

Course Title:
Design of Reinforced Concrete Structures (1)
Date: Jan. 10th 2019

Course Code: CSE221

Junior Level 2018-2019

Allowed time: 3 hrs

No. of Pages: (2)

Remarks: Any missing data may be reasonably assumed.

الإمتحان مكون من ورقتين غير مسموح باصطحاب أى جداول أو مساعدات تصميم بخلاف المُسلّمة فى لجنة الإمتحان.

Question No. (1) (5 Marks)

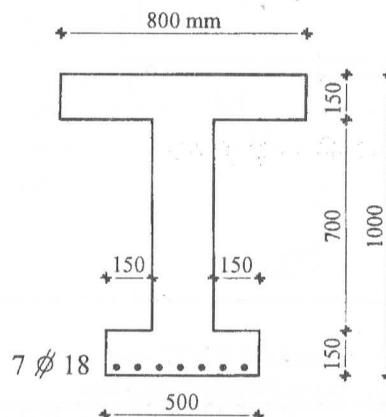
Choose the correct answer:

- 1) Steel is considered the most suitable reinforcement for concrete sections because: (1.0 Mark)
 - a- steel resist tensile strength.
 - b- the coefficient of thermal expansion of steel and concrete are quite close.
 - c- steel is a homogenous material.
- 2) Limit state design method allows the study of the behavior of RC element from zero load up to failure considering: (1.0 Mark)
 - a- the linear behavior.
 - b- the non linear behavior.
 - c- both of (a) and (b).
- 3) Under reinforced section is characterized by: (1.0 Mark)
 - a- $\mu < \mu_b$, $c < c_b$ and $\epsilon_s \geq \epsilon_y$.
 - b- $\mu \geq \mu_b$, $c > c_b$ and $\epsilon_s \leq \epsilon_y$.
 - c- $\mu \leq \mu_b$, $c > c_b$ and $\epsilon_s = \epsilon_y$.
- 4) In the vicinity of mid-span of a uniformly loaded simply supported beam where shear is small and bending stress is large; the crack pattern is nearly: (1.0 Mark)
 - a- inclined.
 - b- horizontal.
 - c- vertical.
- 5) Shrinkage reinforcement is supplied in RC beams when: (1.0 Mark)
 - a- $t - t_s = 600$ mm.
 - b- $t - t_s > 600$ mm.
 - c- $t - t_s < 600$ mm.

Question No. (2) (15 Marks)

For the cross section shown in figure (1), considering steel grade 360/520 and concrete $f_{cu} = 25$ N/mm²; using the first principles, find:

1. The cracking moment (M_{cr}). (5 Marks)
2. The allowable moment (M_{all}). (5 Marks)
3. The ultimate design moment (M_u). (5 Marks)





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Question No. (3) (20 Marks)

Clear drawings are greatly considered.

For the part of the structural plan of residential building shown in figure (2); it is required to:

1. Draw the load distribution of slabs on the structural plan. (2.0 Marks)
2. Calculate load on beam on axis (B-B). (4.0 Marks)
3. Draw with a suitable scale the S.F.D and B.M.D due to ultimate total loads only. (2.0 Marks)
4. Design critical sections of that beam for flexure and shear for the case of total loads only. (4.0 Marks)
5. Using moment of resistance diagram (MRD), show flexure and shear reinforcement details for the beam in elevation and cross sections to a suitable scale. (3.0 Marks)
6. Calculate development and anchorage lengths and then show it on the reinforcement elevation section. (2.0 Marks)
7. For the beam at axis (B-B), for the service load condition, check deflection at the mid-span section. (3.0 Marks)

Consider slab thickness = 140 mm, width of all beams = 250 mm, flooring cover = 1.50 kN/m², live load = 3.0 kN/m² and walls exist over all beams with intensity of 5 kN/m², floor height 3.0 m and total beam thickness 700 mm, column dimensions 250×500 mm, $f_{cu} = 25.0 \text{ N/mm}^2$, Steel grade is 360/520.

