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*

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

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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 ofdesign presentation drawings including 3D rendering, coloured plan and elevation plan
   - If other, please specify*

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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*

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   ❖ Building Information Modelling (BIM)/Computer-Aided Design (CAD)

- Draft 2D drawings
- Produce Building Information Model (BIM)
- Perform BIM visualization
- If other, please specify*

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- 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*

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- 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 asPrefabricated 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*

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- 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*

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- 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*

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❖ 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*

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❖ 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*

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❖ 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*

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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*

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6. CONSTRUCTION STAGE

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

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

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- Project Management
  - 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
  - Understand the contract procurement method used in the project
  - Assist project manager in coordinating / executing certain scope of works
  - If other, please specify*

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7. FACILITY MANAGEMENT RELATED

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

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