UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DND 2113
COURSE	: LIQUID PENETRANT TESTING
SEMESTER/SESSION	: 1-2022/2023
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **all** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Figure 1 shows the capillary action phenomenon of straw placed inside a glass fill with a liquid. At 30°C, the liquid surface tension is 0.07103 N/m. The contact angle for the liquid inside the straw is 33.5° and the straw diameter is 6 mm. Calculate the capillary pressure of the liquid inside the straw at temperature 30°C. (5 marks)

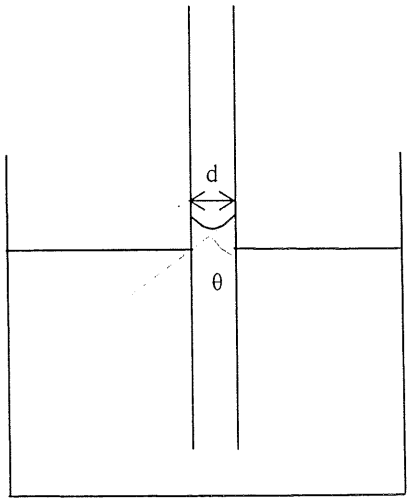

Figure 1

b) Penetrant inspection is totally dependent on the principle of capillary action.

i. Define the meniscus of good penetrant. (1 mark)

ii. Explain the capillary action of penetrant. (2 marks)

iii. Classify the effect of penetrant dwell time for high test surface temperature. (2 marks)

c) Emulsification time for Post-Emulsifiable penetrant is critical to be determined.

i. Describe the water pressure and temperature for removing excess penetrant. (2 marks)

ii. Classify the effect of too short Emulsification time. (3 marks)

QUESTION 2

a) In order to develop indication, it must be done by using developer that assists in the detection of penetrant retained in the discontinuities.

i. Define the development time for penetrant testing. (2 marks)

ii. Classify **two (2)** functions of developer. (4 marks)

b) Define the developer methods as accordance to **EN 571-1** for the followings:

i. Form a (1 mark)

ii. Form b (1 mark)

iii. Form c (1 mark)

iv. Form d (1 mark)

c) Fluorescent penetrant usually available in Water Washable and Post Emulsifiable methods. This type of penetrant is more sensitive than colour contrast penetrant

i. Define the dwell time of penetrant. (3 marks)

ii. List all the basic steps in performing water washable penetrant technique. (6 marks)

iii. Explain **two (2)** characteristics of Lipophilic Emulsifier. (2 marks)

iv. Describe **two (2)** advantages of Post-Emulsifiable penetrant. (3 marks)

v. Classify **four (4)** types of penetrant application on test component. (4 marks)

d) Define the following penetrant systems as accordance to **EN 571-1**:

i. Type I (1 mark)

ii. Type II (1 mark)

iii. Type III (1 mark)

QUESTION 3

a) Viewing condition is the most important factor in conducting the Liquid Penetrant Testing. Define the followings:

i. Minimum Day light or artificial White Light required. (1 mark)

ii. Maximum ambient background lighting for fluorescent technique. (1 mark)

iii. Minimum UV-A irradiance required for fluorescent technique. (1 mark)

iv. Maximum ambient background lighting at washing station for fluorescent technique. (1 mark)

v. Minimum UV-A irradiance required at washing station for fluorescent technique. (1 mark)

vi. Minimum time required for operator's eyes become dark-adapted for fluorescent technique. (1 mark)

vii. **Four (4)** types of penetrant test block used in penetrant testing. (4 marks)

b) Interpret the Acceptance/Rejection criteria for Liquid Penetrant Testing accordance to ASME VII, Division 1, Appendix 8. (6 marks)

c) Referring to ASME V, Standard Procedure for Liquid Penetrant Testing (LPT), interpret the following:

i. The allowable temperature range for LPT. (2 marks)

ii. The minimum dwell time and development time required to find the crack on the bevel surface of butt weld pipe. (2 marks)

d) Describe the penetrant removal techniques as accordance to **EN 571-1** for the followings:

i. Method A (1 mark)

ii. Method B (1 mark)

iii. Method C (1 mark)

iv. Method D (1 mark)

QUESTION 4

a) Liquid Penetrant Testing (LPT) is a surface testing method for detecting surface breaking defects. Classify the followings:

i. **Two (2)** advantages of Visible Dyes Penetrant over Fluorescent Dyes. (4 marks)

ii. **Three (3)** types of material that can be inspected by LPT. (3 marks)

iii. **Three (3)** types of material that cannot be inspected by LPT. (3 marks)

b) There are many important properties of penetrant such as wetting ability, viscosity, density and many more. Define the followings:

i. Volatility (2 marks)

ii. Surface tension (2 marks)

iii. Flash point (2 marks)

iv. Fluorescent Penetrant (2 marks)

c) Thixotropic penetrant is a one of special purpose penetrant. Describe **Three (3)** properties of Thixotropic penetrant. (6 marks)

d) Classify the Electromagnetic Spectrum wavelength for the followings:

i. UV-A (2 marks)

ii. UV-B (2 marks)

iii. UV-C (2 marks)

----------End of question----------

ATTACHMENT 1

Table 1: Minimum Dwell Times

TABLE T-672 MINIMUM DWELL TIMES

Material	Form	Type of Discontinuity	Dwell Times [Note (1)] (minutes)	
			Penetrant	Developer
Aluminum, magnesium, steel, brass and bronze, titanium and high-temperature alloys	Castings and welds	Cold shuts, porosity, lack of fusion, cracks (all forms)	5	7
	Wrought materials — extrusions, forgings, plate	Laps, cracks (all forms)	10	7
Carbide-tipped tools		Lack of fusion, porosity, cracks	5	7
Plastic	All forms	Cracks	5	7
Glass	All forms	Cracks	5	7
Ceramic	All forms	Cracks, porosity	5	7

$$\text{Capillary pressure} = \frac{2S \cos \theta}{W}$$

----------End of attachment----------