INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**GROUND IMPROVEMENT TECHNIQUES**
Course Code	:	**A60127**
Class	:	**III B. Tech II Semester**
Branch	:	**Civil Engineering**
Year	:	**2017 – 2018**
Course Coordinator	:	**Dr. Kavita Singh, Associate Professor, Civil Engineering**
Course Faculty	:	**Dr. Kavita Singh, Associate Professor** **Ms. J. Hymavathi, Assistant Professor**

OBJECTIVES:

The objectives of this course are to impart knowledge and abilities to the students to:

I. Apply knowledge on ground improvement techniques such as reinforced earth, drainage and dewatering and grouting techniques on stabilization of expansive soils.
II. Impart knowledge of mechanical modification techniques such as deep compaction, blasting, vibro-compaction, dynamic tamping and compaction Piles.
III. Design of dewatering system which is treated as one of the ground improvement technique.
IV. Familiarize with different ground improvement techniques for cohesive and granular soil.
V. Understand the concept of reinforced earth, geosynthetics and soil reinforcement in ground improvement.

S. No.	QUESTION	Blooms taxonomy level	Course Outcomes
	UNIT - I **INTRODUCTION TO GROUND MODIFICATION**		
	Part - A (Short Answer Questions)		
1	What is the need for ground improvement?	Remember	1
2	What are the objectives of ground improvement?	Understand	1
3	What is expansive soil? Give one example.	Remember	1
4	What are the major problematic soils?	Understand	1
5	What are the difficulties faced with soft clay?	Understand	1
6	What is a collapsible soil?	Understand	1
7	Name various soil deposits found in India.	Remember	1
8	What is the need for improving the ground?	Remember	1
9	Name any four ground improvement techniques.	Remember	1
10	Define ground improvement.	Understand	1
11	Classify ground modification techniques.	Understand	2
12	What are the tests to identify the problematic soils?	Understand	2
13	Explain in brief mechanical modification.	Understand	2
14	Define hydraulic modification.	Understand	2

15	Explain in brief physical and chemical modification.	Remember	2
16	Define Electrical modification.	Remember	2
17	Explain in brief thermal ground improvement technique.	Understand	2
18	Differentiate between mechanical and hydraulic modification techniques.	Remember	2
19	What are the applications of physical and chemical ground modification techniques?	Remember	2
20	Differentiate between electrical and thermal modification techniques.	Understand	2
Part - B (Long Answer Questions)			
1	Explain in detail the role of ground improvement in foundation engineering.	Remember	1
2	What are the objectives of ground improvement Technique?	Remember	1
3	What are the various geotechnical problems faced with black cotton soil, laterite soil and alluvial soil deposits?	Understand	1
4	Explain in detail thermal modification techniques along with their merits and demerits?	Understand	2
5	What are the factors influencing the selection of ground improvement techniques?	Remember	2
6	Classify ground improvement technique and explain them in detail.	Remember	2
7	Explain in detail mechanical modification techniques along with their merits and demerits.	Understand	2
8	Explain in detail hydraulic modification techniques along with their merits and demerits.	Remember	2
9	Explain in detail physical and chemical modification techniques along with their applications.	Understand	2
10	What are the various laboratory and field tests to characterise problematic soils? Explain them in detail?	Remember	2
11	Explain in detail various methods used to determine the water content in the soil.	Remember	2
12	Discuss the importance of plastic limit of the Soil.	Understand	2
13	Discuss the importance of liquid limit of the soil.	Remember	2
14	What are the applications of mechanical and hydraulic modifications techniques?	Understand	2
15	Differentiate between electrical and thermal modification techniques.	Remember	2
Part - C (Problem Solving and Critical Thinking Questions)			
1	Discuss the practical situations which necessitate the ground modification.	Understand	1
2	Explain in detail various field compaction tests and its applicable soil types?	Remember	1
3	What are the objectives of various soil improvement methods? Give an outline of various available techniques.	Remember	2
4	What are the major geotechnical problems in black cotton soils and discuss on the basic principles of each identified problem.	Understand	1
5	Discuss the appropriate techniques that can be used for controlling the problems in black cotton soils?	Remember	1
6	Discuss in detail the laboratory test for problematic soils?	Understand	1
7	Discuss the problems associated with expansive soils on building foundations?	Understand	1
8	Discuss the field conditions that favour the swelling of soils and write its consequences?	Understand	1
UNIT - II MECHANICAL MODIFICATION			
Part – A (Short Answer Questions)			
1	What are the various methods of in-situ densification of soil?	Understand	3
2	What is vibro compaction.	Remember	3

