INTRODUCTION

My many years of Professional activities and social interaction talking to a number of Professional Electrical Engineers and old and young Electrical Engineers from the consulting, electrical installation and contracting industry, as well as Plant Electrical Engineers from the manufacturing sectors, I gained the strong impression that there was one need which had not really been fulfilled and satisfied. This was the need to conduct a comprehensive training course on the Code of Practice for Electrical Installation – CP5 for all interested parties involved in the electrical industry.

OBJECTIVES

The code of practice for electrical installation – CP5 applies to the design, selection, erection, testing and inspection of electrical installations. It covers all general commercial and industrial electrical installations operating at voltage up to 1000 Volts. Its main objective is to provide safety from fire, shocks and burns.

There are a total of seven parts which make up the Code - CP5:

- Part 1 – Scope, objective and fundamental requirements for safety
- Part 2 – Definitions of terms used in the Code- CP5
- Part 3 – Assessment of general characteristics
- Part 4 – Protection for safety
- Part 5 – Selection and Erection of equipment
- Part 6 – Special installation or locations
- Part 7 – Inspection and Testing and Seven (7) Appendices

The course aims to provide participants with a thorough knowledge and understanding of the Code of Practice with explanations backed by basic electrical engineering theory why certain regulations are written and worded in a way seen less obvious for the average person.

Note – Participants taking this course must bring their own copy of the Code of Practice CP5.
COURSE OUTLINE

The topics to be discussed in each part of the Code of Practice will include but not limited to the following:

Part 1 – Scope, objective and effects and fundamental requirements for safety

- Inclusions and Exclusions from the scope
- Objective and Effects
- In Contractual Agreement
- Relationship with Statutory Authority
- Licensing of Electrical Installations
- Workmanship and Materials
- Equipment
- Conductors
- Overcurrent Protective Devices
- Protection against earth leakage and earth fault
- Fundamental safety requirement

Part 2 – Definitions

- Suggest for self – reading

Part 3 – Assessment of general characteristics

- Purpose, Supplies and Structure
- Arrangement of Live Conductors
- Type of Earthing
- Earthing arrangement used in Singapore
- Prospective short-circuit current
- External Earth Fault Loop Impedance

Part 4 – Protection for Safety

- Protection against Electrical Shock
- Temperature Effect on \(Z_s\) under earth fault conditions
- Protection against both Direct and Indirect Contact
- General requirement for EEBADS
- Purpose of Providing Equipotential Bonding Equipotential Zone
- Inside and Outside of Equipotential Zone
- EEBADS for TN-S System
- Protection against Indirect Contact on TN-S System
- Circuits with Difference disconnection times emanating from a common distribution board
- EEBADS for TT-System
- EEBADS Supplementary equipotential Bonding
- Protections against thermal effects
- Protections against overcurrent
- Overload Current and Fault Current
- Nature of Protective Devices
- Protection against both overload and fault current
- Co-ordination between conductor and protective devices
- Determination of Prospective Fault Current
- Short Circuit Calculations
- Phase to Neutral Short Circuit
- Phase to Phase Short Circuit
- Three Phase Short Circuit
- Phase to Earth Short Circuit
- Fault Current at the origin of an installation
- Characteristics of a Fault Protective device
- Isolation and Switching
- Protection according to the nature of the circuit and distribution systems
Day 2: Low Voltage Electrical Installation design calculations for compliance with Code of Practice for Electrical Installation – CP5

INTRODUCTION

The first stage in designing an electrical installation system after having carried out the assessment of general characteristics demanded in part 3 of CP5 and the determination of the design current, is the choice of the type of cable and the method of installation of that cable for such circuit.

Where there are a number of options open to the installation designer from purely technical considerations, the final choice will depend on the commercial aspects or designer’s or clients personal preference.

