



5 questions in two pages
 Using tables of pavement and highways is allowable

Question 1 (20 marks)

- 1- Discuss the importance of compaction and its effect on physical properties on soil?
 Illustrating the factors affect soil compaction?
- 2- Compare between the methods and equipments used to determine the soil density in the field and the laboratory?
- 3- Discuss the types of roller used in compaction?
- 4- In the field a sand cone test was performed in compacted soil. the results of sand cone test were as follow:-

Weight of excavated soil ----- 20 Ibs.
 Weight of sand before performing the test ----- 57 Ibs.
 Weight of sand after performing the test ----- 25 Ibs.
 Weight of sand that fill the cone ----- 18 Ibs.
 Unit weight of calibrated sand ----- 97.3 Pcf.
 Oven-dry weight of excavated soil ---- 15.5 Ibs.

- a) Determine the max dry density
- b) Discuss the relative compaction if the laboratory dry density was 121.2 Ib/ft³.
- c) Calculate the saturated moisture content if specific gravity was 2.6

Question 2 (20 marks)

- 1- A wet soil sample weights 40 gm , After oven drying the weight is reduced to 29 gm , determine the moisture content . If the degree of saturation of the sample is 80% and its specific gravity is 2.7, determine the porosity, the void ratio, the bulk density and dry density.
- 2- A cohesion less soil has a degree of saturation of 45% when it is in natural state. The saturated density of the soil is 1.95 t/m³ and the dry density is 1.62 t/m³ . Determine the bulk density of this soil at the natural state. Also determine the moisture content.
- 3- What is the mean of rocks weathering ? explaining the different between the physical and chemical weathering ?
- 4- Discus with net sketch the types of underground drainage ? illustrating the conditions and specification of trench drains and filter ?
- 5- What are the types and advantages of surface drainage? Illustrate by drawing.

Question 3 (20 marks)

1- The grain size analysis of a subgrade soil as the following:

Sieve NO.	4	10	40	60	100	200	L.L	P.L
Open size (mm)	4.75	2.0	0.425	0.25	0.1	0.075		
% passing	60	56	30	19	13	10	22	19

- a) Classify the above soil according to AASHTO and Unified system and FAA?
- b) Determine the group index (GI) and the suitable compactor type for this soil?
- c) Propose and sketch the type of sub drainage system assuming the subgrad soil exists at a depth of 6 feet in a cut section of a road ? if ground water table is at 1 feet blew the surface.

- 2- What are the main contents of the soil? Illustrating the effect of soil contents on its performance?
- 3- What are the characteristics that required in aggregate used in pavement?
- 4- Discuss **in details** all tests required for aggregate used in pavement?

Question 4 (20 marks)

- 1- How the soil strength can be measured? Discussing the factors that affect on the results of each test used to measure the soil strength?
- 2- Discuss the following:
 - unconfined compression test,
 - triaxial compression test,
 - vane shear test,
 - direct shear box test.
- 3- Illustrate how the modulus of subgrade reaction can be determined and corrected?
- 4- The following data was taken during a CBR test :

Penetration (in)	0.05	0.1	0.15	0.2	0.3	0.4	0.5
Load (Ib)	30	90	210	300	450	525	570

- a- Determine the CBR of this soil?
- b- Determine the surcharge weight required for the above CBR test where the estimating pavement thickness will be 18 inch and the pavement will have a unit weight of 140 Ib/ft³

Question 5 (20 marks)

- 1- Compare between: Mechanical & Chemical stabilization?
- 2- Talk in details about bituminous stabilization?
- 3- What is the difference between cement stabilization of sand soil and gravel mixtures?
- 4- What are the main functions of lime in lime stabilization? Illustrating the reactions between lime-soil mixtures?
- 5- A soil sample of 22% water content was taken from a field after compaction . the weight of the specimen in air =1220 gm , its weight in air and water after coating with paraffin is 1268 , 700 gm respectively , GS of paraffin = 0.9 , maximum dry density in laboratory = 140 pcf , determine the relative compaction .

With my best wishes
Dr. Ahmed Abu El-Maaty

This exam measures the following ILOs (Intended Learning Outcomes)

Question No.	ILOs
1	A-1, A-2, B-3, C-2
2	A-3, B-4, B-5, C-1, C-2, D-3, D-6
3	B-4, B-5, A-4, D-4, C-1
4	A-2, C-3, B-4, D-5, C-2
5	C-1, B-4, B-5, A-4, D-4, C-2