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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021**

COURSE NAME : CIVIL ENGINEERING MATERIALS
COURSE CODE : DAC 11603
PROGRAMME CODE : DAA
EXAMINATION DATE : JANUARY / FEBRUARY 2021
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF FOURTEEN (14) PAGES

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SECTION A

- Q1. Two most commonly used of cement in the world of structural construction, are _____ and _____.
- A. mortar, concrete
 - B. mortar, shotcrete
 - C. shotcrete, plaster
 - D. concrete, aggregates
- Q2. Define mortar in the construction world.
- A. It consists of cement, coarse aggregates and water only
 - B. It consists of cement, fine aggregates or sand and water only
 - C. It consists of lime and cement with certain ratio to form paste
 - D. It consists of soil and cement with certain ratio to obtain uniform mixture
- Q3. Calcium carbonate is one of the raw ingredients in cement. It exists in the following argillaceous rocks and materials, **EXCEPT**
- A. Oyster shells
 - B. Limestone
 - C. Chalk
 - D. Clay
- Q4. Which one is the correct statement of 'calcareous'?
- A. Its materials can be alone to produce cement
 - B. Contain of calcium oxide such as chalk and limestone
 - C. Contain high calcium lime such as siliceous aggregate
 - D. Contain of silica, alumina and iron oxide such as clay or shale
- Q5. All of the following materials are ingredients of aluminous cement, **EXCEPT**
- A. Limestone
 - B. Bauxite
 - C. Chalk
 - D. Silica
- Q6. Concrete applications require cements with different properties. Select the cement property that do not expedite construction procedure.
- A. Increase workability
 - B. Require rapid strength gain
 - C. Require low heat hydration
 - D. Control shrinkage and cracking

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- Q7.** Setting of cement refers to changes of cement paste from a fluid to rigid state. It is usually described in two levels, namely initial and final setting times which take about _____ and _____, respectively.
- A. 45 – 120 minutes, 3 – 7 hours
 - B. 45 – 175 minutes, 3 – 10 hours
 - C. 175 – 300 minutes, 1 – 2 hours
 - D. 45 – 175 minutes, 24 – 36 hours
- Q8.** High alumina cement is comparatively slow-setting but rapid hardening, thus, produces very high early strength. Which one of the following is **NOT** the other criteria for high alumina cement?
- A. Final setting time about 5 hours
 - B. Initial setting time about 2 hours
 - C. About 80% of the ultimate strength is developed at the age of 24 hours
 - D. Able to be placed at lower temperatures than OPC due to heat at hardening
- Q9.** Setting and hardening of cement is caused by hydration process. Cement hydration is a chemical reaction between cement and water which change the following, **EXCEPT**
- A. Calcium and silicone
 - B. Binding capability
 - C. Rate of reaction
 - D. Energy level
- Q10.** Define initial set time using Vicat Set Time apparatus.
- A. Time when a penetration of 25 mm occurs
 - B. Time for penetration of paste for 30 seconds
 - C. Time of penetration process when repeated every 15 minutes
 - D. Time when the needle does not penetrate visibly into the paste
- Q11.** The following are type of clay used in bricks manufacturing, **EXCEPT**
- A. Surface Clay
 - B. Fire Clay
 - C. Shales
 - D. Silt

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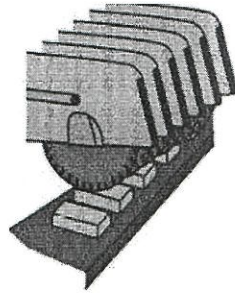


Figure Q12

- Q12.** The following are types of forming method can be used in brick manufacturing process in **Figure Q12**, **EXCEPT**
- | | |
|--------------|---------------|
| A. Stiff mud | C. Cold press |
| B. Soft-mud | D. Dry press |
- Q13.** List the correct sequence of brick manufacturing process is
- | | |
|---------------|-------------------------|
| i. Glazing | iv. Forming and Cutting |
| ii. Screening | v. Burning |
| iii. Drying | |
- | | |
|----------------------|----------------------|
| A. iii, ii, iv, i, v | C. ii, iv, i, iii, v |
| B. iii, ii, i, iv, v | D. ii, v, iii, iv, i |

