UNIVERSITI
TEKNOLOGI
PETRONAS

FINAL EXAMINATION
MAY 2024 SEMESTER

COURSE	:	**AAB4233 - ADVANCES SURFACE COATING**
DATE	:	**30 JULY 2024 (TUESDAY)**
TIME	:	**9.00 AM - 12.00 NOON (3 HOURS)**

INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.

2. Begin **EACH** answer on a new page in the Answer Booklet.

3. Indicate clearly answers that are cancelled, if any.

4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.

5. **DO NOT** open this Question Booklet until instructed.

Note :

    i. There are **SIX (6)** pages in this Question Booklet including the cover page and appendix.

    ii. **DOUBLE-SIDED** Question Booklet.

1. a. The wear properties are dependent on surface roughness of a metallic component. Evaluate the significance of irregularities on wear introduced on the surface of a carbon steel component during grinding, turning and polishing.

    [10 marks]

    b. An automotive gear may undergo excessive wear during its operation. Discuss a technique to improve its surface hardness and suggest a lubricant to protect the gear from wear,

    [9 marks]

    c. Evaluate the surface roughness of shot peening and chemically deburred components. Suggest which component would be more resistant to fatigue. Justify.

    [6 marks]

2. A pharmaceutical company is producing 50,000 coated tablets per day. The diameter and thickness of the tablet is 8 mm and 2 mm respectively. The coating is porous, and an average diameter of the pore is 20 nm. There are 100 pores per mm^2. If the thickness of the porous coating is 30 micrometres.

a. Determine the total number of pores on surface of one tablet and the quantity of material required for 50,000 tablets if density of material is 0.95 g/cm^3.

[12 marks]

b. You are given three processes for coating of tablets. film coating, sugar coating and compression coating. Propose a suitable coating process and parameters required to achieve porous coating of desired thickness on tablets at lower cost. Justify your answer.

[13 marks]

3. a. You are working in a surface coating company as an inspection engineer. Propose a quality assurance plan for coating and inspection of carbon steel components for corrosion protection.

    [15 marks]

    b. A carbon steel component is required to be used in the grinding equipment. Propose a relevant method that can be used to harden the surface of the carbon steel component.

    [10 marks]

4. a. A carbon steel plate is required to be protected from corrosion by using metal coating. Propose a coating process and highlight the chemical used for this coating and their disposal for environment safety.

[10 marks]

b. Evaluate the surface roughness of the steel plate to achieve adhesion strength suitable for industry application.

[8 marks]

c. A carbon steel plate of dimensions 50 mm x 50 mm is to be coated with epoxy and dry film thickness (DFT) of the coating is 2 mm. Assess the mass of epoxy required to achieve 2 mm dry film thickness (DFT) of the coating if the density of the epoxy is 1.25 g/cm^3,

[7 marks]

END OF PAPER

Appendix

Shape	Lateral Surface Area (LSA)	Total Surface Area (TSA)
Cuboid (rectangular prism)	$2h(l + b)$	$2(lb + bh + lh)$
Cube	$4a2^2$	$6a2^2$
Right Prism	Base perimeter × Height	LSA + 2 (area of one end)
Right Circular Cylinder	$2\pi rh$	$2\pi r(r + h)$
Right Circular Cone	πrl	$\pi r(l + r)$
Solid Sphere	$4\pi r2^2$	$4\pi r2^2$
Hemisphere	$3\pi r2^2$	$3\pi r2$