3	What do you understand from the term in-situ densification?	Understand	3
4	What is vibro-displacement?	Understand	3
5	Define Dynamic Tamping.	Understand	4
6	Define mechanical modification.	Understand	3
7	What is compaction?	Remember	4
8	What is compaction pile and where it is used?	Understand	3
9	What is stone column?	Understand	3
10	How is blasting a ground improvement technique?	Remember	3
11	Write the advantages of compaction piles.	Understand	3
12	What are the applications of stone column?	Understand	3
13	What are the methods of installing a stone column?	Remember	3
14	Write the advantages and disadvantages of compaction piles.	Remember	3
15	Define dynamic compaction?	Remember	3
16	What are the various deep compaction techniques?	Understand	3
17	What is vibro-flotation?	Understand	4
18	What are the applications of vibro-flotation?	Remember	4
19	What is dynamic consolidation?	Remember	4
Part - B (Long Answer Questions)			
1	What are the equipments used in vibro compaction method?	Understand	4
2	Discuss with a neat diagram installation of explosives for ground improvement techniques	Understand	4
3	Explain in detail the method dynamic consolidation of cohesive soil.	Understand	4
4	How is a rammed stone column installed?	Understand	4
5	Explain in detail vibro-compaction? In which soils it is adopted?	Understand	4
6	What are compaction piles? Discuss the installation procedure of compaction piles.	Understand	4
7	What is stone column? What are the methods of installing a stone column?	Understand	4
8	Explain in detail the method of dynamic compaction of cohesion less soil.	Remember	4
9	Explain in detail with a neat diagram the method of dynamic tamping?	Understand	4
10	Discuss in detail the procedure of the vibro compaction?	Understand	4
11	What is in-situ densification of soil? Explain in detail.	Understand	4
12	How dynamic tamping is helpful in compaction of the soil.	Remember	4
13	Write the advantages and Disadvantages of sand blasting Techniques.	Remember	4
14	Write short notes on: a) Heavy Tamping b) Impact rollers c) Plate vibrators	Understand	4
15	How does a sand compaction pile improve the soil? Write a detailed note on its installation and functioning.	Understand	4
Part – C (Problem Solving and Critical Thinking)			
1	Compare and contrast the various methods of in-situ densification techniques.	Understand	3
2	Differentiate between vibro compaction and vibro Replacement? Explain them in detail.	Understand	4
3	What are the merits and demerits of dynamic compaction?	Understand	4
4	Explain in brief about the installation and working of a vibro-replacement stone column.	Understand	4
5	Explain in detail with neat sketch stone column construction methods?	Understand	4
6	Describe the vibroflotation technique of identifying granular soil.	Understand	4

7	Explain impact at depth method of soil densification.	Understand	4
UNIT-III HYDRAULIC MODIFICATION			
Part - A (Short Answer Questions)			
1	When are deep wells used for dewatering?	Understand	5
2	Define dewatering system?	Understand	5
3	What is the need for drainage and dewatering?	Remember	5
4	What are the objectives used in dewatering?	Understand	5
5	What are the various methods of dewatering?	Remember	5
6	Explain about well point System.	Understand	5
7	What are the different types of drains?	Understand	5
8	What are the different types of well point systems?	Remember	5
9	What is advantage of using vertical drains along with pre-loading?	Understand	5
10	Discuss traditional dewatering system.	Understand	5
11	What are merits of dewatering system?	Understand	5
12	What are demerits of dewatering systems?	Understand	5
13	What are the types of drainages?	Understand	5
14	What are Suction pumps?	Remember	5
15	What is hydraulic modification?	Understand	5
16	Define Horizontal drain.	Remember	5
17	Define well point system.	Understand	5
18	What is hydraulic modification?	Remember	5
19	Define coarse grain soils.	Understand	5
20	Define borehole pumps.	Remember	5
21	How are sumps and ditches used in dewatering?	Understand	5
22	Define vacuum dewatering system.	Remember	5
23	What is electro kinetic dewatering?	Understand	5
24	Define Consolidation techniques.	Understand	5
25	Define fine grain soils.	Understand	5
26	What is electro-osmotic dewatering?	Remember	5
27	Define permeability and seepage.	Understand	5
28	Define preloading as hydraulic modification technique.	Remember	5
29	Define Vertical Drains	Remember	5
30	What is Preloading technique?	Understand	5
31	Define geosynthetics in ground improvement techniques?	Understand	5
32	What are the different types of drains?	Remember	5
33	What is electro kinetic dewatering?	Understand	5
34	How seepage control is done with geosynthetics?	Remember	5
35	What is the role of geosynthetics in separation work?	Understand	5
36	What is preloading and when it is adopted as a ground improvement technique?	Understand	5
37	Define Vertical drains.	Remember	5
38	Define Pre-fabricated vertical drains.	Understand	5
39	What is advantage of using vertical drains along with pre-loading?	Understand	5