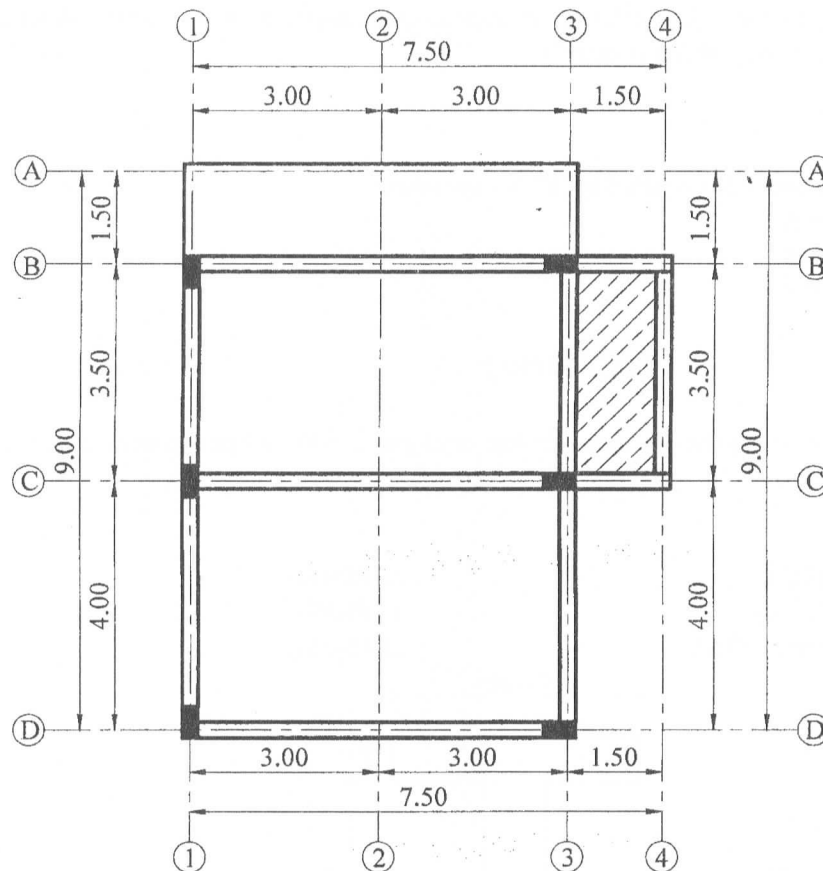


Fig. 2

Course Examination Committee

Prof. Dr. Abdel-Hakim Abdel-Khalik Khalil
Dr. Eng. Ahmed Taha Baraghith



Tanta University

Construction Engineering Program

Total Marks: 40 Marks



Faculty of Engineering

Course Title	Surveying	Final term Exam	Course Code	CEP 211
Date	23-01-2019	No. of Pages: 2	Allowed time	3 hours

أجب على جميع الأسئلة الآتية:

السؤال الأول (١٠ درجات):

أ- أذكر ما تعرفه عن كل من موضحاً إجابتك بالرسم الدقيق:

- وحدات قياس الزوايا (الدرجة الستينية والراديان الدائري والجراد المئوي) والعلاقة بينهم.
- زاوية الانحراف الرأسي وزاوية الاختلاف.
- المستوى الأفقي عند نقطة والسطح المستوي.
- العوامل التي يتوقف عليها اختيار مقياس الرسم المناسب لخريطة.
- أنواع ومزايا مقاييس الرسم التخطيطية عن أنواع المقاييس الأخرى. (٥ درجات)

ب- المطلوب تصميم ورسم مقياس رسم تخطيطي ١ : ١٦٠٠ يقرأ مباشرة على الخريطة إلى اقرب ٤,٠ قسبة - ثم بين عليه خطأ طوله ٣٨,٨ قسبة، ثم أفتح الفرجار على مسافة ٩,١ سم وشرح موضحاً بالرسم كيف يمكنك تعيين الطول المقابل لفتحة الفرجار في الطبيعة مستخدماً هذا المقياس. (٥ درجات)

السؤال الثاني (١٠ درجات):

