Subject Description Form

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>EE536</th>
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<tbody>
<tr>
<td>Subject Title</td>
<td>Signalling and Train Control Systems</td>
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<tr>
<td>Credit Value</td>
<td>3</td>
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<tr>
<td>Level</td>
<td>5</td>
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<tr>
<td>Pre-requisite/Co-requisite/Exclusion</td>
<td>Nil</td>
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<tr>
<td>Collaboration Institute</td>
<td>MTRC</td>
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Objectives
1. To provide students with a comprehensive understanding on the basic principles and terminology of railway signalling.
2. To enable students to acquire knowledge on train control systems and their implications to safe and efficient railway operation.
3. To enable students to understand the design processes of signalling layout and the control of signals.
4. To provide students with the basic concepts on the principles, means, instrumentation and commissioning of train detection and interlocking systems.
5. To appreciate the structure and components of an automatic train control system.

Intended Learning Outcomes
Upon completion of the subject, students will be able to:
- Identify the functions, operation principles and key components of a signalling system.
- Given track layout and signalling requirements, formulate a simple signalling layout.
- Describe the train detection methodologies and implementation considerations, and compare their advantages and limitations.
- Compare between relay interlocking and processor-based interlocking, their safety principles and commissioning plans.
- Explain the requirements and structure of an automatic train control system.

Subject Synopsis/Indicative Syllabus
1. Basic signalling principles: Safe operation of trains, prevention of trains collision and locking of points and routes; type of signalling, signal spacing and signalling layout; headways line capacity, headways for different types of signalling systems, factors affecting headways; control table, conditions for setting of routes, clearing of signals and locking of routes and points; aspect sequence, meaning of signal aspect and the circumstances under which signals display.
2. Train detection: Track circuit, axle counter and advanced detection system; track circuit bonding; track circuit connections and maintenance of traction return at points and crossings.
3. Relay interlocking: Interlocking implementation based on relays, safety principles; processor based interlocking, interlocking implementation based on processors/computers, safety principles.
5. Automatic train control system: Automatic train protection, automatic train operation and automatic train supervision.

Case Study:
Site visits to MTR train control centres

Teaching/Learning Methodology
Basic principles of signalling functions and operations are usually simple but they are always complicated by the implementation and practices in systems with unique requirements. Lectures are necessary to cover the fundamentals, supplemented by the examples and exercises from real-life applications. Site visits to the MTR Control Centres are also arranged so that the students are able to co-relate what they have learned to actual operations.

<table>
<thead>
<tr>
<th>Teaching/Learning Methodology</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Site visits</td>
<td>✔ ✔ ✔ ✔ ✔</td>
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<tr>
<td>Industrial seminars</td>
<td>✔ ✔ ✔ ✔ ✔</td>
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Assessment Methods in Alignment with Intended Learning Outcomes
Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |
----------------------------------|------------|-----------------------------------------------|
1. Examination                   | 60%        | ✔ ✔ ✔ ✔ ✔ |
2. Test                          | 25%        | ✔ ✔ ✔ ✔ ✔ |
3. Assignments                   | 15%        | ✔ ✔ ✔ ✔ ✔ |
Total                             | 100%       | ✔ ✔ ✔ ✔ ✔ |

The examination is to evaluate the students’ understanding of the underlying principles in general. Signalling involves signal layout and route setting, which requires substantial practical skills through exercises. Test and assignment provides the means to assess such practical design skills.

Student Study Effort Expected
- Class contact:
  - Lecture/Tutorial 33 Hrs.
  - Industrial/Research seminars 6 Hrs.
- Other student study effort:
  - Assignments 10 Hrs.
  - Self-study 50 Hrs.
  - Site visit 3 Hrs.

Total student study effort 102 Hrs.

Reading List and References
Textbooks:
2. Edited by B. Ning, Advanced Train Control Systems, WIT, 2010
Reference books:
1. Proceedings of International Conferences on Computers in Railways, WIT Press
2. Selected papers on IRSE Proceedings
3. IRSE Green Book No. 27, Signalling the Layout
4. IRSE Green Book No. 29, Solid State Interlocking

June 2016