



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

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| Course Name | : | GROUND IMPROVEMENT TECHNIQUES |
| Course Code | : | ACE509 |
| Program | : | B.Tech |
| Semester | : | VII |
| Branch | : | Civil Engineering |
| Section | : | A & B |
| Academic Year | : | 2019 - 2020 |
| Course Faculty | : | Ch. Bala krishna, Assistant Professor S. Siva Rama Krishna, Assistant Professor |

COURSE OBJECTIVES:

| The course should enable the students to: | |
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| I | Identify the types of soils and categorize the problematic soils by in-situ laboratory tests. |
| II | Design dewatering systems to prevent significant groundwater seepage into the excavation and to ensure stability of excavation side slopes. |
| III | Modify the ground by different procedures such as admixtures, shot Crete, grouting and ground freezing. |
| IV | Apply different methods of soil reinforcement like soil anchors, rock bolts and soil nails in cohesive and granular soils. |

DEFINITIONS AND TERMINOLOGY QUESTION BANK

| S.No | QUESTION | ANSWER | Blooms Level | CO | CLO | CLO Code |
|---------------|---|---|--------------|------|-------|-----------|
| UNIT-I | | | | | | |
| 1 | Define soil erosion. | Soil erosion is defined as the wearing a way of topsoil. Topsoil is the top layer of soil and is the most fertile because it contains the most organic, nutrient-rich materials. | Remember | CO 1 | CLO 1 | ACE509.01 |
| 2 | Explain problematic soils. | The soil that causes additional problems from the engineering point of view as a result of the circumstances of its composition or a change in environmental conditions. | Understand | CO 1 | CLO 1 | ACE509.01 |
| 3 | What is expansive soil? Give one example. | Expansive soils are soils that expand when water is added, and shrink when they dry out. This continuous change in soil volume can cause homes built on this soil to move unevenly and crack. Ex- clay soil | Understand | CO 1 | CLO 2 | ACE509.02 |

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| 4 | What are the difficulties faced with soft clay? | The geotechnical problems usually encountered in land reclamation and soil improvement projects include settlement, consolidation, and stability. | Understand | CO 1 | CLO 2 | ACE509.02 |
| 5 | Explain how loose sand is challenging soil? | A loose sand has a tendency to compress when a load is applied. The phenomenon is most often observed in saturated, loose (low density or un compacted), sandy soils. | Understand | CO 1 | CLO 2 | ACE509.02 |
| 6 | What is a collapsible soil? | Collapsible soils are those unsaturated soils that can withstand relatively high pressure without showing significant change in volume, however upon wetting; they are susceptible to a large and sudden reduction in volume. | Understand | CO 1 | CLO 2 | ACE509.02 |
| 7 | Name the various soil deposits found in India. | Alluvial Soils, Black Soils, red soils, Laterite and Lateritic Soils, Forest and Mountain Soils, Arid and Desert Soils, Saline and Alkaline Soils, Peaty and Marshy Soils. | Remember | CO 1 | CLO 3 | ACE509.03 |
| 8 | What is the need for improving the ground? | It increase the density of the fill mass and/or subsoil to prevent liquefaction; and. improve soil permeability in order to increase drainage capacity. | Remember | CO 1 | CLO 1 | ACE509.01 |
| 9 | Name any four ground improvement techniques. | Vibro-compaction, Vibro stone columns, Dynamic compaction, Rapid impact compaction. | Remember | CO 1 | CLO 4 | ACE509.04 |
| 10 | Define ground improvement. | Ground Improvement refers to a technique that improves the engineering properties of the soil mass treated. Usually, the properties that are modified are shear strength, stiffness and permeability. | Remember | CO 1 | CLO 1 | ACE509.01 |
| 11 | How to improve soils structure | Organic matter helps sandy soil retain moisture and improves drainage of clay and silty soils. It also increases pore space, or pockets of air. Without this pore space, roots struggle to absorb water and nutrients, and literally have no space to grow. | Understand | CO 1 | CLO 3 | ACE509.03 |
| 12 | Define Raft foundations | Raft foundations known as Mat Foundations are a large concrete slab which can support a number of columns and walls. | Remember | CO 1 | CLO 2 | ACE509.02 |
| 13 | Define Reinforced Concrete | Reinforced concrete is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement. | Remember | CO 1 | CLO 3 | ACE509.03 |