أ- يراد مد خط كهرباء لإنشاء مدينة سكنية جديدة وتم تحديد المسافة الأفقية بين كل برجين متتاليين من خريطة بمقياس رسم ١ : ٢٥٠٠ فكانت مساوية ٣,٢ سم فإذا كانت الأرض الطبيعية منتظمة الانحدار بحيث أن فرق المنسوب بين نقطتي تثبيت الكابل فوق كل برجين متتاليين = ١٣,٨ متر وكان الترخيم في منتصف المسافة بين كل برجين متتاليين = ١٠,٦ متر أحسب نسبة الزيادة في طول الكابل الحقيقي بين كل برجين والذي يجب صرفه من المخازن. (٥ درجات)

ب- شريط طوله ٣٠ متر تمت معايرته وهو مستند على كامل طوله في درجة حرارة ٦٨ فهرنيت فوجد أن وزن الشريط = ١٥٠٠ جرام، وأن طوله الحقيقي = ٢٩,٧٤ متر فإذا استخدم هذا الشريط لقياس خط في درجة حرارة ٩٢ فهرنيت وكان الطول المقاس للخط هو ٣١٢,٣٤ متر وكان الشريط مرتكزاً عند طرفيه فقط لجميع طرحات القياس وكان الشد عليه مساوياً ١٥ كجم - أوجد الطول الصحيح للخط المقاس. (٥ درجات)

السؤال الثالث (١٠ درجات):

أخذت القراءات الآتية بالأمتار في ميزانية أجريت في موقع كوبري علوي وكانت كما يلي:

٢,٣٤ - ٣,٢٥ - ١,٧٨ - ٢,٢٦ - ١,٩٨ - ٢,٥٤ - ١,٩٢ - ٣,٤٤ - ٢,٣٣ - ٢,٦٨ - ٢,٥٨ - ٣,٣٤ - ٢,٥٦ - (س) - ١,٧٧

فإذا علمت أن منسوب النقطة الخامسة = ٤,٦٧ متر وأن الميزان نقل بعد القراءات الرابعة والسابعة والثانية

عشر، وأن النقطة السادسة مأخوذة أسفل كمره الكوبري العلوي والقامة مقلوبة فالمطلوب:

١- إيجاد مناسب النقط المختلفة في جدول ميزانية كامل.

٢- عمل جميع التحقيقات الحسابية.

٣- إيجاد مقدار القراءة (س) إذا علمت أن هذه القراءة عند نقطة منسوبها = ٥,١٧ متر.

٤- إيجاد انحدار سطح الأرض بين النقطتين الأولى و التاسعة إذا علمت أن المسافة بينهما تساوي ٢٠٠ متر.

السؤال الرابع (١٠ درجات):

أ- إذا علمت أن الانحراف الجغرافي للخط (أب) هو $٤٥^\circ ٨٨'$ ، وأن زاوية الاختلاف سنة ١٩٩٠ هي $٣٠^\circ ٩'$ غرباً، أوجد الانحراف المغناطيسي المختصر سنة ١٩٩٠ للخط (ب أ) وإذا كان معدل التغير في زاوية الاختلاف سنوياً هو $٤٥'$ شرقاً فما هو الانحراف المغناطيسي المختصر للخط (أب) في سنة ٢٠١٩. (٥ درجات)

ب- مضلع مقفل (أ ب ج د أ) رصدت أطوال أضلاعه بالشريط وانحرافاتهما بالبوصلة كما هو مبين بالجدول الآتي:

الانحراف	الطول	الخط
$٣٠^\circ ١٢٥'$	٦٤,٤٠ متر	أ ب
$٢٠^\circ ٤٥'$	٨١,٣٠ متر	ب ج
$٤٠^\circ ٣٢٨'$	٢٨,٢٠ متر	ج د

أحسب مركبات خطوط المضلع وإحداثيات نقط رؤوسه إذا علمت أن إحداثيات نقطه ب هي (١٠٠ م، ١٠٠ م) ثم

أوجد الطول والانحراف المختصر للمضلع أ د. (٥ درجات)



Course Title	Building Construction and City Planning	Midterm Exam	Course Code	ARE231
Date	19-01-2019	No. of Pages 2	Allowed time	3 hours

