Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CE-New)/SEM-6/CE-601/2010

2010

SOIL MECHANICS-II

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) Unconfined compressive strength test is
      a) Undrained test
      b) Drained test
      c) Consolidated undrained test
      d) Consolidated drained test.

   ii) The angle of Coulomb's failure envelope that makes with the horizonatal is called
      a) cohesion
      b) angle of internal friction
      c) angle of repose
      d) none of these.

   iii) Shear strength of a soil is a unique function of
      a) effective stress only
      b) total stress only
      c) both (a) and (b)
      d) none of these.

iv) In a triaxial compression test when drainage is allowed during the first stage (*i.e.* application of cell pressure) only and not during the second stage (*i.e.* application of deviator stress at constant cell pressure), the test is known as

a) consolidated drained test

b) consolidated undrained test

c) unconsolidated drained test

d) unconsolidated undrained test.

v) In a triaxial compression test, when a soil sample is subjected to a uniformly distributed fluid pressure only, the Mohr's representation of the state of stress on sample is

a) b)

c) d)

vi) In the triaxial compression test, the application of additional axial stress (*i.e.* deviator stress) on the soil specimen produces shear stress on

a) horizontal plane only

b) vertical plane only

c) both horizontal and vertical planes

d) all planes except horizontal and vertical planes.

vii) Coefficient of consolidation of a soil is affected by

a) compressibility b) permeability

c) both (a) and (b) d) none of these.

viii) Degree of consolidation is

a) directly proportional to time and inversely proportional to drainage path

b) directly proportional to time and inversely proportional to square of drainage path

c) directly proportional to drainage path and inversely proportional to time

d) directly proportional to square of drainage path and inversely proportional to time.

ix) If the time required for 50% consolidation of a remoulded sample of clay with single drainage is t, then the time required to consolidate the same sample of clay with same degree of consolidation but with double drainage is

a) $t/4$ b) $t/2$

c) $2t$ d) $4t$.

x) Skempton's pore pressure coefficient B for saturated soil is

a) 1 b) 0

c) between 0 and 1 d) greater than 1.

xi) Select the incorrect statement :

a) In a direct shear box test, the plane of shear failure is predetermined

b) Better control is achieved on the drainage of the soil in a triaxial compression test

c) Stress distribution on the failure plane in the case of triaxial compression test is uniform

d) Unconfined compression test can be carried out on all types of soils.

xii) In a deposit of normally consolidated clay

a) effective stress increases with depth but water content of soil and undrained strength decrease with depth

b) effective stress and water content increase with depth but undrained strength decreases with depth

c) effective stress and undrained strength increase with depth but water content decreases with depth

d) effective stress, water content and undrained strength decrease with depth.

xiii) If a cohesive soil specimen is subjected to a vertical compressive load, the inclination of the cracks to the horizontal is

a) 90° b) 45°

c) 22·5° d) 0°.

xiv) Time factor for a clay layer is

a) a dimensional parameter

b) directly proportional to permeability of soil

c) inversely proportional to drainage path

d) independent of thickness of clay layer.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What do you understand by 'Optimum moisture content' and 'Maximum dry density' ?
3. Define preconsolidated, normally consolidated and under-consolidated soil.
4. Compare the compactive energy used in IS heavy compaction test with that of IS light compaction test.
5. Derive the equation $\sigma_1 = \sigma_3 N_\Phi + 2 C N_\Phi$ with usual notations.
6. What are the assumptions of Rankine's earth pressure theory ?
7. What are the modes of failure in finite slope ? Discuss them with neat sketches.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. A saturated clay overlaying an impervious stratum and is underlain by a pervious stratum is 10 m thick. Its co-efficient of permeability is $3.3 \propto 10^{-8}$ cm/s and C_c = 0.24. At initial stress of 100 kPa, its void ratio is 1.6 :

   i) What would be its void ratio when the clay is subjected to an overburden pressure of 200 kPa ?

   ii) Estimate the ultimate settlement of the clay strata due to primary consolidation.

   iii) What is the coefficient of consolidation of the clay layer ?

   iv) Calculate the time required for 50% and 90% of the total settlement.

9. a) The following results were obtained from a conslidated undrained triaxial test on a clay soil :

Cell pressure σ_3 (kN/m^2)	100	250	400
Deviator stress at failure σ_1 (kN/m^2)	340	410	474
Pore water pressure at failure (kN/m^2)	–42	64	177