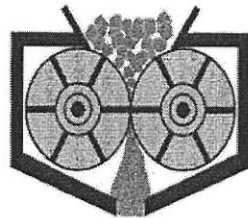


Figure Q14

- Q14.** **Figure Q14** shows the _____ process in bricks manufacturing.
- | |
|----------------|
| A. Glazing |
| B. Winning |
| C. Crushing |
| D. Pulverizing |
- Q15.** The main factors contribute to the brick grade are
- | | |
|-------------------------|-----------------------|
| i. Compressive strength | iii. Water absorption |
| ii. Color | iv. Swelling |
- | | |
|--------------|---------------|
| A. i and ii | C. i and iv |
| B. i and iii | D. ii and iii |

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Q16. _____ of bricks are the least durable and they generally are used only on interior work.

- A. Grade SW
- B. Grade MW
- C. Grade NW
- D. Grade IW

Q17. Masonry is defined as

- A. a mixture of Portland cement, sand and water
- B. the horizontal joint between two courses of brickwork
- C. construction material that formed by combining masonry units
- D. construction in which uniform units "bricks", small enough to be placed with a hand

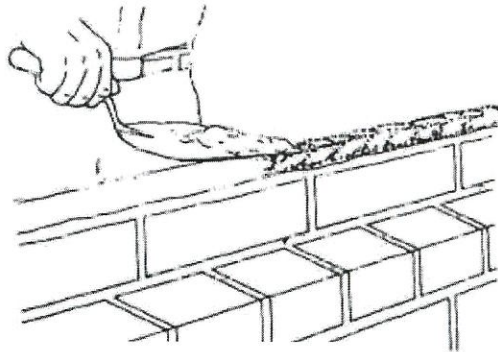


Figure Q18

Q18. Figure Q18 shows the step of _____

- A. cutting off excess mortar
- B. making masonry
- C. making mortar
- D. making furrow

Q19. The compressive strength of clay units depends on

- i. composition of the clay
 - ii. method of manufacturing
 - iii. degree of burning
 - iv. strength of mortar
- A. i, ii and iii
 - B. i, ii and iv
 - C. ii, iii and iv
 - D. i, ii, iii and iv

Q20. The deep-mined clays are _____

- A. Surface Clays
- B. Fire Clays
- C. Shales
- D. Silt

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- Q21.** The softwood density about _____
- A. 285 kg/m³ to 350 kg/m³
 - B. 385 kg/m³ to 735 kg/m³
 - C. 735 kg/m³ to 880 kg/m³
 - D. None of these
- Q22.** The following are incorrect statements for sapwood, **EXCEPT**
- A. Proportion decrease in thickness with the age of tree
 - B. More resistant to insect and fungi
 - C. No longer store food
 - D. Usually darker
- Q23.** Numbers of medium hardwood species as categories under "Malaysian Grading Rules 1984 Edition 1" are:
- A. About 36 species
 - B. About 26 species
 - C. About 16 species
 - D. About 6 species
- Q24.** A temperate species of hardwood are _____
- A. Redwood
 - B. Hemlock
 - C. Pine
 - D. Oak
- Q25.** Plywood is classified as _____
- A. Medium hardwood
 - B. Heavy hardwood
 - C. Light hardwood
 - D. Softwood
- Q26.** Inner bark in wood formation consist of
- A. Cork cambium
 - B. Secondary phloem
 - C. Both (A) and (B)
 - D. Neither (A) nor (B)
- Q27.** Age of tree may be ascertained by
- A. Circumference of its stem
 - B. Number of annual rings
 - C. Number of branches
 - D. Radius of its stem
- Q28.** The crack which extend from bark towards the sapwood in the cross section of a tree, are called _____ shakes.
- A. Radial
 - B. Heart
 - C. Star
 - D. Cup