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| 14 | Define Tensile strength | A measure of the ability of a material to withstand a longitudinal stress, expressed as the greatest stress that the material can stand without breaking | Remember | CO 1 | CLO 4 | ACE509.04 |
| 15 | What is Ductility | Ductility is a measure of a metal's ability to withstand tensile stress | Remember | CO 1 | CLO 4 | ACE509.04 |
| UNIT-II | | | | | | |
| 1 | Define cohesive soil. | Cohesive soil is defined as sticky soil, and can be termed as clay or silty clay. | Remember | CO 2 | CLO 5 | ACE509.05 |
| 2 | What is vibro compaction. | Vibro Compaction is a technique that compacts granular soils and rearrange the soil particulars into a denser state. | Remember | CO 2 | CLO 5 | ACE509.05 |
| 3 | What is the use of tamping machine? | A tamping machine or ballast tamper is a machine used to pack (or tamp) the track ballast under railway tracks to make the tracks more durable. | Understand | CO 2 | CLO 7 | ACE509.07 |
| 4 | What is soil modification? | Soil modification is a process of improving soil engineering properties such as shear strength, bearing capacity, permeability and etc. | Remember | CO 2 | CLO 5 | ACE509.05 |
| 5 | What mechanical modification. | Soil density is increased by the application of short-term external mechanical forces, including compaction of surface layers | Understand | CO 2 | CLO5 | ACE509.05 |
| 6 | What is soil compaction? | Soil compaction is the process in which a stress applied to a soil causes densification as air is displaced from the pores between the soil grains. | Remember | CO 2 | CLO 5 | ACE509.05 |
| 7 | What is compaction pile? | One of a group of piles, driven in a pattern, to compact a surface layer of loose granular soil to increase its bearing capacity. | Remember | CO 2 | CLO 6 | ACE509.06 |
| 8 | What are stone columns? | Stone column ground improvement involves adding vertical columns of stone into the ground to a depth of at least 4m below the ground surface. | Remember | CO 2 | CLO 6 | ACE509.06 |
| 9 | Define cohesion less soil | Cohesion less soil is any free-running type of soil, such as sand or gravel, whose strength depends on friction between particles. | Remember | CO 2 | CLO 5 | ACE509.05 |
| 10 | What is the use of plate compactor | Plate compactors can be used to compact sub base and asphalt on driveways, parking lots and repair jobs. | Understand | CO 2 | CLO 5 | ACE509.05 |

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| 11 | What is vibro-replacement stone columns? | Vibro Replacement is a method of constructing densely compacted stone columns using a depth vibrator to densify the aggregate backfill and surrounding granular soil. | Understand | CO 2 | CLO 6 | ACE509.06 |
| 12 | Explain the principal of blasting technique | The blasting of explosives in a predetermined pattern causes liquefaction, followed by the expulsion of pore water and subsequent densification of the ground. | Understand | CO 2 | CLO 7 | ACE509.07 |
| 13 | What do you mean by dynamic compaction | Dynamic Compaction (DC) is a ground Modification technique where by loose soils can be effectively and economically densified to improve its mechanical characteristics and allow construction of structures directly on compacted soil, without need of deep foundations or soil replacement. | Remember | CO 2 | CLO 5 | ACE509.05 |
| 14 | What is deep compaction | Deep compaction techniques are required when in-situ soil extending to large depths does not meet the requirements of performance criteria specified for the expected loading and environmental conditions. | Remember | CO 2 | CLO 7 | ACE509.07 |
| 15 | What is explosive compaction? | Explosive Compaction is the ground modification technique whereby the energy released from setting off explosives in subsoil inducing artificial earthquake effects, which compact the soil layers. | Remember | CO 2 | CLO 7 | ACE509.07 |
| UNIT-III | | | | | | |
| 1 | What is dewatering? | Dewatering is the removal of water from solid material or soil by wet classification, centrifugation, filtration, or similar solid-liquid separation processes, | Understand | CO 3 | CLO 8 | ACE509.08 |
| 2 | What are the methods of dewatering? | WellPoint method of dewatering, eductor wells, open sump pumping and deep well Point method. | Remember | CO 3 | CLO 9 | ACE509.09 |
| 3 | What is a well point system? | It consists of a number of well points spaced along a trench or around an excavation site, all connected to a common header which is attached to one or more well point pumps | Remember | CO 3 | CLO 9 | ACE509.09 |

