

## **SYLLABUS (PART B) – ELECTRICAL**

### **1. Regulatory Practice**

- a. Registration of Engineers Act 1967 (Revised 2015)
  - o A Guide to Good Engineering Practice for M&E Engineers
- b. Street, Drainage and Building Act (Act No 133)
  - o Assume understanding of topics covered under "Common Paper":
    - Introduction and a general overview on function of the Act.
    - 'Principal Submitting Person' and role of PSP
    - UBBL as by-law under the Act
    - Ministry and Government agency responsible.
    - Street lighting
  - o Role of Professional Engineer with Practising Certificate (PEPC) Electrical in support of PSP's duty and responsibilities.
- c. Uniform Building By-Law
  - o Understanding of the topics covered under the "Common Paper":
    - UBBL as a uniform building design code for Peninsular Malaysia.
    - Introduction to UBBL and general description of the various Parts of the UBBL
    - Part VII - Fire Fighting. Understanding 'life safety' concept as prescribed in the UBBL (exit discharge, fire barriers/walls)
    - Responsibilities of PEPC in the certification process of Certificate of Completion and Compliance issuance.
  - o Lighting requirement
  - o Requirements of MS 1525
  - o Lightning Protection requirement to MS IEC62305
  - o Lifts requirement
  - o Part VII - Fire Fighting Requirement pertaining to purpose/hazard class for building, fire barriers, etc
  - o Part VIII - Fire Protection System, Fire Alarm, Fire Detections, Emergency power, Power Isolation, etc.
- d. The Electricity Supply Act 1990 (Act 447) and Sarawak Electricity Ordinance (Chapter 50)
  - o Ministry and Government agency responsibilities
  - o Introduction to the Acts, Ordinance, Rules and Regulations, its function; Electrical safety, Regulator for electricity production, distribution and retail (licensing for IPPs,

approval of tariffs, license premises, notification of accidents etc. electrical efficiency)

- Competent persons registered under the Act in the submission procedure
- Safety and 'control item' list under the Regulations.
- Other Regulations under the Act:
  - Efficient Management of Electrical Energy Regulations (2008);
  - Electricity Regulations 1994 (Peninsular Malaysia & Sabah);
  - Electricity Rules 1999 (Sarawak).
  - Codes (Grid, Distribution, etc)
- e. The Energy Commission Act 2001 (Act 610)
  - Ministry and Government agency responsible.
  - Part III, Functions and Power of the Commission
- f. Factories and Machinery Act 1967
  - Electric Passenger and Goods lift Regulations
- g. Fire Services Act 1988 (Act 341)
  - Ministry and Government agency responsible
  - Function and Power of the DG of fire services
  - General Overview of the Act
  - Regulations under the Act
    - Fire Certification Regulations 2001.
- h. The Communications and Multimedia ACT 1998 (Act 588)
  - Ministry and Government agency responsible
  - Function and Power of the DG of Multimedia Commission
  - General Overview of ACT pertaining to telecommunications
  - "Technical Standards, Infrastructure Requirements" (TSIR, issued by MCMC).

## **2. The Electricity Supply System**

- a. Generation, transmission and distribution system  
Electrical transmission and distribution systems in Peninsular Malaysia, Sabah and Sarawak.
  - General description of the public distribution system in Peninsular Malaysia, Sabah and Sarawak (500kV, 275kV, 132kV, 33kV, 11kV, 400/230V), generation levels.
  - Generation systems (Smart Grid, PV, etc).

- Design and application of power supply to private installation; EHV intake, 33kV intake, PPU for township, 33kV and 11kV switch rooms for private installation, single-chamber & double chamber substation. Load estimation and substation design; selection of tariff. TNB Supply Handbook, Contribution Charges Handbook and Sarawak Electricity Rules.
- Power factor correction (tariff requirement and method of PF correction).
- Standby Power supply system; generator set, battery pack, changeover system.
- MV and HV intake design configurations (1-feeder, 2-feeder, H-formation, double-bus, single bus system).
- Fault level and Basic Insulation level design considerations.
- Safe operation working procedures for the distribution system.

b. HV Systems

- Transmission System

Basic understanding and role of the transmission system in the electricity supply industry as listed below.