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- Q29.** Shake and knot defect in timber occurs during _____
- A. subsequent machining
 - B. subsequent handling
 - C. growth
 - D. drying
- Q30.** Common composition used in water soluble preservative are
- A. Copper-chromate-arsenic
 - B. Chromate-zinc chloride
 - C. Benzene-hexa-chloride
 - D. All the above
- Q31.** Medium carbon steel consists of _____
- A. 0.25 % to 0.7 % carbon
 - B. 1.25 % to 1.7 % carbon
 - C. 2.25 % to 2.7 % carbon
 - D. 3.25 % to 3.7 % carbon
- Q32.** Tensile strengths for high carbon steel are approximately _____
- A. 1000 to 1400 N/mm²
 - B. 1400 to 2000 N/mm²
 - C. 2000 to 2400 N/mm²
 - D. 2400 to 3000 N/mm²
- Q33.** Vanadium steel is generally used for _____
- A. Crossing in railways
 - B. Mining equipment
 - C. Auto parts
 - D. Rollers
- Q34.** Pick up the correct statement from the following
- A. Medium carbon used in heat-treated condition for machine components
 - B. High carbon is tougher and more elastic than mild steel
 - C. Mild steel can be forged and welded
 - D. All the above
- Q35.** The steel used for rails under heavy traffic and on sharp curves is _____
- A. Manganese steel
 - B. Vanadium steel
 - C. Stainless steel
 - D. Nickel steel
- Q36.** The steel used in reinforced cement concrete work is _____
- A. Vanadium steel
 - B. Stainless steel
 - C. Nickel steel
 - D. Mild steel

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- Q37.** The manufacturing of steel are as follow, **EXCEPT**
- A. LD-converter process
 - B. Boucherie process
 - C. Crucible process
 - D. Duplex process
- Q38.** The advantages of basic oxygen steelmaking process are as follow, **EXCEPT**
- A. Major by-product of the process can produce acetic acid
 - B. Major by-product of the process can be used as a fuel
 - C. The process takes less than an hour
 - D. Produces no air pollution

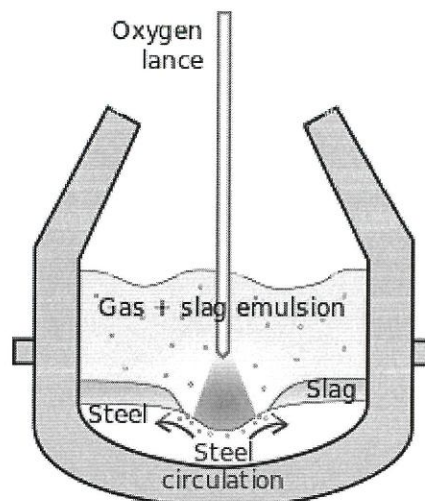


Figure Q39

- Q39.** The manufacturing of steel using **Figure Q39** concept is _____
- A. Lintz and Donawitz process
 - B. Electric smelting process
 - C. Cementation process
 - D. Duplex process
- Q40.** The open hearth process involve material as follow, **EXCEPT**
- A. Malleable scrap iron
 - B. Cement powder
 - C. Pure iron ore
 - D. Pig iron

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SECTION B

- Q1** (a) Calculate the specific gravity of high density aggregate which the unit weight is 2800 kg/m^3 . (2 marks)
- (b) Referring to **Table 1**, calculate the moisture content of coarse aggregates sample. The weight of the tray is 0.252 kg . (3 marks)
- (c) **Table 2** shows the sieve analysis result of an aggregates sample.
- (i) Calculate the percentage of retained aggregates and its cumulative. (6 marks)
 - (ii) Calculate the percentage of passing aggregates (3 marks)
 - (iii) Calculate the fineness modulus value (2 marks)
 - (iii) Plot the grading curve of aggregates (4 marks)
- Q2** (a) Consider the 28-day compressive strength should be 40 MPa and the concrete mix design using the following properties.

