

SULIT



KSCP Examination
2024/2025 Academic Session

September 2025

EBB522 – Surface and Corrosion Engineering

Duration : 2 hours

Please check that this examination paper consists of FIVE (5) pages of printed material before you begin the examination.

Instructions: Answer **FOUR (4)** questions. **PART A is COMPULSORY.** Answer **ONE (1)** question from Part B and **ONE (1)** question from Part C. All questions carry the same marks.

The answers to all questions must start on a new page.

All questions must be answered in English.

Should any candidate be caught cheating or in possession of materials not authorised to be brought into the Examination Hall during the examination, appropriate disciplinary action will be taken against the candidate concerned. In the event a candidate is found guilty of cheating, he/she can be expelled from the University.

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PART A

- (1). (a). Explain the term “surface” from engineering perspective.
(5 marks)
- (b). Explain the term “surface energy” and elaborate the two mechanisms of contamination happens on a surface by providing one example.
(15 marks)
- (c). Differential between adhesion and cohesion of a material system by giving an example.
(2 marks)
- (d). Explain factors affecting contact angle of a liquid on a solid surface and provide an example.
(3 marks)
- (2). (a). Explain and illustrate with the a diagram what is meant by pitting corrosion
(10 marks)
- (b). Discuss with a specific illustrative example, the relationship between pitting corrosion and the passive film.
(10 marks)
- (c). Using the log I versus E curve, describe the concept of *critical pitting potential*.
(5 marks)

PART B

(3). A thin film is usually deposited on a substrate. The deposited thin film may be delaminated from the substrate.

(a). Explain functions of the thin film deposited on a substrate
(5 marks)

(b). Based on the concept of thin film deposition technique, differentiate between chemical vapor deposition (CVD) and physical vapor deposition (PVD) techniques of thin film. Do not include detailed operation and instrumentation in your answer.

(10 marks)

(c). Explain the possible root causes of this issue

(10 marks)

(4). Polymer surface can be modified via plasma treatment to enhance adhesion with another polymeric material. Answer the following questions.

(a). Elaborate effects of process control parameters of plasma treatment on adhesion of the polymeric material system.

(10 marks)

(b). "Hydrophobic recovery" is one of the issues on the treated surface. Explain this phenomenon.

(5 marks)

(c). List down and justify **TWO (2)** characterization techniques that can be used to confirm "hydrophobic recovery" occurs.

(10 marks)

PART C

- (5). MSteel Sdn Bhd engaged USM to investigate the corrosion behaviour of their metal rod sample X (outer diameter up to 5 cm) (**Figure 1**). Using your knowledge of open circuit potential (OCP) characterization, provide suitable diagrams and explanations for the following:



Figure 1: Sample X rod

- (a). Outline the procedure for preparing electrode samples. (10 marks)
- (b). Propose an appropriate cell circuit configuration. (10 marks)
- (c). Recommend data acquisition, plotting methods, and analysis strategies to evaluate the corrosion resistance of sample in **Figure 1**. (5 marks)

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- (6). **Figure 2** illustrates the installation of a metal pipe for agricultural water distribution.



Figure 2 : Installing underground metal pipe

- (a). Provide a list of common corrosion types relevant to this design and application, along with brief explanations.

(10 marks)

- (b). Explain how corrosion of the metal pipe can be prevented, supporting your explanation with a sketch.

(15 marks)

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