Subject Description Form

Subject Code	EE535
Subject Title	Maintenance and Reliability Engineering
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with a comprehensive understanding on various maintenance management processes. 2. To enable students to understand the impact of maintenance management on railway objectives in safety, reliability and cost effectiveness. 3. To enable students to acquire knowledge and techniques in reliability engineering. 4. To equip students to make decisions on sound maintenance and reliability improvement. 5. To enable students to apply the techniques in reliability engineering to railway operation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify the possible faults in railway systems and their impacts to the overall system reliability. b. Develop fault trees for a sub-system in railways and apply various reliability models on fault analysis. c. Discuss system data collection for reliability assessment. d. Evaluate maintenance schedules and assess the corresponding risk with appropriate techniques and tools. e. Review the advantages and limitations on condition-based monitoring maintenance, alternative sourcing of inventory and maintenance outsourcing management for railway assets. f. Organise and present an assigned research topic.
Subject Synopsis/ Indicative Syllabus	**Reliability Engineering** 1. Reliability fundamentals: Reliability Mathematics. Failure distributions. Causes of failures and their treatment. Reliability apportionment and prediction. Reliability data books. Data Recording and Corrective Action System (DRACAS). 2. Reliability analysis and modelling methods: Fault tree analysis, Failure Mode Effects and Criticality Analysis (FMECA), Reliability block diagram, Reliability Growth Models – IBM and Duane Reliability Growth modelling, Reliability testing. Monte Carlo Reliability Simulation. Weibull Analysis. **Maintenance Management** 1. Asset management framework based on ISO55000/55001. Alignment with corporate asset management direction. Asset management organization. Asset management and business sustainability. 2. Maintenance techniques and tools: Maintenance as an essential element for asset management. Reliability Centred Maintenance as a means for maintenance decision. Topics on conditioned based maintenance.

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<tr><td></td><td>3. Management for business performance: Computerized Maintenance Management System – from planning to implementation. Alternative spare sourcing. Maintenance outsourcing management for railway assets.
Site visits to MTR depots and industrial/research seminars.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Video clips together with computer animations are used to supplement conventional lectures. Case studies will be used extensively to highlight the practicality of the subject materials being covered. Practitioners are also invited to have experience sharing sessions with the class. A group project is to be carried out to demonstrate and integrate the knowledge learned.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="6">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>Lectures</td><td>√</td><td>√</td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>Tutorials</td><td></td><td>√</td><td>√</td><td></td><td>√</td><td></td></tr>
<tr><td>Project works</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
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<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Group Mini Project</td><td>20%</td><td></td><td>√</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Tests</td><td>20%</td><td>√</td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>3. Examination</td><td>60%</td><td>√</td><td></td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
This is a specialist subject with bias on maintenance and reliability of railway assets, in particular on rolling stocks. A large number of case studies are discussed in the lectures and the outcomes are to test the understanding of the student on the underlying fundamentals through quizzes, mini-projects and written examinations.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture/Tutorial</td><td>36 Hrs.</td></tr>
<tr><td>▪ Industrial/Research seminars</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignment and Self-studies</td><td>66 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>105 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>Textbooks:
1. V. A. Profillidis, Railway management and engineering, 3rd Edition, Burlington, Ashgate Pub. Co., 2006.
2. P. D. T. O'Connor, Practical Reliability Engineering, Wiley, 2006</td></tr>
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	Reference Books: 1. ISO 55000 – Asset Management 2. ISO 55001 - Asset management — Management systems — Requirements 3. ISO 55002 - Asset management — Management systems — Guidelines for the application of ISO 55001