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Roll no. \_\_\_\_\_

	Indian Institute of Technology Kanpur
	Department of Civil Engineering
	<b>Concrete Engineering and Technology</b>
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	<b>Assignment No 1</b>

**Problem 1, read the pairs of statements, and write A, B, C and D as defined below:**

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|--|---|
| <ul style="list-style-type: none"> <li>• <b>Write A</b> when both statements are True</li> <li>• <b>Write C</b> when statement 1 is true and 2 is false</li> </ul> | <ul style="list-style-type: none"> <li>• <b>Write B</b> when both statements are False</li> <li>• <b>Write D</b> when statement 1 is false and 2 is true</li> </ul> |
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<b>1</b>	<ol style="list-style-type: none"> <li>1. As the <math>s/a</math> is increased, the mortar content in a concrete mix decreases.</li> <li>2. Normally <math>s/a</math> is given as the ratio of the sand in the total aggregate content of concrete by mass.</li> </ol>
<b>2</b>	<ol style="list-style-type: none"> <li>1. Laitance formation at the top of the concrete pour is a result of bleeding in fresh concrete.</li> <li>2. Laitance should be removed before (more) fresh concrete is poured across a construction joint.</li> </ol>
<b>3</b>	<ol style="list-style-type: none"> <li>1. Formation of ITZ in the bottom of the coarse aggregates is a manifestation of bleeding.</li> <li>2. Segregation resistance is a desirable property in concrete.</li> </ol>
<b>4</b>	<ol style="list-style-type: none"> <li>1. In principle, as the compaction factor increases, the slump decreases.</li> <li>2. Slump and slump flow of concrete are both measured in mm or cm.</li> </ol>
<b>5</b>	<ol style="list-style-type: none"> <li>1. A slump cone measures 100mm (top diameter), 200mm (bottom diameter) and 350mm (height).</li> <li>2. The slump test helps in qualitatively understanding the setting time of concrete.</li> </ol>
<b>6</b>	<ol style="list-style-type: none"> <li>1. Hydration of cement begins as soon as water comes in contact with the cement.</li> <li>2. Hydration of OPC is an exothermic reaction.</li> </ol>
<b>7</b>	<ol style="list-style-type: none"> <li>1. Quality control of concrete construction is usually based on strength tests carried out at an age of 28 days.</li> <li>2. Strength development in concrete is completed in about a month.</li> </ol>
<b>8</b>	<ol style="list-style-type: none"> <li>1. Characteristic strength of concrete is normally defined as the strength that is likely to be exceeded 95% of the times.</li> <li>2. If instead of allowing 5% of samples to fall below the characteristic strength, 10% of the samples are allowed to fall below the characteristic strength, the design strength (of the mix) will be higher.</li> </ol>
<b>9</b>	<p>The target strength (T) for which a concrete mix is proportioned is often determined as <math>(f_{ck} + k\sigma)</math>. Now, here</p> <ol style="list-style-type: none"> <li>1. <math>k</math> and <math>\sigma</math> both depend on the percentage of samples allowed to fall below <math>f_{ck}</math></li> <li>2. a low value of <math>\sigma</math> represents a low level of quality control at site.</li> </ol>
<b>10</b>	<ol style="list-style-type: none"> <li>1. Concretes cured at higher temperatures initially leads to lower early strengths.</li> <li>2. Curing is a process that facilitates (eases) hydration.</li> </ol>

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<b>Problem 2 Identify the correct response(s) in the following questions. Please note that there may be more than one 'right' response.</b>				
<b>1</b>	Which of the following is/are hydration product of OPC.			
	<b>(a)</b>	<i>Alite</i>	<b>(b)</b>	<i>Ettringite</i>
	<b>(c)</b>	<i>Monosulphate</i>	<b>(d)</b>	<i>Calcium hydroxide</i>
<b>2</b>	Which of the following is/are a constituent(s) of OPC			
	<b>(a)</b>	<i>C<sub>3</sub>A</i>	<b>(b)</b>	<i>Portlandite</i>
	<b>(c)</b>	<i>Na<sub>2</sub>O</i>	<b>(d)</b>	<i>Gypsum</i>
<b>3</b>	False set occurs in a cement when			
	<b>(a)</b>	<i>High gypsum and high aluminate content</i>	<b>(b)</b>	<i>Low gypsum and high aluminate content.</i>
	<b>(c)</b>	<i>Low gypsum and low aluminate content</i>	<b>(d)</b>	<i>High gypsum and low aluminate content.</i>
<b>4</b>	If in an application, higher ultimate strength is desired, which of the cements is the most suitable.			
	<b>(a)</b>	<i>One that has a high C<sub>3</sub>S content</i>	<b>(b)</b>	<i>One that has a high C<sub>2</sub>S content</i>
	<b>(c)</b>	<i>One that has a high C<sub>3</sub>A content</i>	<b>(d)</b>	<i>One that has very little gypsum.</i>
<b>5</b>	Considering the affect of the properties of coarse aggregate used in concrete, which of the following statements is/are TRUE_			
	<b>(a)</b>	<i>Strength of aggregates is not a governing criteria in lower strength concrete</i>	<b>(b)</b>	<i>The quantity of water required for a given workability is higher if the maximum size of the aggregates is smaller.</i>
	<b>(c)</b>	<i>The quantity of water required for a given workability is higher if the aggregates are angular (compared to rounded)</i>	<b>(d)</b>	<i>Coarse aggregates used in concrete should be in saturated surface dry condition</i>

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**Problem 3 Answer the following questions**

- 1) For a concrete with the following constitution [W = 180, C = 360, Fine stone dust = 85, Sand = 542, coarse stone dust = 172, and Coarse aggregate = 1093], what may be taken as the volumetric paste and mortar content. Ignore air content, take specific gravity of all stone dust to be 2.65 and that of cement, sand and coarse aggregate to be 3.12, 2.64 and 2.74, respectively, and assume that all the quantities given are in  $\text{kgs/m}^3$ .
- 2) The specific gravity and bulk density of a coarse aggregate is found to be 2.7 and  $1500 \text{ kgs/m}^3$ . Estimate the void content in the sample used to determine the bulk density.
- 3) Write a short note defining 'porosity' of a material and how it is different from 'permeability'.
- 4) Give reasons for the following
  - (A) Design and quality control measures sometimes allow upto 91 days to determine if the concrete reaches strength (instead of the more common 28days) in cases when blended cements or mineral admixtures are used in concrete construction.
  - (B) Strength of concrete reduces as the water-cement ratio is increased, in the normal range of operations
  - (C) Specifications give a minimum value for the IST and a maximum value for the FST