

Subject Description Form

Subject Code	EE536
Subject Title	Signalling and Train Control Systems
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Collaboration Institute	MTR Academy
Objectives	<ol style="list-style-type: none"> 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 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	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. Identify the functions, operation principles and key components of a signalling system. b. Given track layout and signalling requirements, formulate a simple signalling layout. c. Describe the train detection methodologies and implementation considerations, and compare their advantages and limitations. d. Compare between relay interlocking and processor-based interlocking, their safety principles and commissioning plans. e. Explain the requirements and structure of an automatic train control system.
Subject Synopsis/ Indicative Syllabus	<ol style="list-style-type: none"> 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. Signalling interlocking: Interlocking implementation based on relays, safety principles; processor based interlocking, interlocking implementation based on processors/computers, safety principles. 4. Principles of testing: Competence, functional tests, scenario tests, independent test, test strategy, test plan, commissioning plan, records. 5. Automatic train control system: Automatic train protection, automatic train operation and automatic train supervision.

	Case Study: Site visits to MTR train control centres Industrial/Research seminars						
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.						
	Teaching/Learning Methodology	Outcomes					
		a	b	c	d	e	
	Lectures	✓	✓	✓	✓		
Site visits		✓		✓	✓		
Industrial seminars					✓		
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
			a	b	c	d	e
	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					53 Hrs.	
	▪ Site visit					3 Hrs.	
Total student study effort					105 Hrs.		

Reading List and References**Textbooks:**

1. 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