- Transmission voltages in Malaysia
- Equipment (and their key characteristics thereof) used in transmission networks eg overhead lines, underground cables, circuit breakers, disconnectors, transformers, protection relays, dc systems etc. The terms commonly used to rate equipment eg rated current, short circuit breaking capacity or in the case of transformers, the impedance voltage etc.
- Common configurations of high voltage switchyards and their effects on operation and maintenance, understanding of the types of clearances as applied to transmission technology,
- Earthing as applied to high voltage substations and basic knowledge of key concepts in IEEE Standard 80 - Guide for Safety in AC Substation Grounding

- Generation System

Basic understanding and identification of main elements used in the generation of electricity in Malaysia as listed below,

- Knowledge of the process of power generation in hydro, coal fired and gas turbine combine cycle power plants, solar panels, etc.
- Knowledge of the design and operating characteristics of the synchronous generator, and key words used to describe the rating of the generator eg MVA, short circuit ratio, types of impedances etc

- Commonly used excitation systems; able to explain the function from block diagrams, etc
  - Knowledge of common electrical configurations of a power plant, the role of the generator, generator transformer, unit and station service transformer, circuit breakers, DC and UPS systems
  - Safety and equipment isolation procedures for maintenance
- c. MV Systems and Equipment
- MS/IEC 60076; Transformer types (cast resin, ONAN, etc)
  - MV switch gears; load break switch, isolator, circuit breakers, arc breaking/suppression technology in switching (vacuum, arc chute, magnetic suppression, SF6 etc.)
  - MV System and Substation Design
  - MV cabling systems
  - Earthing system for MV substations
- d. L.V. Distribution System
- MSIEC 60364 - Electrical Installation in Building (Part 1 to Part 7).
  - MS 1979 : Electrical Installation of Buildings - Code of Practice
  - MS 1936 : Electrical Installation of Building - Guide to MS IEC 60364

The above cover the topics such as types of earthing (TNC, TNS, TI), SPD, selection of protection devices, wiring installation, voltage drop calculation, cable selection, verification, etc.

- e. Power Quality (PQ) and Electromagnetic Compatibility (EMC)
- PQ
    - MS1760 and IEC 61000-2-8; Definition of PQ phenomenon (surge, dip, transient).
    - MS-IEC 61000-4 Mitigating Measures for PQ & immunity levels
  - EMC
    - Understanding of EMC phenomena, its definition, classification which is generally based on IEC 61000 family of standards and UK Engineering Council recommendations ERP28 5/4 and 29. Common EMC phenomena include voltage unbalance, step changes in voltage, fluctuations, flicker and harmonic distortion.
    - Understanding of the EM Environment, emission and immunity limits, the testing and measurement techniques as applied for EMC.

- Understanding of mitigating concepts e.g. by the use of mitigating disturbances, classification, protection zones, earthing and suitable design of cabling systems.

### **3. System Protection**

- a. Basic concepts
  - Classification of protection (zone, unit protection, pilot wire).
- b. Short Circuit & System Discrimination
  - Understanding of short circuit, short circuit calculation, per unit calculation.
  - Discrimination and system protection, protection setting, protection discrimination curve.
- c. Types of protection relay
  - Overcurrent and Earth Fault
  - Motor Protection
  - Transformer Differential Protection
  - Transformer Restricted Earth Fault
  - Cable Feeder Protection
  - Overhead Line Protection ( Auto-reclosure, Distance, Line Differential)
  - Generator Protection
- d. Instrumentations
  - Types and class of metering CT.s and PTs; Protection Class (Class X, Class XPXX, knee point voltage), Metering Class.
- e. Unit Protection Requirements
  - Transformer protection
  - Generator Protection

