# Subject Description Form

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>BRE450</th>
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<tbody>
<tr>
<td>Subject Title</td>
<td>Building Maintenance for Sustainability</td>
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<tr>
<td>Credit Value</td>
<td>3</td>
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<tr>
<td>Level</td>
<td>4</td>
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<tr>
<td>Pre-requisite</td>
<td>BRE261 &amp; BRE361 or equivalent</td>
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## Objectives

1. equip students with the practical knowledge and skills in their future roles as building construction and maintenance professionals;
2. provide students an understanding and appreciation of sustainable construction/building;
3. provide students an understanding that sustainability can be achieved by not only constructing sustainable new buildings but also by effective maintenance and repair of existing buildings (i.e. by prolonging their service life through upholding/enhancing their integrity, safety, durability and hygiene). (This subject focuses on the aspects of building structures/elements/fabrics/materials and not building services systems that are installed inside.); and
4. provide students an understanding that building energy-wise sustainability can be enhanced through appropriate retrofitting.

## Intended Learning Outcomes

Upon completion of the subject, students will be able to:

### Part A Sustainability

- a) understand fundamental principles and various attributes of sustainability of the built environment in balancing economic, environmental and social objectives
- b) understand current legislations, regulations, assessment schemes relating to building sustainability in the aspects of repair and maintenance
- c) make informed selection of construction materials with the awareness of embodied energy and carbon contents of construction materials
- d) enhance a building’s energy-wise sustainability through retrofitting of advanced glass or films technologies as well as low-energy consuming lighting

### Part B Building Maintenance

- e) understand that Condition Monitoring (CM) acts as a precursor for effective maintenance and repair
- f) Understand the fundamental physical principles of and conduct advanced Condition Monitoring (CM), Rehabilitation Techniques (RT) and Strengthening Techniques (ST) on buildings and their fabrics (typical high-rise RC buildings)
- g) Acquire the practical skills in undertaking measurement, acquiring data in the aspects of building integrity, safety and energy performance (with occasional specialist technical support in the cases of some very sophisticated equipment) as well as in the applications of RT and ST
- h) conduct building pathology and defect diagnostics by interpreting appropriately data/charts/visual images obtained by the equipment with due regards paid to the strength, weakness and limitations of each technique

## Subject Synopsis/Indicative Syllabus

**Need of sustainability** in global and local context - issues and impacts on environmental, economic and social sectors, Kyoto Protocol.

**Principle of construction sustainability**: concepts and principles, roles and responsibilities of building professionals.
Strategy for sustainable construction:
- active measures:
  - design /construction stages: green building / materials, HKBEAM, BREEAM, LEED, BHHI
  - building in use: importance of building maintenance
- passive measures:
  - legislations and regulations (e.g. on thermal, ventilation, electricity, etc.);
  - energy auditing and life cycle assessment;
  - inspection for regular maintenance

Building maintenance for sustainability:
- choices of building materials - application, re-use and recycling; embodied energy and carbon contents of construction materials;
- rehabilitation and strengthening techniques;
- condition appraisal, building inspection - Mandatory Building Inspection Scheme in Hong Kong;
- different building defects diagnostic techniques and their applications and subsequent remedial maintenance work;
- maintenance management using Building Information Modeling.

Retrofitting using advanced materials and technologies:
- use advanced glazing (glass technologies) and solar-energy-reducing films;
- use advanced energy-reducing lighting;
- use repair/replacement materials with appropriate balance regarding embodied energy and carbon contents.

Teaching/Learning Methodology
The subject covers theoretical, conceptual, statutory as well as practical issues in building maintenance for sustainability. Much of these will be taught in lectures and reinforced in tutorials and seminars.

Interactive lecture
- practical and workshop (guided)
- hands-on experience as reinforcement of knowledge by undertaking Group Projects
- Peer learning from other Groups during project Viva and presentation

Assessment Methods in Alignment with Intended Learning Outcomes
Assessed 100% by coursework and no written examination.

<table>
<thead>
<tr>
<th>Part I:</th>
<th>Specific assessment methods/tasks</th>
<th>% weighting</th>
<th>Intended subject learning outcomes to be assessed (Please tick as appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Group Project Report</td>
<td>40%</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Viva</td>
<td>20%</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>individual reflective Journal on the group project</td>
<td>10%</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Total</td>
<td>70%</td>
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Part II:

<table>
<thead>
<tr>
<th>Specific assessment methods/tasks</th>
<th>% weighting</th>
<th>Intended subject learning outcomes to be assessed (Please tick as appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class assignment/ Class Tests/ Essay/</td>
<td>30%</td>
<td>b ☑    c ☑    d ☑    e ☑    g ☑    h ☑</td>
</tr>
<tr>
<td>Total</td>
<td>30%</td>
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Student Study Effort Expected

Class contact:
- Lecture
  - 26 Hrs.
- TU/LAB/ FIELD TEST
  - 12 Hrs.
- Viva and Presentation
  - 2 Hrs.

Other student study effort:
- Practical work
  - 40 Hrs.
- Self Study and reading
  - 40 Hrs.

Total student study effort
- 120 Hrs.

Reading List and References

**Sustainability of Construction:**


**Sustainability of materials: Tables of Embodied Energy and Embodied Carbon Dioxide (ECO2)**


**Building Diagnostic or Non-destructive Testing (NDT) Techniques:**


**Rehabilitation and Structural Strengthening:**


Vilhena, A., Costa Branco De Oliveira Pedro, J., and Vasconcelos de Paiva, J. "Assessment method for buildings' Rehabilitation needs: Development and


**Building Information Modeling on Maintenance Management**