SYLLABUS (PART B) – CHEMICAL

1. Regulatory Practice

i. Environment Quality Act 1974 (Act No. 127)

a. Waste water treatment unit operation

- Grit Chamber
- Equalisation tank
- Coagulation and flocculation tank
- Dissolve air flotation
- Clarifier
- Aeration tank
- Sequential batch reactor
- Sand filter
- Activated carbon filter
- Sludge dewatering units
- Sludge thickening tank
- Sludge holding tank
- Membrane filters
- Ozoniser and etc.

b. Design of waste water treatment process

- Primary treatment
- Secondary treatment
- Tertiary treatment

c. Crude palm oil regulations and order 1977

d. Raw natural rubber regulations and order 1978

e. Environmental Impact Assessment) Order 1987

f. Scheduled Wastes Treatment And Disposal Facilities regulations and order 1989

g. Prohibition On The Use Of Cfcs And Other Gases As Propellants And Blowing Agents Order 1993

h. Prohibition On The Use Of Controlled Substance In Soap, Synthetic Detergent And Other Cleaning Agents Order 1995

i. Refrigerant Management Regulations 1999

j. Halon Management Regulations 1999

k. Dioxin And Furan Regulations 2004

l. Scheduled Wastes Regulations 2005
m. Sewage Regulations 2009
n. Control Of Pollution From Solid Waste Transfer Station And Landfill Regulations 2009
o. Industrial Effluent Regulations 2009

ii. Occupational Safety and Health Act 1994 (Act No. 514)
   a. Local ventilation system
      - Layout and diagram
      - Hood
      - Exhaust fan
      - Air cleaner
      - Ducting
   b. Design of local ventilation system
      - Pressure drop
      - Fan / Exhaust fan pressure, exhaust air volume, fan motor
      - Hood controlled air velocity, exhaust air volume
      - Dust collector capacity
      - Exhaust gas disposal system
   c. Control of Major Accident Hazards
   d. Classification, labelling and safety datasheet of hazardous chemicals
   e. Prohibition of use of substance
   f. Occupational health and safety management systems OSHAS 18001:2007
   g. Malaysian Guidelines for the Formulation of a Chemical Safety Datasheet 1997
   h. Malaysian Guidelines for the Classification of Hazardous Chemicals 1997
   i. Malaysian Guidelines for Labelling of Hazardous Chemicals 1997
   j. Malaysian Guidelines for the Preparation of a Chemical Register 2000
   k. Malaysian Guidelines on the Control of Chemicals Hazardous to Health 2001
   l. Malaysian Guidelines for HS (Environmentally Hazardous Substance) Notification & Registration

iii. Food Act 1983 (Act 281)
   a. Food Regulations 1985
   b. Food Hygiene Regulations 2009
   c. Food Irradiation Regulations 2011

iv. Pesticides Act 1974 (Act 149)
    a. Highly toxic pesticides regulations 1996
    b. Labelling regulations 1984
    c. Licensing for manufacturing rule 2011
    d. MS 409:2012 packaging and storage of pesticides - code of practice
v. Factories and Machinery Act 1967 (Revised 1974) (Act 139)
    a. Steam Boiler and Unfired Pressure Vessel Regulations 1970
    b. Fencing of Machinery and Safety Regulations 1970
    c. Safety, Health and Welfare Regulations 1970
    d. Notification, Certificate of Fitness and Inspection Regulations 1970
    e. Lead Regulations 1984
    f. Asbestos Regulations 1984
    g. Noise Exposure Regulations 1989
    h. Mineral Dust Regulations 1989
    i. MS ISO 14159:2005 (confirmed:2011) safety of machinery - hygiene requirements for the design of machinery
    j. MS ISO 12100:2011 Safety of machinery - general principles for design - risk assessment and risk reduction
vi. Petroleum (Safety Measures) Act 1984 (Act 302)
    a. Transportation Of Petroleum By Water Regulations 1985
    b. Transportation Of Petroleum By Pipelines Regulations 1985
vii. Biosafety Act 2007 (Act 678)
    a. Risk assessment
    (b) Risk management
    (c) Emergency response plan
    (d) Labelling