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| 4 | How deep is sand point well? | Atmospheric pressure of about 14.7 pounds per square inch allows a “shallow-well” pump to “pull” water up from a maximum depth of only about 20 feet. | Remember | CO 3 | CLO 11 | ACE509.11 |
| 5 | Explain the necessity of dewatering? | To allow excavations to be carried out in workable dry conditions, to prevent the excavation from flooding. | Understand | CO 3 | CLO 8 | ACE509.08 |
| 6 | Define well | An excavation or structure created to access groundwater in underground aquifers. | Understand | CO 3 | CLO 8 | ACE509.08 |
| 7 | What are deep wells? | A deep well refer to a water well, whose depth is more than 10,000 feet. | Understand | CO 3 | CLO 10 | ACE509.10 |
| 8 | What is well point dewatering? | Well Point Dewatering is a simple yet efficient method of lowering the water table in excavations. A WellPoint dewatering system consists of a series of shallow wells, known as well points, which are installed at a pre-determined depth and appropriate spacing around an excavation. | Understand | CO 3 | CLO 10 | ACE509.10 |
| 9 | How does a dewatering pump work? | A submersible pump is placed at the bottom of the hole, and when the water rises to a certain level, the pump sends it out. | Understand | CO 3 | CLO 11 | ACE509.11 |
| 10 | What does shallow well mean? | A well is considered to be shallow if it is less than 50 feet deep. | Understand | CO 3 | CLO 12 | ACE509.12 |
| 11 | What is surcharge fill? | Surcharge refers to the vertical pressure or any load that acts over the ground surface. It is called as surcharge load. | Remember | CO 3 | CLO 11 | ACE509.11 |
| 12 | What is a wick drain? | Wick drains, also known as Prefabricated Vertical Drains (PVD), are installed to provide drainage paths for pore water in soft compressible soil. | Remember | CO 3 | CLO 12 | ACE509.12 |
| 13 | What is prefabricated vertical drain? | Vertical drainage. Prefabricated vertical drains, also known as wick drains, are one of the most commonly used techniques to make soft compressible subsoil with a low bearing capacity constructible. | Remember | CO 3 | CLO 12 | ACE509.12 |
| 14 | Name any two methods of vacuum consolidation | 1) air-tight sheet method and 2) vacuum-drain method | Remember | CO 3 | CLO 12 | ACE509.12 |
| 15 | Define the term Separation | They can be used as a separator to separate the two dissimilar materials and prevent them from mixing, such as the use of geotextile between fine grained subgrade and granular base course below a roadway. | Understand | CO 3 | CLO 9 | ACE509.09 |

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| UNIT-IV | | | | | | |
| 1 | What is meant by shotcreting | Shotcreting refers to a process in which compressed air forces mortar or concrete through a hose and nozzle onto a surface at a high velocity and forms structural or non-structural components of buildings. | Remember | CO 4 | CLO 13 | ACE509.13 |
| 2 | Why is shotcrete used? | In building repairs, shotcrete is commonly used for repair of fire and earthquake damage and deterioration, strengthening walls, and encasing structural steel for fireproofing. | Remember | CO 4 | CLO 13 | ACE509.13 |
| 3 | What is shotcrete shoring? | Shotcrete is a pneumatically applied concrete with extremely high compressed strengths and a very high early yield. | Understand | CO 4 | CLO 13 | ACE509.13 |
| 4 | What is Gunite made out of? | Gunite is made of sand, water, and cement, and it's basically the same as regular concrete, with one important exception. Unlike traditional concrete, which is poured by section into wooden frames, gunite is applied in layers using a specialized spray gun. | Remember | CO 4 | CLO 13 | ACE509.13 |
| 5 | What is the difference between concrete and Gunite? | Concrete pools can be made of either shotcrete or gunite. The difference is when the concrete mixes with the water. Shotcrete refers to wet concrete that's already fully mixed before it's shot out of a hose. Gunite is dry concrete mix that only mixes with water at the nozzle when it's sprayed. | Remember | CO 4 | CLO 14 | ACE509.14 |
| 6 | Explain sampling? | Gunite pools use a rebar framework that is sprayed over with a concrete and sand mixture. The method is preferable over a traditional poured concrete pool that requires a wooden framework to hold the shape of the basin. | Understand | CO 4 | CLO 14 | ACE509.14 |
| 7 | What are soil admixtures? | Among these, chemical additives are most often used to stabilize the soils by enhancing their inherent properties. Stabilization through chemical additives, such as lime, cement, and fly ash, modifies the soil properties, resulting in a stronger foundation-supporting infrastructure. | Understand | CO 4 | CLO 14 | ACE509.14 |

