

# ENGINEERING MATERIALS

## (1<sup>ST</sup> RUN)

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In this course the fundamental material properties of concrete and steel are examined. The importance of ductility is stressed. How structures can become brittle and how to avoid it is explained. Corrosion is steel's Achilles' heel and its effect is examined. Welding is an efficient way of joining steel components but can cause problems which will also be examined from a materials point of view. Concrete is brittle but when well-detailed with steel reinforcement, is ductile. Unfortunately, it is prone to cracking. Some of the main causes are discussed. In addition, concrete protects steel from corroding but this protection can be lost over time. The course also considers the causes and likely consequences of this weakness.

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### Course Objectives

Provide background to understanding structural aspects of both steel and concrete materials

### Target Audience

Design and Professional Engineers

### Contents

#### 1. Introduction:

- Ductile and Brittle materials: Interatomic bonding
- Stress concentration
- Strength of thin fibres
- Dislocations
- Work of fracture
- Charpy test
- Fast fracture, Critical crack length

#### 2. Steel:

- Steel Manufacture
- Heat treatment
- Rolling and casting
- Controlling grain size
- Stress-strain curve
- Young's modulus
- Creep/relaxation
- Temperature
- Corrosion, Welding
- Lamellar tearing
- Tri-axial tension. Implications for design
- Case studies of corrosion and welding

#### 3. Concrete:

- Production
- Tensile strength
- Structural and non-structural cracks
- Shrinkage
- Creep, Compression strength
- Young's modulus
- Static fatigue
- Deterioration of RC: carbonation, cracking and chloride attack
- Case study: durability
- SS EN 1992 series of Design of Concrete Structures

## Lecturer Profile



Er. Dr Niall MacAlevey is currently an independent consultant specializing in the analysis and design of reinforced and prestressed concrete structures, forensic engineering and the strengthening of concrete structures. He is the founder of the firm 'Shamrock Consultants', is a member of The Institution of Engineers of Ireland and is a registered Professional Engineer in Singapore.

After graduating from University College Dublin, Ireland in 1987 with a B.E (Civil) degree, he then obtained his M.Sc. degree in "Concrete Structures" at Imperial College, London in 1988. He completed his Ph.D degree at the Nanyang Technological University in 1997 on "The Strengthening of Concrete Structures" and later joined the academic staff there. He obtained a PGDipTHE (Post-Graduate Diploma in Teaching in Higher Education) from the National Institute of Education in 2001.

He has worked for a number of consulting engineering firms and specialist prestressing subcontractors in London, Cambridge, Hong Kong and Singapore. He is the author of four books "Structural Engineering Failures: lessons for design", Preliminary Design of High-Rise Buildings in Non-Seismic Regions, Design of Reinforced Buildings to Resist Blast and Prestressed Concrete in Buildings. All books are available from Amazon.com

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## Course Details

**Date/Time:** 10 December 2019 / 9.00pm – 12.15pm

**Fees :** \$149.80 (IES Member) / \$176.55 (Non-member)

Fees inclusive of 7% GST, course materials, one Halal tea break refreshment

**CPD Programme:** PDU / 3 STU (Structural) -

All to be confirmed

Certificates awarded to participants with 100% attendance



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IES Academy @ Jurong East

80 Jurong East St 21 | #04-10 | Devan Nair Institute | Singapore 609607

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## Registration Form

### Engineering Materials (1<sup>st</sup> Run)

Date	:	10 December 2019, Tuesday
Duration	:	3 hrs (½ day)
Time	:	9.00am – 12.15pm
CPD Programme	:	PDU/ 3 STU (Structural) – All to be confirmed
Venue	:	IES Academy@Jurong East, 80 Jurong East St 21 #04-10 Devan Nair Institute S(609607)
Course Fee	:	\$149.80 (IES Members); \$176.55 (Non members)
Course Coordinator	:	Jessie Tan Tel: 6461 1250 Email: <a href="mailto:jessie.tan@iesnet.org.sg">jessie.tan@iesnet.org.sg</a>
Last Date of Registration	:	3 Dec 2019 or till class fully booked (whichever comes first)

