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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024**

- COURSE NAME : SURFACE ENGINEERING
- COURSE CODE : BDB41103
- PROGRAMME CODE : BDD
- EXAMINATION DATE : JULY 2024
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - 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 **THREE (3)** PAGES.

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Q1 In general, metallurgical surface changes involve many processes that improve the wear resistance of parts while utilizing the rigid interior properties of the steel or cast-iron component.

- (a) Identify the factors that determine the heating characteristics during induction hardening.

(4 marks)

- (b) Laser melting provides distinct advantages in terms of precision, customisation, and material efficiency. Suggest the use of laser melting in the medical industry with explanation.

(6 marks)

- (c) Recommend and figure out the working process of Laser-Beam Hardening for surface treatable of steel.

(10 marks)

Q2 Modification of surface chemistry is one of the surface engineering methods.

- (a) Distinguish between iron phosphate and zinc phosphate in terms of paint adhesion and maintenance.

(4 marks)

- (b) Chromic anodizing is the most popular technique against others. Justify the reason.

(6 marks)

- (c) Recommend the case-hardening process that involves increasing surface carbon content with briefly explanation of the process.

(10 marks)

Q3 A leading aerospace manufacturer faced challenges with the erosion and corrosion of critical engine components, particularly turbine blades, result in decreased of performance and increased of maintenance costs. The industry sought a durable and cost-effective solution and turned to thermal spray coating technology.

- (a) Provide recommendations based on the challenges industries face regarding equipment durability and thermal spray coating maintenance costs.

(10 marks)

- (b) Distinguish the thermal spray process from the weld-overlay coating in terms of principle operation, process characteristics and coating properties.

(6 marks)

- (c) Recommend the innovations made in the field of thermal spray in the recent years.

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(4 marks)

- Q4** Thin films refer to layers of material deposited onto a substrate, typically ranging in thickness from a few nanometres to several micrometres. Thin films can be deposited onto substrates using various deposition methods.
- (a) Suggest and explain the physical vapor deposition (PVD) in terms of method, process, advantages, and disadvantages.
(8 marks)
- (b) Distinguishes chemical vapor deposition (CVD) from other thin film deposition methods.
(6 marks)
- (c) Recommend three (3) commercial applications of atomic layer deposition (ALD) and justify.
(6 marks)
- Q5** Fabrication processes for electrical and electro-optical thin films typically involve various deposition techniques and subsequent processing steps to achieve the desired properties.
- (a) Compare the gas and plasma properties regarding electrical conductivity, acting species, velocity, and interactions.
(4 marks)
- (b) Recommend and discuss the advantages of wet chemical etching in surface modification.
(4 marks)
- (c) Members of group research have created wearable sensors for monitoring health. The sensors utilize thin films to identify different biomarkers. As proper surface treatment is essential to ensure accurate and reliable sensing, explain the significance of surface treatment in producing thin films for wearable sensors. Recommend the most suitable surface treatment to enhance the sensitivity and specificity of the sensors.
(12 marks)

- END OF QUESTIONS -

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