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| 8 | What is chemical stabilization? | Soil stabilization is the process of altering properties of soil by changing the gradation through mixing with other soils or chemicals to improve strength and durability. | Remember | CO 4 | CLO 14 | ACE509.14 |
| 9 | What is cement stabilization? | The addition of cement to a soil, which acts as a binding agent and produces a weak form of concrete called soil cement. Cement can be used with most types of soil, providing the clay fraction is reasonably small and other specified impurities are not present. | Remember | CO 4 | CLO 14 | ACE509.14 |
| 10 | What are the types of soil stabilization? | Cement Soil Stabilization. Soil can be stabilized by mixing it with cement. Lime Soil Stabilization. Lime is ideal for stabilizing clay soils. Bitumen Soil Stabilization. Chemical Soil Stabilization. | Understand | CO 4 | CLO 15 | ACE509.15 |
| 11 | What is lime stabilization? | Using lime is an effective way to modify soils - improving both workability and load-bearing characteristics while increasing stability and impermeability. | Remember | CO 4 | CLO 15 | ACE509.16 |
| 12 | What is fly ash stabilization? | Fly ash has been used successfully in many projects to improve the strength characteristics of soils. Fly ash can be used to stabilize bases or subgrades, to stabilize backfill to reduce lateral earth pressures and to stabilize embankments to improve slope stability. | Understand | CO 4 | CLO 15 | ACE509.16 |
| 13 | What is bituminous stabilization? | Bituminous soil stabilization refers to a process by which a controlled amount of bituminous material is thoroughly mixed with an existing soil or aggregate material to form a stable base or wearing surface. | Remember | CO 4 | CLO 15 | ACE509.15 |
| 14 | Why do we stabilize soil? | Soil Stabilization is the alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load bearing capacity of a sub-grade to support pavements and foundations. | Understand | CO 4 | CLO 15 | ACE509.15 |
| 15 | What is electrical stabilization? | Electrical Stabilization of Soil. Electrical stabilization of cohesive soil is performed using a process known as Electro-osmosis. | Remember | CO 4 | CLO 16 | ACE509.16 |

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| UNIT-V | | | | | | |
| 1 | Write the concept behind soil reinforcement. | To resist the erosion of the soil during the rainy season and also to give strength to the loose soil. | Remember | CO 5 | CLO 17 | ACE509.17 |
| 2 | What are the materials required for construction of a reinforced soil structure? | Geo synthesis, Geo textiles, Normal RC materials | Remember | CO 5 | CLO 17 | ACE509.17 |
| 3 | What are the principle requirements of a reinforcing material? | Stable, should resist corrosion, should be adoptable in case of soil erosion. | Remember | CO 5 | CLO 17 | ACE509.17 |
| 4 | Define geosynthetics. | Geosynthetics are human-made materials made from various types of polymers used to enhance, augment and make possible cost effective environmental, transportation and geotechnical engineering construction projects. | Remember | CO 5 | CLO 17 | ACE509.17 |
| 5 | What are the various types of geosynthetics? | Geotextiles, geo membranes, geogrids, geonets, geosynthetic clay liners, geopipes, geocomposites | Understand | CO 5 | CLO 17 | ACE509.17 |
| 6 | How geosynthetics are manufactured? | The polymers used to manufacture geosynthetics are generally thermoplastics, which may be amorphous or semi-crystalline. Such materials melt on heating and solidify on cooling. The heating and cooling cycles can be applied several times without affecting the properties. | Understand | CO 5 | CLO 17 | ACE509.18 |
| 7 | Define Geosynthetics filter | Adequate permeability: Allow the water to flow through the filter into the drain so as no excess hydrostatic pore pressure can build up. | Understand | CO 5 | CLO 17 | ACE509.18 |
| 8 | What are the functions of geosynthetics? | geosynthetics, perform five major functions: separation, reinforcement, filtration, drainage and moisture barrier | Understand | CO 5 | CLO 17 | ACE509.18 |
| 9 | What are geotextiles made of? | Typically made from polypropylene or polyester, geotextile fabrics come in three basic forms: woven, needle punched. | Understand | CO 5 | CLO 18 | ACE509.20 |
| 10 | Why do we use geotextile? | Geotextiles can be used in both vertical and horizontal applications, helping to solve drainage problems around homes and along roads and curbs. | Understand | CO 5 | CLO 18 | ACE509.20 |

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| 11 | What is geo membrane? | A geomembrane is very low permeability synthetic membrane liner or barrier used with any geotechnical engineering related material so as to control fluid (or gas) migration in a human-made project, structure, or system. | Remember | CO 5 | CLO 18 | ACE509.20 |
| 12 | How do geo grids work? | Geo grid is a flexible mesh that is used to create a reinforced coherent mass behind the retaining wall by stabilizing the soil. | Remember | CO 5 | CLO 18 | ACE509.18 |
| 13 | Define the term Soil nailing | Soil nailing is a construction remedial measure to treat unstable natural soil slopes or as a construction technique that allows the safe over-steepening of new or existing soil slopes. | Remember | CO 5 | CLO 18 | ACE509.19 |
| 14 | What are the advantages of soil nailing? | Soil nail walls are less disruptive to traffic and cause less environmental impact compared to other construction techniques such as drilled shafts or soldier pile walls, which require relatively large equipment | Remember | CO 5 | CLO 18 | ACE509.19 |
| 15 | What is meant by rock bolting? | A rock bolt is a long anchor bolt, for stabilizing rock excavations, which may be used in tunnels or rock cuts. | Remember | CO 5 | CLO 18 | ACE509.19 |

Signature of the Faculty

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