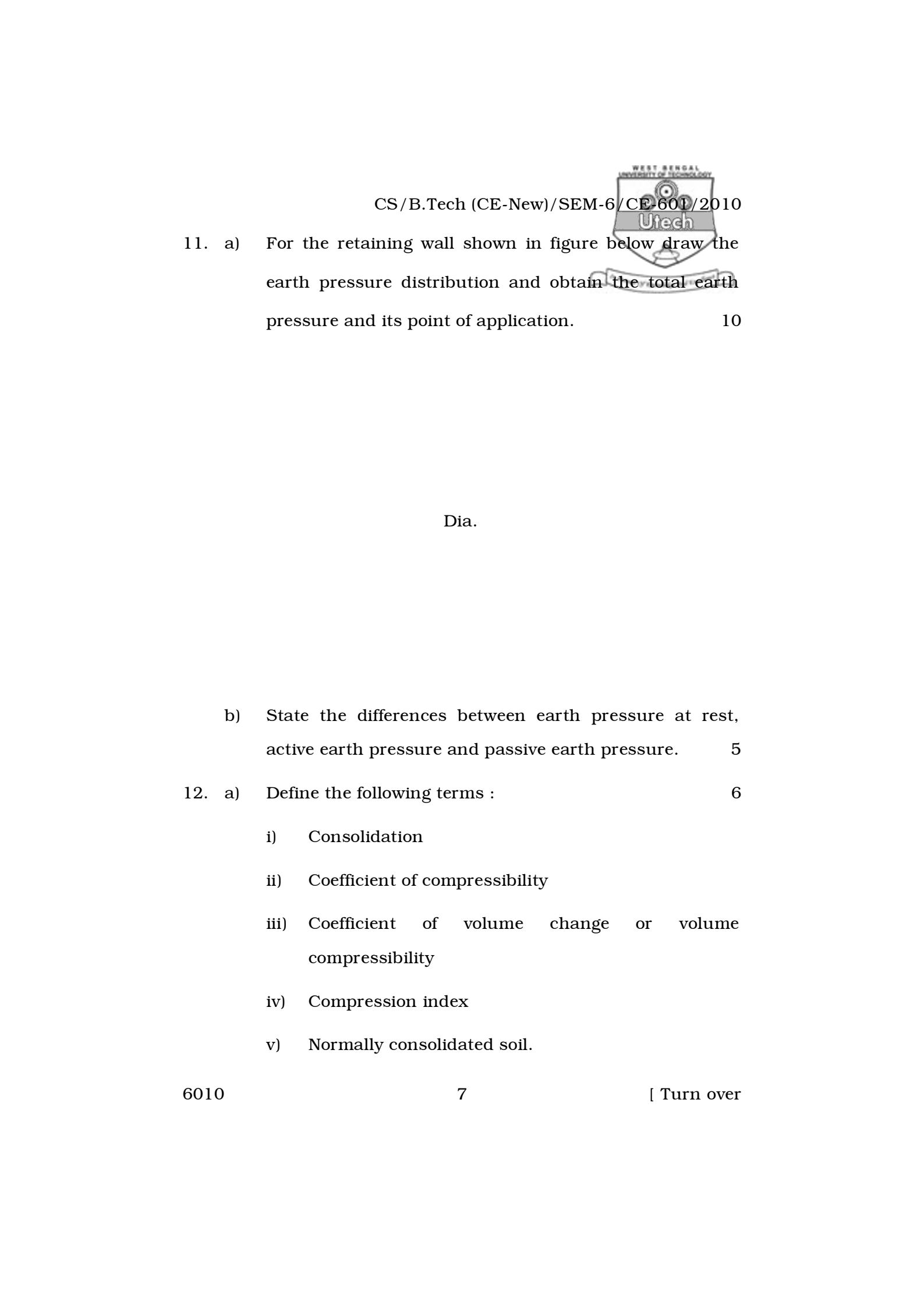
Determine the effective cohesion and effective angle of internal friction of the soil. 10

b) How are triaxial compression tests classified with respect to drainage conditions ? Mention the field situations under which each test is preferred. 5

10. A compacted field is to be constructed using soil from a borrow area having e_n = 0·7, w_n = 15·0%, G_s = 2·67. The compacted volume of the embankment is 60000 m^3 and its unit weight is 19 kN/m^3 at a placement water content of 19%.

Soil from the borrow area is to be excavated and transported to the site in trucks of 10 m^3 capacity. During excavation and dumping of soil in the trucks, the soil increase in volume by 10%. At the site, the required additional amount of water is added to the soil and compacted to the desired extent by pneumatic rubber tyred rollers. The cost of the excavation, transportation and compaction is Rs. 500 per truck. Water charges per truck is Rs. 250. Find the total cost for using soil from the borrow area for construction of the embankment.

11. a) For the retaining wall shown in figure below draw the earth pressure distribution and obtain the total earth pressure and its point of application. 10



b) State the differences between earth pressure at rest, active earth pressure and passive earth pressure. 5

12. a) Define the following terms : 6

i) Consolidation

ii) Coefficient of compressibility

iii) Coefficient of volume change or volume compressibility

iv) Compression index

v) Normally consolidated soil.

b) Determine the stresses at the top and bottom of the cut shown in figure below. Also determine the depth of tensile crack and the depth of unsupported excavation. 9

Dia.

13. a) Distinguish between finite slope and infinite slope. What are the different types of failure of finite slopes ? 5

b) There are two layers of soils *A* and *B* over an inclined rock surface, inclination being $i = 20^\circ$ with the horizontal. Layer *B* lies over the rock surface and it is 6 m below the bottom of layer *A*, layer *A* is 4 m below the top surface.

Soil properties of layers *A* and *B* are as follows :

Layer	γ	c
A	19 kN/m^3	30 kN/m^2
B	20 kN/m^3	50 kN/m^2

Is the finite slope stable ? If not, why and when will slip occur above the rock surface ? 10