these uncertainties may affect calculations/conclusions. |
| 2 | Knowledge and Understanding | Explain how ethical concerns, health and safety risks, and risk management are associated with collecting human data. |
| 3 | Intellectual, practical, affective and transferrable skills | Analyse systems, processes and components through the use of analytical methods and modelling techniques (both traditional mechanical systems and human biomechanical systems). |
| 4 | Intellectual, practical, affective and transferrable skills | Utilise technical literature and other information sources to conduct biomechanical projects. |

| 8a. Module Occurrence to which this MDF Refers | | | | |
|---|---|---|---|---|
| **Year** | **Occurrence** | **Period** | **Location** | **Mode of Delivery** |
| 2025/6 | ZZF | Template For Face To Face Learning Delivery | | Face to Face |

| 8b. Learning Activities for the above Module Occurrence | | | |
|---|---|---|---|
| **Learning Activities** | **Hours** | **Learning Outcomes** | **Details of Duration, frequency and other comments** |
| Lectures | 12 | 1-2 | First hour of weekly class |
| Other teacher managed learning | 24 | 3-4 | Remaining two hours of weekly class: Workshops, Seminars, Project Work |
| Student managed learning | 114 | 1-4 | Independent Reading and Research, Project Work |
| TOTAL: | 150 | | |

| 9. Assessment for the above Module Occurrence | | | | | |
|---|---|---|---|---|---|
| **Assessment No.** | **Assessment Method** | **Learning Outcomes** | **Weighting (%)** | **Fine Grade or Pass/Fail** | **Qualifying Mark (%)** |
| 010 | Coursework | 3 | 25 (%) | Fine Grade | 30 (%) |
| **1 hour in-class test** | | | | | |
| **Assessment No.** | **Assessment Method** | **Learning Outcomes** | **Weighting (%)** | **Fine Grade or Pass/Fail** | **Qualifying Mark (%)** |
| 011 | Coursework | 1 2 4 | 75 (%) | Fine Grade | 30 (%) |
| **Coursework: 10 minute Project Proposal Presentation (LO2) and 1500 word Project Report (LO1-4)** | | | | | |

| Assessment components for Element 011 | | | | |
|---|---|---|---|---|
| **Component No.** | **Assessment Title** | **Submission Method** | **Weighting (%)** | **Components needed for Mark Calculation?** |
| 011/1 | Project Proposal Presentation: 10 minutes (LO2) | | 20 (%) | All |
| 011/2 | Individual Project Report written as Research Grant Application: 1500 words (LO1-4) | | 80 (%) | |

**In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7*).**

**In addition, students are required to:**
**(a) achieve the qualifying mark for each element of fine graded assessment as specified above**
**(b) pass any pass/fail elements**

**[* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]**