40	Define geotextile in ground improvement.	Understand	5
41	What do you mean by multi-stage well point system?	Remember	5
42	Write the application of geosynthetics.	Understand	5
43	Discuss dewatering systems in cohesive soils	Understand	5
44	Define Geomembrane as ground improvement material.	Understand	5
45	Discuss conventional preloading.	Understand	5
46	Write some disadvantages of sand drains.	Understand	5
47	Write some advantages of sand drains	Remember	5
48	Define Filtration technique.	Remember	5
Part – B (Long Answer Questions)			
1	Explain in detail with a neat sketch the method of dewatering using sumps and ditches stating its advantages and disadvantages.	Remember	5
2	Explain in detail the well point system of dewatering.	Remember	5
3	What is a deep well? When is it adopted? What are its merits and demerits?	Understand	5
4	Explain in brief the principle, equipment used, installation and operation adopted in electro-osmotic dewatering.	Remember	7
5	Explain in brief the various steps for designing a dewatering system.	Understand	5
6	Compare the various dewatering systems suitability, uses, merits and demerit.	Understand	6
7	Explain in detail single stage well point with neat sketch.	Understand	6
8	Write the various methods of preloading adopted in ground improvement technique.	Understand	7
9	What are vertical drains and when it is adopted?	Remember	7
10	Discuss in detail electro-kinetic dewatering technique with neat sketch.	Remember	7
11	Explain in detail multi stage well points with neat sketch.	Understand	6
12	Discuss the advantages and disadvantages of dewatering system.	Understand	6
13	Discuss the consideration taken to design a proper dewatering system.	Remember	6
14	Explain in detail with the help of neat sketches, application of geosynthetics as separator.	Understand	6
15	How do geosynthetics function as a filter? How does it differ in its function for drainage? Explain in detail with sketches.	Remember	6
16	Explain in detail application of geosynthetics as a drainage material?	Understand	6
17	Explain in detail various types of geosynthetics & their applications.	Understand	6
Part – C (Problem Solving and Critical Thinking)			
1	Explain in brief various traditional dewatering systems and their choice.	Understand	5
2	Explain the design of dewatering system in hydraulic modification of the ground.	Understand	5
3	What are the advantages of sumps and ditches in dewatering?	Understand	5
4	How do geosynthetics function as a filter? How does it differ in its function for drainage? Explain in detail with sketches.	Understand	6
5	Explain drainage prevention after construction of structure on a ground.	Remember	6
6	Explain in detail about the dewatering techniques used in cohesive soils.	Remember	6
7	Explain in detail the advantage of using vertical drains along with preloading?	Understand	8

