

|                               |                                                    |
|-------------------------------|----------------------------------------------------|
| <b>Module code:</b> MOD004048 | <b>Version:</b> 4 <b>Date Amended:</b> 07/Feb/2023 |
|-------------------------------|----------------------------------------------------|

|                                             |
|---------------------------------------------|
| <b>1. Module Title</b>                      |
| Advanced Materials and Structural Integrity |

|                          |
|--------------------------|
| <b>2a. Module Leader</b> |
| Peter Marshall           |

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

|                                    |
|------------------------------------|
| <b>2c. Faculty</b>                 |
| Faculty of Science and Engineering |

|                  |
|------------------|
| <b>3a. Level</b> |
| 7                |

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

|                    |
|--------------------|
| <b>4a. Credits</b> |
| 15                 |

|                        |
|------------------------|
| <b>4b. Study Hours</b> |
| 150                    |

|                                                    |                    |                    |                  |
|----------------------------------------------------|--------------------|--------------------|------------------|
| <b>5. Restrictions</b>                             |                    |                    |                  |
| <b>Type</b>                                        | <b>Module Code</b> | <b>Module Name</b> | <b>Condition</b> |
| Pre-requisites:                                    | None               |                    |                  |
| Co-requisites:                                     | None               |                    |                  |
| Exclusions:                                        | None               |                    |                  |
| <b>Courses to which this module is restricted:</b> |                    |                    |                  |

## LEARNING, TEACHING AND ASSESSMENT INFORMATION

### 6a. Module Description

Learn the advanced concepts of material processes and their importance in mechanical behaviour, integrity and the performance of structures. You will cover durability concepts involving fatigue, crack generation and stress flow in the parts initially, and later extend the concepts to include structural analysis and stability evaluation of mechanical systems. You will also explore the concept of non-linear behaviour in engineering materials, which is a common phenomenon in the structural behaviour of load-bearing members. This module has been developed to meet industrial needs and standards, highlighting the necessity of feasible and applied part design.

### 6b. Outline Content

- Fatigue and the influence of different periodic loading conditions. - Sensitivity of existence of cracks in mechanical parts. - Advanced material hardening methods with emphasis on local strengthening. - Corrosion in structural parts and methods of prevention. - Non-linear behaviour of material. - Design requirements for composites and orthotropic materials.

### 6c. Key Texts/Literature

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

### 6d. Specialist Learning Resources

Audio/Video equipped classroom. Material lab, Tensile test machine, Electron Scanning Microscope

## 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                                 | Understand and critically evaluate key concepts in materials and structural integrity such as life cycle, cracks, hardening methods, and corrosion.                                                                                  |
| 2   | Intellectual, practical, affective and transferrable skills | Apply knowledge of mathematics and engineering principles to solve complex problems on materials and structural integrity.                                                                                                           |
| 3   | Intellectual, practical, affective and transferrable skills | Formulate and analyse a complex structural integrity problem to reach substantial conclusions; Make engineering judgement in situations with uncertain or incomplete information and discuss the limitations of the techniques used. |
| 4   | Intellectual, practical, affective and transferrable skills | Evaluate the environmental and societal impact of structural integrity across entire product life cycle and minimize adverse impacts.                                                                                                |

| 8a. Module Occurrence to which this MDF Refers |            |                                             |          |                  |
|------------------------------------------------|------------|---------------------------------------------|----------|------------------|
| Year                                           | Occurrence | Period                                      | Location | Mode of Delivery |
| 2026/7                                         | 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                                                | 24    | 1-4               | 2 hours lectures per week.                        |
| Other teacher managed learning                          | 12    | 1-4               | 1 hours tutorials and lab work                    |
| Student managed learning                                | 114   | 1-4               | Private study                                     |
| 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        | 1-4               | 50 (%)        | Fine Grade              | 40 (%)              |
| 1500 words report maps to Engineering Council Learning Outcomes M2, M7 |                   |                   |               |                         |                     |
| Assessment No.                                                         | Assessment Method | Learning Outcomes | Weighting (%) | Fine Grade or Pass/Fail | Qualifying Mark (%) |
| 011                                                                    | Examination       | 1-4               | 50 (%)        | Fine Grade              | 40 (%)              |
| 1.5 Hours exam maps to Engineering Council Learning Outcome M1         |                   |                   |               |                         |                     |

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