

## MODULE DESCRIPTOR

### Module Title

Mechanical Engineering Design 2

|           |             |             |        |
|-----------|-------------|-------------|--------|
| Reference | EN2705      | Version     | 2      |
| Created   | August 2021 | SCQF Level  | SCQF 8 |
| Approved  | March 2021  | SCQF Points | 30     |
| Amended   | August 2021 | ECTS Points | 15     |

### Aims of Module

This module will develop students' understanding of the formal design process with applications to the design of components and systems and machine elements.

### Learning Outcomes for Module

On completion of this module, students are expected to be able to:

- 1 Analyse beam bending behaviour, linear stress-strain and deflection relationships, torsional loading in shafts and shear stresses in beam bending.
- 2 Analyse complex stresses and strains in two-dimensions and principal strains/stresses.
- 3 Solve design problems on power transmission systems and bearing systems.
- 4 Apply effective integrated design methods to the production of technical solutions to specific problems.
- 5 Design mechanical components and assemblies using knowledge of engineering design processes.

### Indicative Module Content

Beam bending theory and the bending equation; properties of plane areas; beam deflection; stress-strain relationships in two-dimensions and Mohr's circle techniques; strain gauge rosettes; relationships between elastic constants; torsion of circular solid and hollow section shafts; shear stresses in beams due to bending; complex loaded beams: lateral and axial loading, SF and thrust; combined bending torsion and axial loading. Thin cylinders and spheres; introduction to strain energy methods in structural analysis. Design process for the solution of engineering systems and components; identifying customer needs and requirements and establishing the engineering characteristics; sources to gather information; creative thinking for concept generation; evaluation methods for concept selection Embodiment design: product architecture; configuration design; best practices for configuration design; parametric design; dimensions and tolerance; human and environmental factors; prototyping and testing. Detail design: final design review, product lifecycle management. Power transmission shafting; couplings; keys; and splines; types of bearings; parameters involved in design and selection of ball and roller bearings; lubrication and seals; assembling and securing bearings on shafts; selection of ball/roller bearing using manufacturer's data/catalogues.

### Module Delivery

The module is delivered by means of lectures, tutorials and guided self-study and is integrated with applications within the laboratory

### Indicative Student Workload

|   | Full Time | Part Time |
|---|-----------|-----------|
| Contact Hours   | 100       | N/A       |
| Non-Contact Hours   | 200       | N/A       |
| Placement/Work-Based Learning Experience [Notional] Hours             | N/A       | N/A       |
| TOTAL   | 300       | N/A       |
| Actual Placement hours for professional, statutory or regulatory body |           |           |

### ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

#### Component 1

|              |                            |            |     |                    |         |
|--------------|----------------------------|------------|-----|--------------------|---------|
| Type:        | Examination                | Weighting: | 50% | Outcomes Assessed: | 1, 2, 3 |
| Description: | A closed book examination. |            |     |                    |         |

#### Component 2

|              |   |            |     |                    |      |
|--------------|---|------------|-----|--------------------|------|
| Type:        | Coursework                                      | Weighting: | 50% | Outcomes Assessed: | 4, 5 |
| Description: | Problem-based assignments including case study. |            |     |                    |      |

### MODULE PERFORMANCE DESCRIPTOR

#### Explanatory Text

The module has 2 components and to gain an overall pass a minimum D grade must be achieved in each component. The component weighting is as follows: C1 is worth 50% and C2 is worth 50%.

|             |   | Examination:   |   |   |   |   |   |    |
|-------------|---|--|---|---|---|---|---|----|
|             |   | A  | B | C | D | E | F | NS |
| Coursework: | A | A  | A | B | B | E | E |    |
|             | B | A  | B | B | C | E | E |    |
|             | C | B  | B | C | C | E | E |    |
|             | D | B  | C | C | D | E | E |    |
|             | E | E  | E | E | E | E | F |    |
|             | F | E  | E | E | E | F | F |    |
| NS          |   | Non-submission of work by published deadline or non-attendance for examination |   |   |   |   |   |    |

### Module Requirements

|                          |                                     |
|--------------------------|-------------------------------------|
| Prerequisites for Module | Completion of EN1700 or equivalent. |
| Corequisites for module  | None.                               |
| Precluded Modules        | None.                               |

**INDICATIVE BIBLIOGRAPHY**

- |   |  |
|---|--|
| 1 | ULRICH, K. T. and EPPINGER, S.D., 2016. Product Design and Development. 6th ed. New York: McGraw-Hill.   |
| 2 | DIETER, G, E. and SHHMIDT, L, C; 2009. Engineering Design. 4th ed. New York: McGraw-Hill.                |
| 3 | COLLINS, J A; BUSBY H; STABB G., 2010. Mechanical Design of Machine Elements and Machines. 2nd ed. Wiley |
| 4 | British Standard BS 8888:2011 - Technical product documentation and specification                        |
| 5 | Manuals and other literature will be made available as appropriate                                       |