Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	CORROSION & PREVENTION
COURSE CODE	:	BDB 40403
PROGRAMME	:	BDD
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS
		2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
		3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Explain in detail how to mitigate pitting corrosion.

(10 marks)

(b) With referred to **Figure Q1(b),** evaluate the types of corrosion and how corrosion prevention can be applied to prevent further corrosion attack.

(10 marks)

Q2 (a) Explain the method to control uniform corrosion.

(5 marks)

(b) With a sketch, explain intergranular corrosion on stainless steel 316L.

(8 marks)

(c) With a sketch, explain how corrosion inhibitor gives protection on metal surface.

(7 marks)

Q3 (a) According to the emf series in **Table Q3 (a)**, zinc has a more reactive potential than iron. Therefore zinc should corrode more easily than iron, but, surprisingly, iron will corrode faster than zinc. Give your explanation.

(5 marks)

(b) What are the differents between sacrificial anode and impressed current in cathodic protection.

(7 marks)

(c) With a sketch, explain what is stress corrosion cracking?

(8 marks)

Q4 (a) Explain how corrosion can be controlled during design stage

(8 marks)

(b) In certain circumtances, volatile corrosion inhibitor is more efficient compared to applying coating. Why?

(7 marks)

(c) List factors that contribute to atmospheric corrosion.

(5 marks)

Q5 (a) Give ONE (1) type of high temperature corrosion and describe the damage mechanism.

(8 marks)

(b) With refer to **Figure Q5 (b),** suggest the method to mitigate corrosion on concrete

(7 marks)

(c) Explain how to control carbon steel pipeline from corrosion attack.

(5 marks)

-END OF QUESTION-

FINAL EXAMINATION

SEMESTER/SESSION: SEM I/2022/2023 PROGRAMME: BDD
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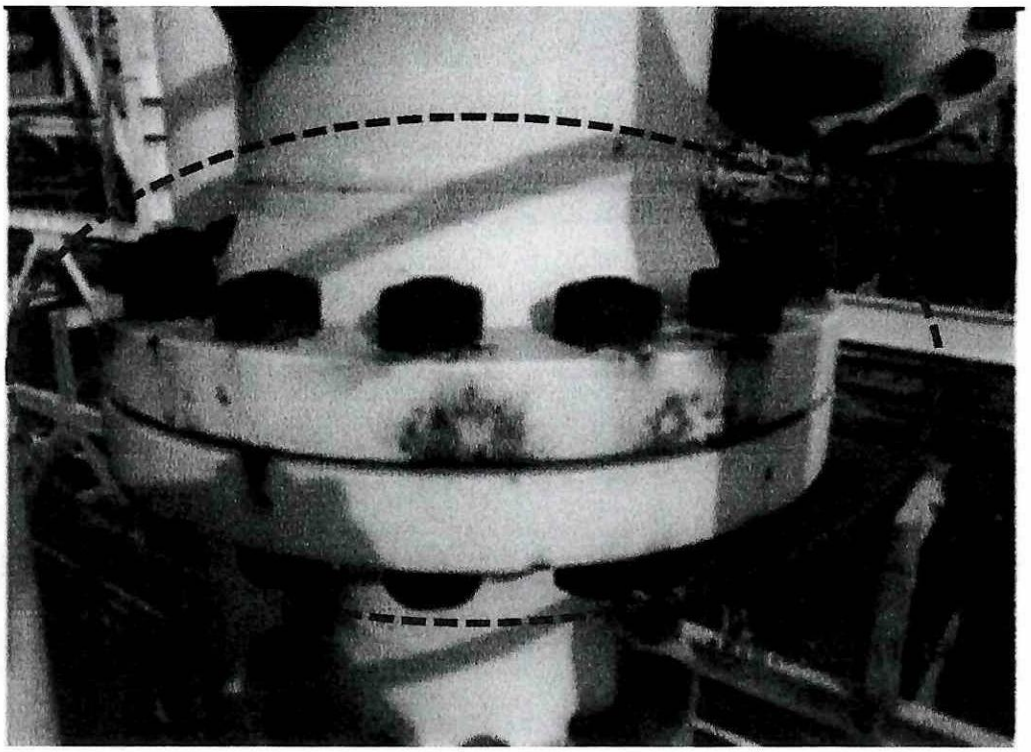

Figure Q1(b): Corrosion around flange

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Table Q3 (a)-emf series

Half-Cell Reaction	E° (volts)
$F_2 + 2e \longrightarrow 2F^-$	2.87
$Au^+ + e \longrightarrow Au^+$	1.68
$Cl_2 + 2e \longrightarrow 2Cl^-$	1.36
$O_2 + 4H^+ + 4e \longrightarrow 2H_2O$	1.229
$O_2 + 4H^+ (10^{-7}\ M) + 4e \longrightarrow 2H_2O$	0.82
$Ag^+ + e \longrightarrow Ag$	0.799
$Fe^{3+} + e \longrightarrow Fe^{2+}$	0.771
$O_2 + 2H_2O + 4e \longrightarrow 4OH^-$	0.48
$Cu^{2+} + 2e \longrightarrow Cu$	0.337
$AgCl(s) + e^- \rightarrow Ag(s) + Cl^-(aq)$	0.22
$2H^+ + 2e \longrightarrow H_2$	0.0000
$Pb^{2+} + 2e \longrightarrow Pb$	-0.126
$Sn^{2+} + 2e \longrightarrow Sn$	-0.14
$Ni^{2+} + 2e \longrightarrow Ni$	-0.25
$Co^{2+} + 2e \longrightarrow Co$	-0.28
$Fe^{2+} + 2e \longrightarrow Fe$	-0.44
$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$	-0.74
$Zn^{2+} + 2e \longrightarrow Zn$	-0.763
$Al^{3+} + 3e \longrightarrow Al$	-1.66
$Mg^{2+} + 2e \longrightarrow Mg$	-2.34
$Na^+ + e \longrightarrow Na$	-2.714
$Ca^{2+} + 2e \longrightarrow Ca$	-2.87
$K^+ + e \longrightarrow K$	-2.925

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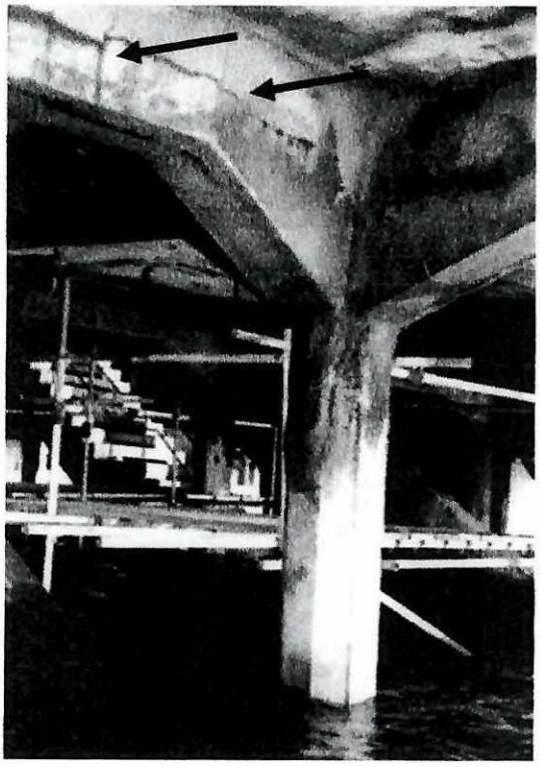

Figure Q1(b) Concrete cracking