To determine the minimum conductor cross-sectional area of the live conductors of a particular circuit, the designer must take into consideration circuits in varying external influences and installation conditions, such as circuits in thermal insulation walls, circuits totally surrounded by thermal insulating material or circuits in ventilated trenches or on perforated metal cable trays or in enclosed trenches or in enclosed metal trunkings or in metal conduits.

Also, the designer must decide at some stage, whether the circuit is to be run singly or bunched or grouped with other circuits. He must also decide whether it is intended the overcurrent protective device is to give:

(a) Overload Protection only, or  
(b) Short Circuit Protection only, or  
(c) Overload and Short Circuit Protection  
(d) Establish the maximum voltage drop  
(e) Estimate the route length of the circuit

It cannot be emphasised too strongly that unless all the foregoing items are available, it is not possible to design any circuit.
OBJECTIVES

The course aims to provide participants with practical skills backed by theoretical knowledge on how to:

- Calculate the cross-sectional areas of live conductors for compliance with Regulation 523-01-01, namely that under normal load conditions that maximum permitted normal operating temperature is not exceeded.
- Calculate the earth fault loop impedance for compliance with the requirement concerning maximum disconnection time of protective device being used for protection against indirect contact.
- Calculate the circuit protective conductor cross-sectional areas for compliance with Regulation 543-01-01.
- Calculate the short circuit current at the origin of an installation and elsewhere.

These are broadly speaking topics demanded in the syllabus of the PPE examination part 2.

Note – Participants taking this course must bring their own copy of the Code of Practice CP5 and Calculator.

COURSE OUTLINE

(A) Calculation for the determination of the cross-sectional areas of circuit live conductors. Topics and calculation examples covered under this section will include but not limited to:

- General Circuits
- Circuits in thermally insulated walls
- Circuits totally surrounded by thermally insulating materials
- Circuits in varying external influences and installation conditions
- Circuits in ventilated trenches
- Circuits on perforated metal cable trays
- Circuits in enclosed trenches
- Circuits in enclosed metal trunkings and in metal conduits
- Circuits in low temperatures
- Motor circuits subject to frequent stopping and starting
- Circuits for Star-Delta Starting of motors

(B) Calculation of Voltage drop under normal load conditions. Topics will include but not limited to:

- Using the simple approach
- Using the more accurate approach taking account of the load power factor
- Using the more accurate approach taking account of both conductor operating temperature and load power factor
- Voltage drop in Ring Circuits

(C) Calculation of Earth Fault Loop Impedance. Topics will include but not limited to:

- The simple approach
- The more accurate approach taking account of conductor temperature
- Calculations taking account of transformer impedance
- Calculations concerning circuits fed from Sub-Distribution boards
- Calculations where cable armouring is used as a protective conductor
- Calculations where conduit or trunking is used as the Protective Conductor

(D) Calculations concerning circuit protective conductor cross-sectional areas. Topics include but not limited to:

- Calculations when the protective device is a fuse
- Calculations when the protective device is an Mcb
- Calculations when the protective device is an RCCB
Calculations related to short-circuit conditions. Topics will include but not limited to:

- AC single-phase circuits
- The more rigorous method for AC single-phase circuits
- Three-phase circuits
  - (a) The symmetrical three-phase short circuit
  - (b) The phase-phase short circuit
  - (c) The phase-neutral short circuit
  - (d) The phase-earth short circuit
- Fault current at the origin of an installation
- Characteristics of a Fault Protective device

Combined Examples

All the previous discussions and examples dealt with individual aspects of the design of circuits. In this last section, we will discuss a series of practical design examples of complete electrical installation and show by calculations how each circuit is designed for compliance with the code CP5. Generally speaking, these will be involved:

- Determine the conductor cross-sectional area
- Voltage drop supply transformer to main intake switchboard
- Voltage drop from main intake switchboard to sub-distribution boards
- Prospective short-circuit current at the terminals of the transformer
- Prospective short-circuit current at the origin of the installation ie. at the main intake switchboard
- Prospective short-circuit current at the sub-distribution boards
- The earth fault loop impedance at main intake switchboard and sub-distribution boards etc.
- Calculations for determination of cross-sectional area of protective circuit conductors etc.