(12 Marks)**السؤال الأول:**

- أ- يتعامل التخطيط العمراني مع مستويات تخطيطية وفراغية مختلفة ، أذكر تلك المستويات التخطيطية مع توضيح كيفية الاستفادة من كل مستوى تخطيطي؟ (4.0 Marks)
- ب- ترجع البدايات الأولى في تخطيط المدن للعمارة الفرعونية فقد ظهرت عدة أنماط للمدن، ماهي الأنماط المختلفة للمدن الفرعونية؟ (4.0 Marks)
- ج- ماهي وسائل الحصول على البيانات في نظم المعلومات الجغرافية؟ وماهي أهميتها؟ (4.0 Marks)

(10 Marks)**السؤال الثاني:**

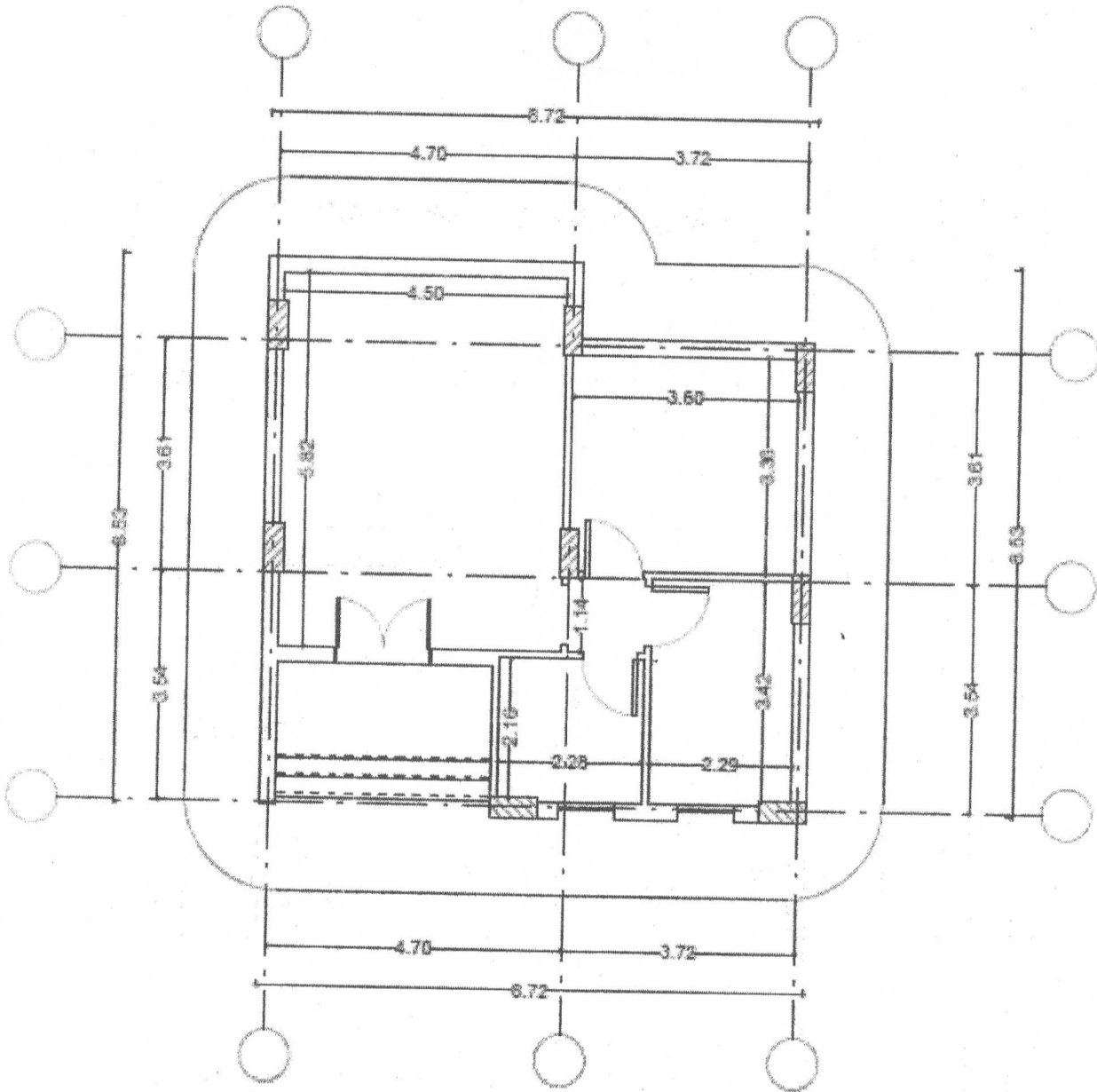
- أ- مرحلة الرسومات التنفيذية وإعداد المستندات واحدة من أحد مراحل إنشاء المبنى، اذكر أسماء اللوحات الهندسية التي تشتمل عليها هذه المرحلة؟ (4.0 Mark)
- ب- اشرح طريقة سبق التجهيز كأحد نظم الإنشاء المتطورة؟ (2.0 Mark)
- ج- اذكر بدون شرح أنواع الأسقف؟ (2.0 Mark)
- د- عرف كلاً من: (شناوي - ترويسة - فانوس السلم - بئر السلم) (2.0 Mark)

