※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Explain what Alkali-silica reaction is, and the results of the reaction. (10%)

2. Explain how the air content in fresh concrete is measured by gravimetric method. (10%)

3. The grain size distributions for aggregates A and B are shown below:

Sieve Size	25 mm	19 mm	12.5 mm	9.5 mm	4.75 mm	2.36 mm	1.18 mm	0.6 mm	0.3 mm	0.15 mm	0.075 mm
%passing of A	100	92	76	71	53	38	32	17	10	5	3
%passing of B	100	100	92	65	37	31	30	29	28	21	15.4

(a) What are the maximum sizes of aggregates A and B? (10%)
(b) Are aggregates A and B well graded? State the reason for each aggregate. (10%)

4. Define the C-S-H phase of cement paste. (10%)

5. A steel pipe having a length of 1 m, an outside diameter of 0.2 m , and a wall thickness of 10 mm, is subjected to an axial compression of 200 kN. Assuming a Young's modulus of 200 GPa and a Poisson's ratio of 0.3, find (a) the shortening of the pipe, and (b) the change in the outside diameter. (10%).

6. What is the effect of an increase in carbon content from 0% to 1% on the (i) cementite (Fe_3C) content, (ii) strength and (iii) toughness of an annealed plain carbon steel? (10%)

7. Explain the difference between an elastomer, a thermoplastic and a thermoset. (10%)

8. Sketch the Bingham model for fluids, and explain its rheological behavior. (10%)

9. Describe the process of fatigue failure in a metal. (10%)