### Participant's Details

Name (as in NRIC)	:		NRIC/FIN No	:				
Company	:		Designation	:				
Address	:							
		Postal Code	:					
Office No	:		Mobile	:		Gender	:	Male / Female
Email	:							
Please indicate	<input type="checkbox"/> IES Member No:		<input type="checkbox"/> Non-Member		<input type="checkbox"/> RTO/RE/PE No:			
	<input type="checkbox"/> Sponsored by Company		<input type="checkbox"/> Special Meal Request – Vegetarian					

### Contact Person (HR/Accounts Department)

Name	:		Designation	:				
Office No	:		Fax	:		Email	:	
Payment	Nets/Cheque:					Amount:		

- \* Cheque to be made payable to 'ENGINEERS SINGAPORE PTE LTD'
- \* Written Notice via email is required for Cancellation/ Withdrawal of course, 7 working days prior to course date
- \* Course fee inclusive of 7% GST, course materials and Halal refreshments
- \* Full payment is require to secure seat in class
- \* Certificate of Attendance will be issued to participants with 100% Attendance

### Acceptance of Terms & Conditions for Registration of IES Academy Courses / Events

I agree to abide to the Terms & Conditions for Registration of IES Academy courses and events

Name:

Signature:

Date:

## **TERMS & CONDITIONS COURSE REGISTRATION**

### **Registration**

Any registration, whether on-line or fax will be on a first-come-first-served basis and will only be confirmed upon receipt of full payment by Engineers Singapore Pte Ltd unless otherwise invoice to company. All registrations must be submitted with duly completed registration form.

### **Closing Date & Payment**

The closing date of the event will be 1 week prior to event commencement date or earlier. Cheques should be crossed 'A/C payee only' and made payable to 'Engineers Singapore Pte Ltd', with the ***Title of The Event indicated clearly written on the back of the cheque***, and submitted with the duly completed registration forms to:

**Att: Jessie Tan**

**IES Academy@Jurong East**

Devan Nair Institute for Employment and Employability,

80 Jurong East Street 21, #04-10

Singapore 609607

### **Confirmation of Registration**

Confirmation of registration will be given at least 1 week before the commencement date via email. ***If you do not receive the said confirmation email, you are required to contact IESA at 6463 9211 during office hours.***

IESA reserves the right to allow only confirmed registrants to attend the Event.

### **Withdrawals/Refunds of Fees**

Written notice at least 1 week in advance before the commencement of the event.

Full course fee shall be refunded subjected to 4.5% transaction charge.

- NO refund otherwise.

No show of participant would not be accepted as a valid reason for withdrawal/refund. One time replacement is allowed only if written notice is received by us at least 1 week before the commencement of the event. However, when an IES member is replaced by a non-member, the participant has to pay the difference in the relevant fees.

### **Cancellation/Postponement**

Changes in Venue, Dates, Time and Speakers for the Events can occur due to unforeseen circumstances. IES reserves the full rights to cancel or postpone the Event under such circumstances without prior reasons. Every effort, however, will be made to inform the participants or contact person of any cancellation or postponement. Fees will be refunded in FULL if any Event is cancelled by IESA.

**UTAP (Union Training Assistance Programme)** is an individual skills upgrading account especially for NTUC members. As a member, you enjoy UTAP funding at 50% of the unfunded course fee capped at \$250 every year.

**SkillsFuture Credit (SFC)** "All Singaporeans aged 25 and above can use their \$500 SkillsFuture Credit from the government to pay for a wide range of approved skills-related courses. Visit the SkillsFuture Credit website ([www.skillsfuture.sg/credit](http://www.skillsfuture.sg/credit)) to choose from the courses available on the SkillsFuture Credit course directory."

Please visit [https://www.ies.org.sg/ies/Skillsfuture & UTAP.pdf](https://www.ies.org.sg/ies/Skillsfuture%20&%20UTAP.pdf) for more information on SFC & UTAP claim.

### **PERSONAL DATA PROTECTION ACT**

I consent to the processing by Institution of Engineers, Singapore of personal data, including sensitive personal data as defined in the Data Protection Act 2014, about me for the proper purposes of Institution of Engineers, Singapore (IES). I undertake to observe the provisions of the Data Protection Act 2014 in relation to any personal data I may myself hold and process as a Members of Institution of Engineers, Singapore, and I agree to indemnify Institution of Engineers, Singapore from liability for any claims or damages that may arise from the processing of this data. For more information kindly refer to [here](#).

### **Enquiries**

For further enquiries, please contact IESA general office at Tel: 6463 9211.