



- Answer all the following questions
- Illustrate your answers with sketches when necessary.
- The exam. consists of two page
- No. of Questions 5
- Total Mark: 90 Marks

Assume any missing data

Mix design and quality control charts are allowed.

يسمح للطلبة دخول الامتحان بمجموعة جداول ومنحنيات تصميم الخلطة الخرسانية وضبط الجودة.

Question No. 1 (6 marks)

Determine Egyptian code recommendations for concrete in sulphate environment in the following cases;

- I) When sulphate content is 0.1% of soil.
- II) When sulphate concentration is 1300 ppm in ground water.
- III) When sulphate concentration is 900 ppm in ground water and chloride salts are present.

Question No. 2 (30 marks)

- a) Design concrete mix with target mean 28 day **cube** strength of 450 kg/cm² using BRE method. Slump= 100 mm, Un-Crushed Coarse aggregate, maximum aggregate size is 20 mm, Combined aggregate relative density = 2.60, fine aggregate with 40% passing 600 µm sieve, and OPC cement (CEM I 42.5).
- b) Design concrete mix with target mean 28 day **cylinder** strength of 350 kg/cm² using ACI method. Slump= 100 mm, Crushed Coarse aggregate, maximum aggregate size is 19 mm, Combined aggregate relative density = 2.60, fine aggregate fineness modulus is 2.8, and OPC cement (CEM I 42.5). Take dry rodded weight of CA and FA equal to 1580 kg/m³ and the relative density equal to 2.60.
- c) Design air entrained concrete mix with 5% entapped air and target mean 28 day **cube** strength of 350 kg/cm² using BRE method. Slump= 30-60 mm, Un-Crushed aggregate, maximum aggregate size is 20 mm, Combined aggregate relative density = 2.60, fine aggregate passing 600 µm seive is 60%, and OPC cement (CEM I 42.5).

Question No. 3 (15 marks)

To study concrete strength in structure, several core samples are extracted (only three are shown in the table below). Calculate the estimated actual concrete strength for each core location.

If the required concrete characteristic strength is 350 kg/cm² and the results of core calculated average estimated actual concrete strength is 285 kg/cm², the highest value is 331 kg/cm², and the lowest value is 266 kg/cm², does the used concrete mix satisfy this strength?

If the standard deviation of the estimated actual concrete strength is 25 kg/cm², do you consider the concrete in the structure homogeneous? Why?

Core No.	Direction	Diameter, cm	Length, cm	Load, ton	Reinforcement	
					Ø, mm	Distance from upper face, cm
1	Horizontal	9.9	15.5	21.8	----	-----
2	Horizontal	9.9	16.1	19.3	----	-----
3	Vertical	9.9	15.8	17.5	12	5.8

Question No. 4 (20 marks)

In a construction site, the required characteristic strength is 300 kg/cm², and the contractor used (sets of 3 cubes) to monitor the quality control of concrete. After 40 tests he found that; Average concrete strength = 411 kg/cm², Overall standard deviation = 55 kg/cm², Average range = 20 kg/cm².

Determine: within test standard deviation and within test coefficient of variation - batch to batch standard deviation – actual characteristic strength (5% defective) - % of samples having strength less than 300 kg/cm².

Evaluate the quality of concrete production in field and comment on the performance of testing laboratory. Is the mix design suitable (Egyptian code)? Why?

Question No. 5 (20 marks)

- d) When evaluation concrete quality in building site using Schmidt hammer," Building A" showed average rebound number of 42 and standard deviation of 6. "Building B" showed average rebound number of 38 and standard deviation of 3. Which building contain concrete with homogenous quality.
- e) Draw a sketch to show the direct method, indirect method and semi direct method in using Ultra Sonic Puls velocity test.
- f) The following table show the results of Schmidt hammer (Rebound Number) and Ultra Sonic Pulse Velocity test (USPV) measurements on concrete columns with 30 cm width. Draw relationship between Schmidt hammer and Pulse velocity of the tested concrete. Which column (or columns) do you think has the best concrete quality? Explain the reason of your choice.

Column	C1	C2	C3	C4	C5	C6	C7
Rebound Number	36	38	38	40	36	39	39
Ultra Sonic Transit Time, μ sec	78	73	68	65	70	68	64

Best wishes.