(8 Marks)**السؤال الثالث:**

- أ- أذكر بدون شرح أنواع الأساسات السطحية (shallow foundation)؟ (2.0 Mark)
- ب- اذكر الفكرة الإنشائية (فكرة العمل) لكل من : طريقة الأسقف المفرغة وطريقة البلاطات المرفوعة (2.0 Marks)
- أ- ارسم مدماكين لركن حائط سمك طوية ونصف بطريقة الرباط الإنجليزي بمقياس رسم (١ : ٢٠) (4.0 Marks)

(10 Marks)**السؤال الرابع:**

- المطلوب رسم المسقط الأفقي التالي مع توضيح كافة المناسيب والأبعاد والمحاور والعناصر الإنشائية علماً منسوب أرضية الدور الأرضي (+ ٠,٤٥) وذلك بمقياس رسم (١ : ٥٠).



End of questions Best Wishes

Dr. azza sobhi el sakka

Dr. marwa ahmed kammer eldawla



Course Title	Soil Mechanics	Final Exam	Course Code	CES211
Date	3 January 2019	No. of Pages	Allowed time	Three Hours

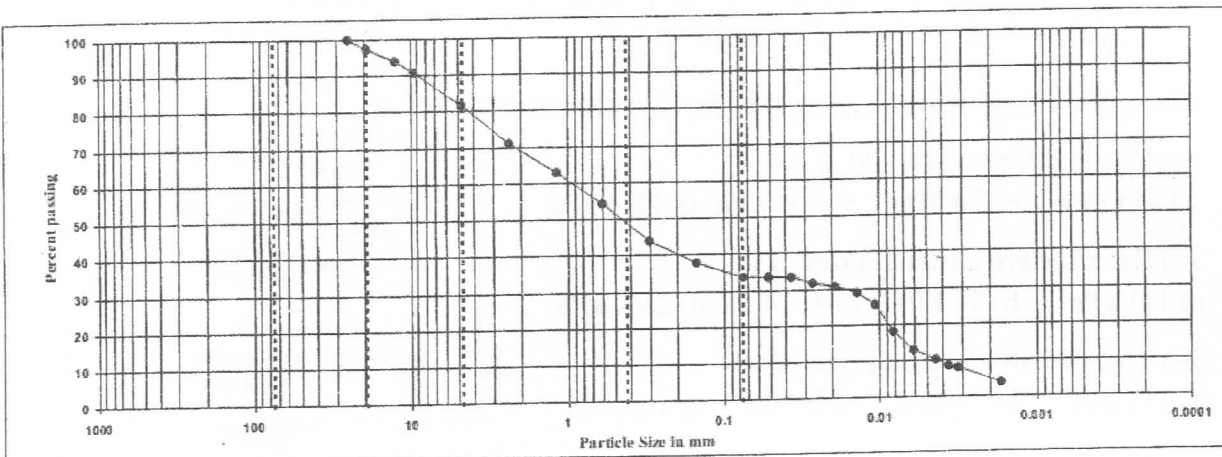
- ❖ Carefully follow the instructions written in the Electronic Answer Form.
- ❖ This question paper must be submitted with your answer form.
- ❖ Don't write your name on the question paper.