Cement class = 42.5
Defective rate = 10 %
Slump required = 10 - 30 mm
Standard deviation = 6 N/mm^2
Density of water = 1000 kg/m^3
Density of cement = 3150 kg/m^3
Density of aggregate = 2700 kg/m^3
Maximum aggregate size = 10 mm
Minimum allowable cement content = 325 kg/m^3
Maximum allowable free-water/cement ratio = 0.55
Fine aggregate crushed = 80% pass 600 microns size

Prepare a concrete mix design using the DOE method (Use **Table 3** through **5** and **Figure Q2(a)** and **(b)**).

(20 marks)

- END OF QUESTION -

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LIST OF TABLE, FIGURE AND FORMULA**Table 1. Weight of aggregate**

Weight before oven dry	5.605 kg
Weight after oven dry	5.260 kg

Table 2: The result of sieve analysis for aggregate

Sieve Size (mm)	Mass of Retained (kg)
25	89
19	245
12.5	987
9.5	1324
4.75	672
2.3	228
1.18	106
Pan	54

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Table 3: K Value for different defective rate

Defectives	Value of K
10%	1.28
5%	1.64
2.5%	1.96
1%	2.33

Table 4: Approximately compressive (N/mm³) of concrete mixes made with a free water cement ratio 0.5

Cement strength class	Type of coarse aggregate	Compressive strengths (N/mm ²)			
		Age (days)			
		3	7	28	91
42.5	Uncrushed	22	30	42	49
	Crushed	27	36	49	56
52.5	Uncrushed	29	37	48	54
	Crushed	34	43	55	61

*Throughout publication concrete strength is express in the unit N/mm²
 1 N/mm² = 1MN/m² = 1MPa. (N = newton; Pa = pascal)*

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LIST OF TABLE, FIGURE AND FORMULA

Table 5: Approximately free water content (kg/m³) required to give various levels of workability

Slump (mm)		0 - 10	10 - 30	30 - 60	60 - 180
Vebe time (s)		> 12	6 - 12	3 - 6	0 - 3
Maximum size of aggregate (mm)	Types of aggregate				
10	Uncrushed	150	180	205	225
	Crushed	180	205	230	250
20	Uncrushed	135	160	180	195
	Crushed	170	190	210	225
40	Uncrushed	115	140	160	175
	Crushed	155	175	190	205

Note: When coarse and fine aggregates of different types are used, the free-water content is estimated by expression

$$2/3W_f + 1/3W_c$$

*where $2/3W_f$ = free-water content appropriate to type of fine aggregate
 and $1/3W_c$ = free-water content appropriate to type of coarse aggregate.*