### **4. Building Systems**

- a. Lighting Systems
  - Knowledge of various lighting concepts :-
    - Luminous intensity (candela)
    - Luminance (candela/sqm)
    - Illuminance (Lux)
    - Colour rendering index (CRI)

- The different types of light sources and colour effects selections for energy efficiency.
  - Local authorities requirements
  - Daylighting concept for energy efficiency (MS 1525)
    - Switching and control strategies for energy savings
  - MS ISO 8995; Lighting of Indoor Work Places-
- b. Lightning Protection
- MS IEC 62305-Protection of building structures against lightning strikes.  
The assessment of risks and provision of measures to protect building structures.
- c. Fire Protection For Electrical Engineers
- MS 1745 Fire Alarm and Detection System
  - BS5839 Part 8 and 9 (Emergency call system)
  - Emergency standby generating system.
  - Emergency lighting and exit signs
  - Fire lifts
- d. Extra Low Voltage Systems
- Telecommunication System
    - Fixed network infrastructure and space planning
    - In-building structured and fibre cabling
    - Public address
  - SMATV Systems
    - System design
    - CCTV Surveillance System
    - Camera and video fundamental
    - Equipment selection
    - Analogue versus digital
  - Security System
    - Security components
    - Perimeter and interior protection
    - Access control
  - Building Automation System
    - Control - type of inputs and outputs
    - System infrastructure
    - Integration with other systems such as Energy Management System, etc

- e. Vertical and Horizontal transportations
  - o Control and Safety issues
  - o Harmonics mitigation
- f. Hazardous Environment
  - o Hazardous area classifications
  - o Risks mitigation
  - o Equipment and cable selection
- g. Energy Efficiency

MS1525: Code Of Practice On Energy Efficiency And Use Of Renewable Energy For Non-Residential Buildings

  - o Application for Green Building Index grading of Buildings

## 5. Infrastructure

- a. Exterior Lighting
  - o Roads, junctions, roundabout, interchanges and housing.  
MS 825 Part 1; Code of Practice for the Design of Road Lighting - Part 1: Lighting of Roads and Public Amenity Areas
    - Roads, junctions, roundabout, interchanges and housing.
    - Boulevards
    - Open car park
  - o MS 825: Part 2: 2008 - Code of Practice for the Design of Road Lighting - Part 2: Lighting of Tunnels
    - Tunnels, underpass and vehicular box culvert (VBC)
  - o MS 825: Part 4, Part 5 and Part 6
  - o Department of Civil Aviation (DCA) - ICAO Annexe 14
    - Obstruction lights
  - o Wharfs, ports, jetties
  - o Façade lighting
  - o Landscape lighting
- b. Telecommunication Infrastructure
  - o Manholes and ducting
  - o Termination and interfacing points
  - o Avoidance of microwave communication paths

- c. Traffic Control System
  - o Traffic Signal System
  - o CCTV monitoring
- d. Special Systems
  - o Railway earthing system
  - o Aircraft hangar power supply system for aircrafts

**6. Common Requirements**

- a. Work acceptance
  - o Understanding Technical Standards, types of standards (basic standards, components standards, assembly standards).
  - o Understanding certifications, basic safety certification, conformance certification, type test certification.
  - o Types of work certification; first party, second party and third party certification.
  - o The work acceptance procedures in the construction process.
  - o Commissioning (type of tests and commissioning procedures)
- b. Ingress Protection (IP) Classifications for Enclosures
- c. Switchboard forms of segregation - IEC 60439.1

**Weightage for the Question for the Examination**

The following tables are to server as a guide to show the weightage of the syllabus allotted for the examination question in the various disciplines.

**Electrical Paper**

No. of multiple choice question = 40

No. of subjective question = 3 out of 5

Category	Proposed Weightage in %
Regulatory Practice	20
The Electricity Distribution System	25
System Protection	15
Building Systems	30
Infrastructure	10

Note: Subjective question may comprise combination of some or all of the above categories