TARGET AUDIENCE

This course should be of interest to all Electrical Installation designers, Electrical Engineers from the installation and contracting industry, Plant Electrical Engineers from Industrial Sector as well as all LEWs and any interested parties. This course will benefit greatly those young Electrical Engineers and individuals who are aspiring to be professional engineers as well as those who are preparing to sit for the Practice of Professional Engineering Examination Part 2 (Electrical). CP5 is one of the major topics in the syllabus of the PPE examination Part 2.
Er Lee Keh Sai is a Chartered Electrical Engineer and a Registered Professional Engineer with more than 50 years of industrial experience. He specializes in Electrical Power Engineering, Energy Management and Power Quality Solutions.

Er Lee is the Principal of K.S.Lee & Associates which he established in 1970. He has provided consultancy services to many MNC and SMEs. Prior to the establishment of his consultancy services, he held senior staff positions in the Electricity Department of the former Public Utilities Board and later with Shell Eastern Petroleum at their Pulau Bukom Refinery Complex.

Er Lee has served in various capacities in many professional associations, government agencies and educational institutions. He had previously served as Deputy Chairman, Board of Governors, for both the ITE and Singapore Polytechnic. He is currently serving as a member of Strata Titles Board and EMC’s Market Surveillance Compliance Panel.

Er Lee is an approved and certified trainer and is currently teaching the core module “Motor Driven Systems” under the Singapore Certified Energy Managers (SCEM) Program.
Registration Form

IES PREPARATION COURSE FOR PPE PART2 EXAM ELECTRICAL ENGINEERING: CP5 on Wiring Regulations and Low Voltage Design Calculations

Date: 27 & 28 March 2018, Tuesday & Wednesday
Time: 9am – 6.00pm
Venue: IES Academy@Jurong East (Devan Nair Institute, Ezi Building)
80 Jurong East Street 21, #04-10 Singapore 609607
Fees (Include GST): IES Members: $695.50
Non-Members: $909.50

Please register online/fax the completed form by **20 March 2018 before 3pm** to:
Contact Person: Vincent Chiew
Address: 80 Jurong East Street 21, #04-10 Singapore 609607
Tel: 64639211 Fax: 64639468

**Participant Details**

*Name*: ________________________________  *NRIC*: ________________________________  
(Please written in BLOCK Letter)

*Company*: ________________________________  *Designation*: ________________________________

*Address 1*: ________________________________  
(For mailing of invoice and receipt)

*Address 2*: ________________________________  
(For mailing of Certificate)

*Postal Code*: ________________________________  *Sex*: _______ Male / Female

*Contact No.*: ________________________________  *Fax*: ________________________________

*Your Email*: ________________________________  
(For sending of confirmation email, preferable personal unless company sponsored)

Please indicate:  
☐ IES members  IES M’ship No.: ________________________________
☐ Non-members

**Contact Person Details (if different from participant)**

#Name: ________________________________  Designation: ________________________________
#Tel: ________________________________  Fax: ________________________________
#Email: ________________________________

**Payment Details**

Bank / Cheque No.: ________________________________  Amount ($): ________________________________
☐ Sponsored by company
* All Fees are inclusive of 7 % GST.
* Cheque should be made payable to: “Engineers Singapore Pte Ltd”.

**Acceptance of Terms and Conditions for Registrations of IES Academy’s Events**

I agree to abide by the Terms and Conditions for Registration of IES Academy’s Events

Name: ________________________________  Signature: ________________________________

*Mandatory entry
#Compulsory Entry for participant who choose to be INVOICE to your company
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 cheques, and submitted with the duly completed registration forms to:

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.

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) to choose from the courses available on the SkillsFuture Credit course directory.”

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.

Please visit HERE 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.