Module Code	MEP55B18
Module Name	Multibody Dynamics
ECTS Weighting	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Professor Ciaran Simms
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Use vector and tensor algebra to describe three-dimensional kinematics/dynamics. LO2. Apply the principles of Newtonian mechanics to the analysis of physical systems in which components can be modelled as essentially rigid. LO3. Analyze the motion of linked rigid body systems in 3D including the formulation of constraints due to kinematic joints. LO4. Model contact interactions between rigid bodies using analytic models and using software such as MADYMO. LO5. Understand the Principle of Virtual Power applied to solving the motion of linked rigid bodies. LO6. Apply the above theory and computational methods to the analysis of eg vehicle systems, human gait, impact analysis or robotics. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	This module on the Dynamics of Multibody systems addresses kinematics and dynamics and is focused mainly on applications in biomechanics. It reviews the fundamental matrix algebra required for kinematic and dynamic analysis and computations, introduces three-dimensional kinematics and dynamics, and covers the theory and procedures for modelling systems of rigid bodies connected by kinematic joints. Analytical and applied contact models are reviewed. Applications to human body modeling for gait and impact analysis, vehicle dynamics and robotics are considered.

	For a short video, see: [Teaching - Trinity Centre for Biomedical Engineering - Trinity College Dublin (tcd.ie)]
Teaching and Learning Methods	This module uses in-person lectures, self-directed individual assignments and in-person tutorials to help students achieve the required learning outcomes.
Assessment Details **Please include the following:** • **Assessment Component** • **Assessment description** • **Learning Outcome(s) addressed** • **% of total** • **Assessment due date**	see table below

Assessment Component	Assessment Description	LO Addressed	% of total	Week due (provisional)
Written examination	End of semester examination	1-6	70	Exam period
Computer Laboratory Assignment	Ball kicking simulation	1 - 4	10	Week 3
Assignment	Software based assignments with optional experimental component	1-6	20	Week 10

Reassessment Requirements	Written Examination
Contact Hours and Indicative Student Workload Error! Bookmark not defined.	**Contact hours: (30 Lectures, 10 tutorials, 1 Lab)** **Independent Study (preparation for course and review of materials): 35** **Independent Study (preparation for assessment, incl. completion of assessment): 40**

Recommended Reading List	• Wittenburg, Dynamics of Multibody systems, Springer, 2008. • Moon, Applied Dynamics with Applications to Multibody and Mechatronic Systems, Wiley 1998. • Simms and Wood, “Pedestrian and Cyclist impact, a Biomechanical Perspective”, Springer, 2009
Module Pre-requisite	MEU11E07 Mechanics; MEU33B05 Mechanics of Machines
Module Co-requisite	NA
Module Website	
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	
Academic Start Year	
Academic Year of Date	