General Guideline on Pre-defined Learning Outcomes for Civil Engineering Students interning in Consultancy Built Environment Firms

1. UNDERSTANDING INDUSTRY DOCUMENTATION/ DRAWING STANDARD
   - Interpret as-built drawings
   - Understand the functions of common BIM/CAD softwares (such as Xref, block tools, layer system and etc.)
   - Interpret the scale, dimension, text and annotation in civil engineering drawings
   - If other, please specify

2. COMMUNICATION SKILLS FOR WORK
   - Learn formal report writing
   - Learn business email writing
   - Make oral presentation to seniors / management / clients
   - If others, please specify

3. EXPOSURE TO CONCEPT DESIGN
   - Introduction to project brief and site information
   - Introduction to client and user needs
   - Process of generating ideas and inspiration to build design scheme
   - Support preparation of design presentation drawings including 3D rendering, coloured plan and elevation plan
   - If other, please specify

4. EXPERIENCING DESIGN DEVELOPMENT PROCESS
   - Overall Design and Planning Stage
     - Learn how to justify design solutions relative to the goal and objective of the design concept
     - Understanding and analysing Support the review and analysis of material properties and characteristics before choosing, including liaising with product / material suppliers to get more information.
     - Exposure to different government regulations (e.g. code of practice on buildable design etc) that have an impact on building/infrastructure designs
     - Exposure to URA planning submission and BCA building plan submission requirements and procedure
     - Attend design review and discussion with project lead/manager
     - Participate in the project’s meeting to observe inter-disciplinary problem solving process
     - Minute key points of meeting discussion
     - If other, please specify

   - Building Information Modelling (BIM)/Computer-Aided Design (CAD)
Draft 2D drawings 
Produce Building Information Model (BIM) 
Perform BIM visualization 
If other, please specify*

Integrated Digital Delivery (IDD)
- Understand the concept and objectives of IDD
- Understand the scope of IDD in digital design/digital manufacturing and fabrication/digital construction/digital asset delivery and management
- Understand the roles and responsibilities of civil engineers in IDD
- Understand the roles and responsibilities of team members from other disciplines in IDD
- Carry out / support collaborative and coordinated design via BIM/Virtual Design & Construction (VDC) and other computation tools
- Understand how digital design tools help to optimise downstream process (manufacturing, fabrication, construction and maintenance)
- If other, please specify*

Design for Manufacturing and Assembly (DfMA)
- Understand the concept and objectives of DfMA
- Understanding the DfMA continuum and different DfMA construction technologies from prefabricated components to fully-integrated assemblies such as Prefabricated Prefinished Volumetric Construction (PPVC)
  - Application of DfMA construction technologies to different types of developments
  - Understand design considerations and limitations for different DfMA technologies
  - Identify the suitable types of DfMA modules to be considered and the choice of material (e.g. reinforced concrete PPVC module or Steel PPVC Module)
  - Perform / assist in analysis to assess structural integrity
  - Exposure to different joints and connections and their design principles for different DfMA technologies
  - Understand project management consideration in site planning (e.g. staging areas for hoisting machinery and modules) and construction sequencing
- If other, please specify*

Structural Mechanics
- Appreciation of structural mechanics in structure analysis
- Understand the importance of material properties and behaviour
- Application of Shear Force and Bending Moment in structures
- Understand the importance of sectional properties in structural members
- Deepen knowledge in Structural Mechanics as a bridge to Structural Analysis
- If other, please specify*

Structural Analysis
- Analyse continuous beams/ non-sway rigid frames
Perform calculation for Axial Force Diagram (AFD), Shear Force Diagram (SFD) and Bending Moment Diagram (BMD)
Calculate deformations for determinate beams/trusses/rigid frames
Use integrated Software for Structural Analysis and Design (SAP2000) to analyse beams/ trusses/ rigid frames
If other, please specify*

Reinforced Concrete Design & CAD
Design reinforced concrete beams, slabs, columns and footings according to Eurocode 2 for a real life project
Use the AutoCAD Structural Detailing (ASD) software to detail rebars
If other, please specify*

Hydrology & Hydraulics
Exposure to storm water management
Application of hydraulic design, e.g. ABC Water project
Design for water supply system
If other, please specify*

Geotechnical Engineering
Observe ground investigation practices such as rotary drilling, soil sampling and conduct of standard penetration test (SPT) etc
Interpret laboratory testing results of various soil properties
Understand soil compaction associated with road works
Assist in simple footing and retaining wall design
Assist in audit stability of soil slopes
If other, please specify*

5. CONTRACT DOCUMENTATION
Prepare drawings, schedules and specifications as an integrated system of contract documents, appropriate to project size and scope, including design solutions and related interior construction details.
Prepare contract drawings include layout plans, electrical plans, lighting/reflected ceiling plans, elevations, sections and details.
Produce schedules including interior building specifications, furniture specifications, finishes schedule, sanitary schedules and door schedules.
Learn about contractual and administration procedure to issue drawings/document such as drawing transmittal and distribution.
If other, please specify*

6. CONSTRUCTION STAGE
Construction and Measurement
  o Understand and observe the actual site condition
  o Learn how to develop alternative design solutions to resolve construction error or unexpected site constraints
  o Learn how to control and distribute incoming and outgoing drawings/documents
  o If other, please specify*

Overview of Safety, Health & Environment Management
  o Learn about Workplace Safety and Health (WSH) Management System
  o Understand the Workplace Risk Assessment (RA)
  o If other, please specify*

Project Management
  o Understand the role and responsibilities of different personnel (e.g. site supervisor, Resident Technical Officer, Resident Engineer, project manager from contractor firm etc) in the project team
  o Understand the contract procurement method used in the project
  o Assist project manager in coordinating / executing certain scope of works
  o If other, please specify*

7. FACILITY MANAGEMENT RELATED

Design for Maintainability
  o Understand the basic principles of design for maintainability in design
  o Basic understanding on the different material properties especially properties related to durability and maintainability
  o Assess the quality of construction materials
  o Able to recommend selection of materials to minimize maintenance issue
  o Understand the inter-dependability of structural design with other disciplines that may affect maintenance
  o Statutory requirements
  o Duties of inspectors
  o Assessment/classification of defects
  o Inspection and submission procedure and requirements
  o Report submission format
  o Repair works supervision
  o If other, please specify*