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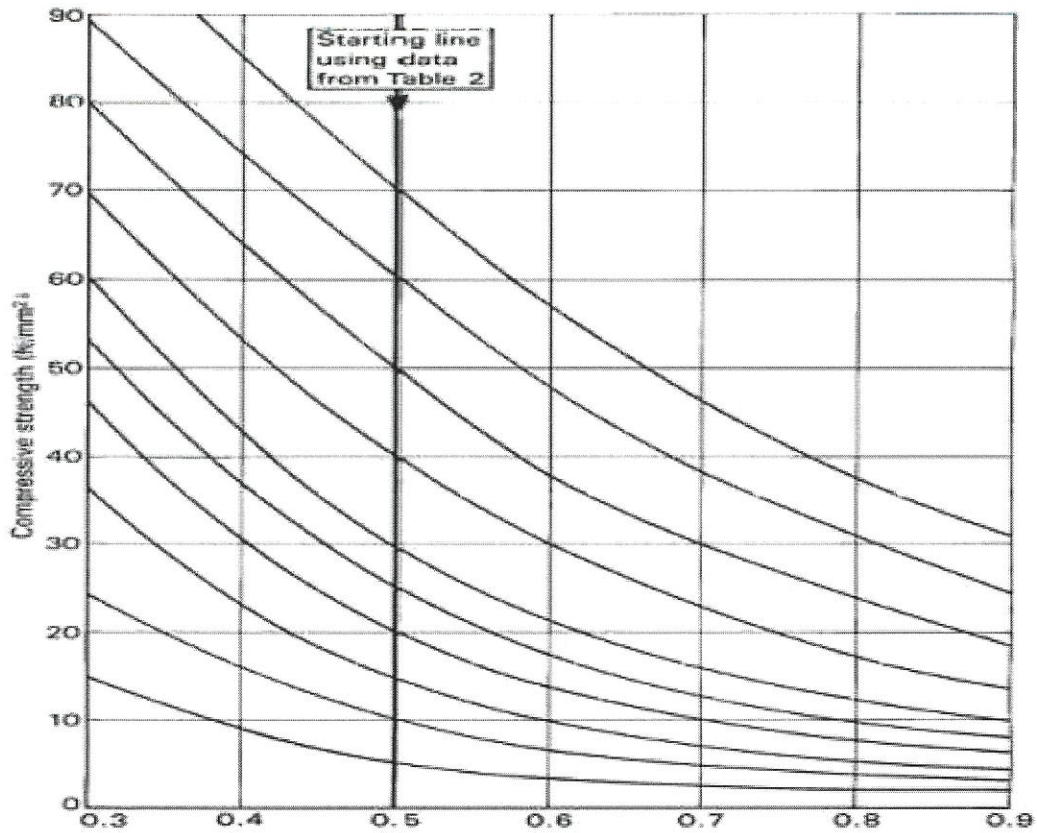


Figure Q2(a): Relation between compressive strength and free-water/cement ratio

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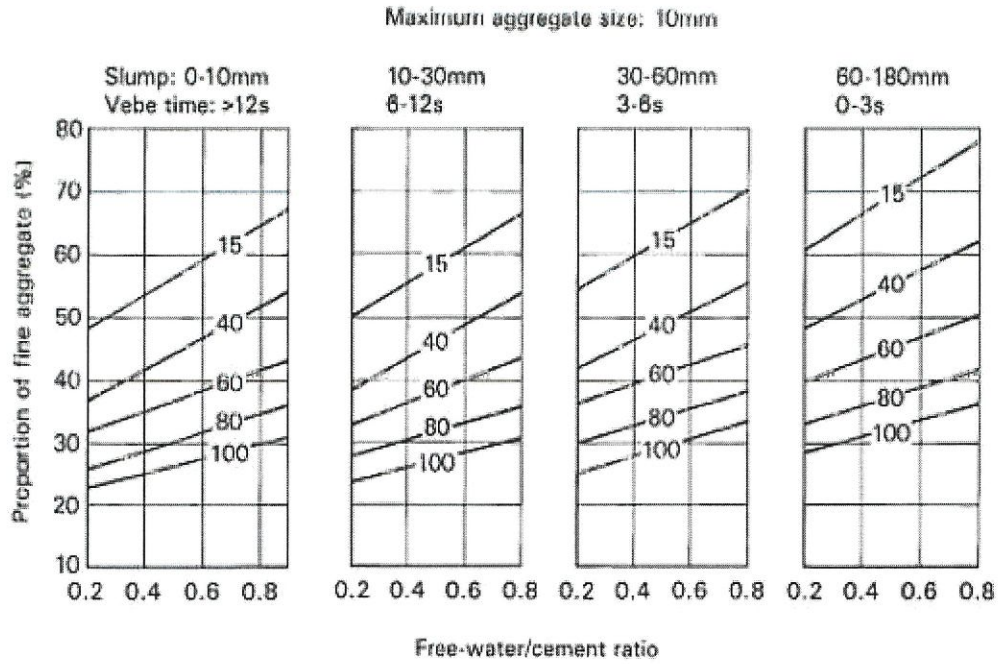


Figure Q2(b): Recommended proportions of fine aggregate according to percentage passing 600 micron sieve (d_{max} 10 mm)

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