Module Template for New and Revised Modules[1]

Module Code	Module Code CEU33A04
Module Name	3A4 STRUCTURAL ANALYSIS
ECTS Weighting[2]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Dermot O'Dwyer
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. The student will be able to analyse statically indeterminate structures using both the stiffness and flexibility methods of analysis. Such analyses require that the student can: • Identify the degree of indeterminacy of the structure; • Identify a suitable system of releases (flexibility method) or an appropriate set of degrees of freedom (stiffness method); • Assemble the flexibility or stiffness matrices using the details of the structure; • Construct the force vector (stiffness method) or displacement vector (flexibility method); • Formulate and solve the equilibrium equations (stiffness method) or boundary conditions (flexibility method); • Use the solution of the system equations to identify the structural response of the individual component of the structure. LO2. The student will be able to apply the moment area method to analyse multi-span beam structures subject to a variety of vertical loading including point loads, patch loading, uniform loading and triangular loading. In addition the student will be able to incorporate support settlements and will be able to use the moment area method to compose the standard tables used in the flexibility and stiffness method. LO3. The student will be able to utilize the method of virtual work to calculate the displacement of plane frames. The student will be able to use either integration tables or direct integration to calculate displacements. LO4. The student will be able to develop qualitative diagrams showing the displaced shape, bending moments and support reactions for an indeterminate plane frame. To do this the student must be capable of conceptualizing the response of the structure, synthesize diagrams showing

[1] An Introduction to Module Design from AISHE provides a great deal of information on designing and re-designing modules.
[2] TEP Glossary

probable response, critique the diagrams for consistency and amend them as necessary until the displaced shape, bending moments and support reactions are mutually consistent and agree with the loads and boundary conditions of the structure.

Graduate Attributes: levels of attainment

To act responsibly - Enhanced

To think independently - Enhanced

To develop continuously - Not embedded

To communicate effectively - Enhanced

Module Content

This course introduces students to the techniques of structural analysis used to calculate the member forces, stresses, strains and displacements of statically indeterminate structures. The course covers the application of virtual work, the stiffness (displacement) and flexibility (force) methods of structural analysis, the moment area method, and the qualitative analysis of structures.

The presentation of the moment area method is designed to complement the students' mathematical training in their freshman years. The moment area method is presented as a differential equation that must be solved subject to boundary conditions. In addition, MaCauley bracket notation is introduced to facilitate the integration of piecewise continuous functions.

The qualitative analysis is essential to this course. Whereas the other sections of the course aim to foster the students' ability to analyse engineering structures, qualitative analysis develops the students' ability to: conceptualise structural behaviour, hypothesise different potential structural responses and appraise the validity of their solutions. Given that most structural analysis is now carried out using computer programs, the ability to predict the qualitative behaviour of a structure, independently of computer analysis, is a key skill.

- Qualitative analysis
- Flexibility method
- Moment area method
- Virtual Work

Stiffness method

Teaching and Learning Methods	The module is delivered through a combination of lectures, tutorials, online learning resources and laboratories.

Assessment Details[3]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
End of Term Exam	Exam	1 - 4	100%	

Reassessment Requirements

Contact Hours and Indicative Student Workload[3]

Contact hours: 58
Independent Study (preparation for course and review of materials): None if students have taken 1E7 Mechanics and 2E4 Solids and Structures and mastered this material.
Independent Study (preparation for assessment, incl. completion of assessment): **67 hours of preparation to master the material and prepare for the exam.**

Recommended Reading List	Any standard structural analysis text will be helpful but none are necessary.
Module Pre-requisite	Ability to analyse statically determinate structures
Module Co-requisite	None
Module Website	All materials are available in Blackboard

[3] TEP Guidelines on Workload and Assessment

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	September 2022
Academic Year of Date	2022-23