Question Number (1) (30 Marks)

Choose the correct answer using the submitted electronic form:

Consider the following Figure for the questions Below

The following is the grain size distribution of soil sample from New Administrative Capital:



- 1) The percentage of Gravel in the sample (USCS)
 - a) 18% b) 48% c) 34% d) 4%
- 2) The percentage of Sand in the sample (USCS)
 - a) 18% b) 48% c) 34% d) 4%
- 3) The percentage of Fines in the sample (USCS)
 - a) 48% b) 34% c) 30% d) 4%
- 4) The percentage of Silt in the sample (USCS)
 - b) 48% b) 34% c) 30% d) 4%
- 5) The percentage of Clay in the sample (USCS)
 - c) 48% b) 34% c) 30% d) 4%
- 6) The classification of soil Sample can be:
 - a) Silty Gravel with Sand
 - b) Clayey Gravel with Sand
 - c) Silty Sand with Gravel
 - d) Clayey Sand with Gravel



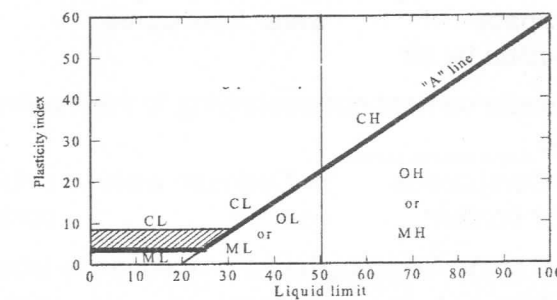
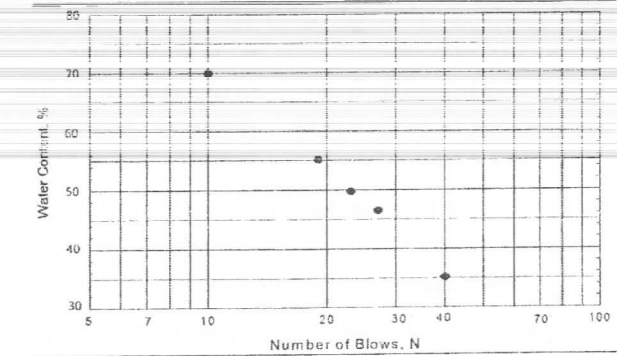
- 7) The percentage of Gravel in the sample (MIT Classification)
 - b) 31% b) 35% c) 34% d) 18%

Consider the following Figure for the questions below

The Atterberg Limits results of soil sample from the Casagrande Cup and Plasticity tests are given.

Two determinations for the plastic limit gave water contents of 20.3% and 20.8%

- 8) The liquid limit of the sample is
 - a) 38% b) 48% c) 32.5% d) 20.5%
- 9) The Plastic limit of the sample is
 - a) 38% b) 48% c) 32.5% d) 20.5%
- 10) The Plasticity Index of the sample is
 - a) 27.5% b) 17.5% c) 35% d) 20.5%
- 11) The Liquidity Index of the sample if the natural water content is 27.5 % is
 - a) 0.394 b) 0.605 c) 0.745 d) 0.254
- 12) The Consistency Index of the sample if the natural water content is 27.5 % is
 - a) 0.394 b) 0.605 c) 0.745 d) 0.254
- 13) The classification of the soil according to the Unified Soil Classification System
 - a) CL b) ML c) OL d) MH
- 14) The soil is classified as
 - a) Clay
 - b) Silt
 - c) Sand
 - d) Gravel



Consider the following data for the questions below

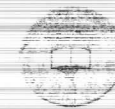
15) A sand sample has $w = 25\%$, total unit weight is 19 kN/m^3 , and $G_s = 2.7$.