UNIT-IV PHYSICAL AND CHEMICAL MODIFICATION			
Part – A (Short Answer Questions)			
1	Define grouting as a ground improvement techniques.	Understand	9
2	Write the applications of grouting.	Understand	9
3	What are the various methods of grouting?	Understand	9
4	What are the different types of grouts?	Remember	9
5	Name the different methods of grout injection.	Understand	9
6	What are the two methods of mechanical stabilization?	Remember	9
7	How is stabilization of soil achieved by cement?	Understand	9
8	How ground modification is done by grouting?	Remember	9
9	Explain stabilization by heating in thermal methods of ground improvement techniques.	Understand	9
10	Explain in brief Jet Grouting.	Understand	9
11	Explain about compaction Grouting.	Understand	9
12	Discuss dry mix Vs wet mix.	Understand	9
13	Differentiate between Shotcreting and Guniting.	Understand	9
14	What is crack grouting?	Understand	9
15	What is low mobility Grouting?	Remember	9
16	Explain freezing of ground.	Understand	9
17	Explain heating of ground.	Understand	9
18	Define shotcreting technology.	Understand	9
19	Define Guniting technology.	Understand	9
20	Define thermal modification?	Understand	9
Part – B (Long Answer Questions)			
1	Describe in detail various methods of grouting with neat sketches.	Understand	9
2	Write short notes on: (a) Pre-grout investigation. (b) Grout holes pattern. (c) Selection of grout characteristics.	Remember	9
3	How are heating and freezing used to improve ground?	Remember	10
4	Discuss in detail compaction grouting and jet grouting	Remember	10
5	What are the various methods of jet grouting?	Understand	9
6	Define Grouting. What are the materials used in grouting?	Remember	9
7	Discuss in detail the grouting procedure.	Understand	9
8	Explain about the jet grouting with neat sketch.	Remember	9
9	What do you understand from the term chemical stabilization?	Understand	10
10	What is the procedure for cement grouting of cracks in concrete structures?	Understand	10
11	Discuss the application of Grouting?	Remember	9
12	Discuss various methods of Shotcreting?	Understand	9
13	Discuss Shotcrete Vs Gunite in detail.	Understand	9
14	Describe in detail the various applications of grouting?	Understand	9
15	Describe in detail chemical stabilization of the soil with the help of an example.	Understand	10
Part – C (Problem Solving and Critical Thinking)			
1	Explain in detail how expansive soils are stabilized.	Understand	10
2	Explain in detail cement stabilization?	Understand	10

3	How thermal methods are helpful in soil stabilization.	Remember	10
4	Explain in detail difference between compaction and jet grouting?	Understand	9
5	Explain in detail principle of ground modification at depth by grouting?	Remember	9
UNIT-V MODIFICATION BY INCLUSIONS AND CONFINEMENT			
Part - A (Short Answer Questions)			
1	What is soil reinforcement?	Understand	11
2	Define grid reinforced soil.	Understand	11
3	Define soil nailing.	Understand	11
4	Discuss about ground anchors.	Understand	11
5	What is soil reinforcement?	Understand	11
6	What is the application of geosythetics?	Remember	11
7	What is in-situ reinforcement?	Remember	11
8	Define soil or fill material.	Remember	11
9	Define Grouted nails.	Remember	11
10	Define facing in reinforcement.	Remember	11
11	Define Geogrids in ground improvemt.	Remember	11
12	Define rock bolting.	Remember	11
13	Define driven nails.	Remember	11
14	Write a brief note on geosynthetics as reinforcement.	Remember	11
15	What is reinforced soil wall?	Understand	11
16	Define Geomembrane.	Understand	11
17	What are the advantages of soil nailing?	Understand	12
18	Define Grouted nails.	Remember	12
19	What is meant by reinforced soil?	Understand	12
20	What are the advantages of soil nailing?	Understand	12
Part - B (Long Answer Questions)			
1	What are the various types of geosynthetics & explain in detail four major applications of geosynthetics ?	Understand	12
2	Describe in detail about soil nailing and when is it adopted?	Remember	12
3	Describe in detail rock bolting.	Understand	12
4	"Geosynthetics can be used as soil reinforcement "– Justify in detail with supporting sketches.	Understand	12
5	Why soil nails are called passive inclusion.	Remember	12
6	Write short note on: a) Soil nailing b) Rock bolting c) Ground Anchor d) Reinforced Earth	Remember	12
7	What are the three basic material composites required in the construction of any reinforced soil structure?	Understand	12
8	What are the applications of earth reinforcement?	Understand	12
9	What are the applications of soil nailing?	Understand	12
10	What are the applications of ground anchors?	Understand	12
11	Define ground anchors. What are the different types of ground anchors?	Remember	12

12	With neat sketches explain in detail the various applications of reinforced earth for ground improvement.	Understand	12
13	Write the applications of rock bolting.	Understand	12
14	Describe in detail about soil nailing and when is it adopted.	Understand	12
15	Explain in details various in-situ ground reinforcement techniques.	Understand	12
Part – C (Problem Solving and Critical Thinking)			
1	Explain in detail the use of geosynthetics as reinforcement.	Understand	12
2	Explain the design principles of reinforced earth walls.	Understand	12
3	What do you understand by reinforced earth? Enumerate various applications of reinforced earth.	Remember	12
4	Explain the procedure of soil nailing and rock bolting?	Understand	12
5	Explain the difference between ground anchor and soil nailing?	Understand	12

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