2. Plant Operation

i. Process safety
    a. Process safety management OSHA 3132
    b. Management of change
ii. Loss Prevention and layer of protection
    a. Layer of protection analysis (LOPA)
    b. Safety integrity level (SIL)

iii. Risk assessment
    a. Hazard Identification
        - Process hazards
        - Operational hazards
        - Environmental hazards - noise, dust, etc.
    b. Risk Analysis of operations
        - Consequence& Probability analysis of failures
    c. Risk reduction
        - Minimise, substitute, simplify, moderate
    d. Residual Risk management
        - Critical system operating procedures
        - Safeguarding systems - alarms, trips & shutdowns
        - Emergency management when failures occur
    e. Quantitative& Qualitative Risk Assessment (QRA)
    f. Health Risk assessment (HRA)
    g. Environmental Risk Assessment (ERA)
iv. Fire and explosion
    a. NFPA 654 standard for the prevention of fire and dust explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
    b. MS 1745:2004 fire detection and fire alarm systems
v. Toxicity
vi. Hazard analysis
    a. HAZOP
        - Understanding HAZOP process
        - Continuous operations HAZOP
        - Sequential Operations HAZOP / Procedural HAZOP
        - Computerised Process System HAZOP
    b. Process hazard analysis NFPA 654
    c. IChemE Guide on HAZOP
vii. Process control
    a. Process control diagram
    b. Relief design
viii. Process design

a. Hydraulic design

b. Piping API 14E

3. Professional Drawing

i. Process flow diagram (PFD) and Utility flow diagram (UFD)
   a. Ability to describe a PFD or UFD example
ii. Process & Instrumentation diagram (P&ID)
   a. Ability to describe a P&ID example

4. Handling of Materials

i. Handling of liquid
   a. Common types of liquid behaviour
   b. Tank discharge
ii. Gas processing
   a. MS 830:2003 code of practice for the storage, handling and transportation of liquefied petroleum gases
   b. MS 930:2010 code of practice for the installation of fuel gas piping systems and appliances
iii. Handling of particulate solids
   a. Storage and flow of particulate solids in silos

5. Unit Operation

i. Reaction
   a. Reactor sizing
   b. Types of reactor
ii. Separation and purification
   a. Distillation
   b. Absorption and adsorption
   c. Membrane separation
   d. Extraction
   e. Evaporation
   f. Drying
   g. Filtration, sedimentation and centrifugal separation
iii. Equipment

a. Pump
   - Examples of different types of pumps and their applications
   - Hydraulic calculation and system curve

b. Compressor

c. Turbine

d. Storage tank
   - API 650

iv. Pressure vessel

a. Design of pressure vessel
   - ASME code & local authority inspection requirements
   - Types of vessels
   - Materials of construction
   - Pressure / temperature limitations
   - Types of fluids in the process
   - Vessel insulation

b. Pressure relief

c. Types of Pressure Safety Valves for different fluids & process conditions
   - Bursting Discs
   - Blowdown systems

v. Refrigeration and heat pump

vi. Water supply treatment and distribution

6. Chemical Engineering Principles

i. Thermodynamics

ii. Heat and mass transfer

iii. Energy and material balances

iv. Fluid mechanics and fluid dynamics

v. Ventilation and humidification

vi. Psychrometrics

7. Role of Chemical Engineer in Society

i. Environmental impact and sustainability

a. Environmental impact assessment
   - Life cycle analysis

b. Risk assessment
c. Discharge and disposal
d. Waste management

ii. Green technology
a. Example of green technology and practices
b. Recent development in the industry
- Example: turning sewage effluent into grey water, recover household sewage as grey water
- Example: turning EFB into syn gas and etc.

iii. Code of Practice
a. Engineer's responsibility to society and to the public
b. Professionalism on a conceptual basis
c. Ethical conduct and professional practice
d. IChemE forms of contract
e. BP Process Safety Series - including what went wrong

iv. Continual professional development (CPD)

a. Aware of the recent technological development in the area of services
- BEM magazine
- New advancement