The void ratio of the sample is

- a) 0.778 b) 0.60 c) 0.56 d) 0.85
- 16) If the void ratios corresponding to densest and loosest states of the sand are 0.55 and 0.91, respectively, the relative density of the sand is
- a) 36.67% b) 86.11% c) 97.22% d) 16.67%
- 17) The degree of saturation of the sand is
- a) 86.8% b) 112.5% c) 120.5% d) 79.4%

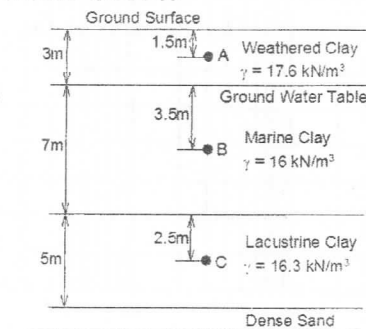


- 18) The angle to the horizontal at which the soil is expected to stay in the absence of any lateral support, is known as:
- a-) The ϕ angle b- The angle of repose c- The angle of internal friction d- All of these
- 19) The shear strength of a soil
- a-) is directly proportional to the degree of saturation of the soil b- is inverse proportional to the angle of internal friction of the soil c- Decreases with increase in normal stress d- Decreases with decrease in normal stress
- 20) The angle of internal friction, is maximum for
- a-) Angular-grained loose sand b- Angular -grained dense sand c- Round-grained loose sand d- Clays
- 21) Pick up the correct statement from the following:
- a-) The plastic limit is the smallest water content at which the soil is plastic b- The ratio of the natural water content minus the plastic limit to the plasticity index of soils, is called plasticity index c- The ratio of natural water content minus its plastic limit to its plasticity index is called liquidity index d- All of these
- 22) The density of soil can be increased
- a-) By reducing the space occupied by air b- By expelling water from pores c- All of these d- None of these
- 23) The water content corresponding to the maximum density in compaction curve is called _____
- a-) Compaction water content b- Optimum water content c- Ultimate water content d- Maximum water content
- 24) Which of the following test are used in the laboratory, for compaction?
- a-) Core cutter test b- Standard proctor test c- Sand cone test d- All of the mentioned
- 25) At low water content values, the compacted dry density is increased when the water content of the soil is _____
- a-) Increased b- Decreased c- Constant d- None of the mentioned
- 26) Higher density at a lower optimum water content is easily achieved by _____
- a-) Coarse grained soil b- Fine grained soil c- Cohesion less soil d- Saturated soil
- 27) Water content of soil can
- a-) Never be greater than 100 % b- Take values only from 0 % to 100 % c- Be less than 0 % d- Be greater than 100 %



- 28) Which of the following is a measure of particle size range?
- a-) Effective size b- Uniformity coefficient c- Coefficient of curvature d- None of these
- 29) A cohesive soil yields a maximum dry density of 1.8 gm/cm^3 at an OMC of 16 % during a standard proctor test. What will be its degree of saturation? (Take $G_s = 2.65$)
- a-) 100 % b- 60.45 % c- 89.79 % d- None of these
- 30) If the plasticity index of a soil mass is zero, the soil is
- a-) Sand b- Silt c- Clay d- Clayey silt
- 31) Inorganic silt with low compressibility are represented by
- a-) MH b- SL c- ML d- CH
- 32) Coarse grained soils are best compacted by a
- a-) Smooth roller b- Pneumatic tyre roller c- Sheep's foot roller d- Vibratory roller
- 33) The coefficient of curvature for a well graded soil, must be between
- a-) 0.5 to 1.0 b- 1.0 to 3.0 c- 3.0 to 4.0 d- 4.0 to 6.0

Consider the following Figure for the questions below



- 34) The total Stress at Point A is
- a) 111 kPa b) 74 kPa c) 101 kPa d) 26.4 kPa
- 35) The effective stress at Point B is
- a) 111 kPa b) 74 kPa c) 101 kPa d) 26.4 kPa
- 36) The effective stress at point C is
- a) 111 kPa b) 74 kPa c) 101 kPa d) 206 kPa
- 37) Applying an effective stress on soil
- a) Increases voids ratio and decreases permeability b) Increases both voids ratio and permeability c) Decreases both voids ratio and permeability d) Decreases voids ratio and increases permeability
- 38) Which one of the following clays behaves like a dense sand?
- a- Over-consolidated clay with a high over-consolidation ratio b- Over-consolidated clay with a low over-consolidation ratio c- Normally consolidated clay d- Under-consolidated clay
- 39) If the void ratio of a soil sample decreases from 1.50 to 1.25 when the pressure is increased from 25 t/m^2 to 50 t/m^2 , the coefficient of compressibility is
- a- 0.01 b- 0.02 c- 0.05 d- 0.001

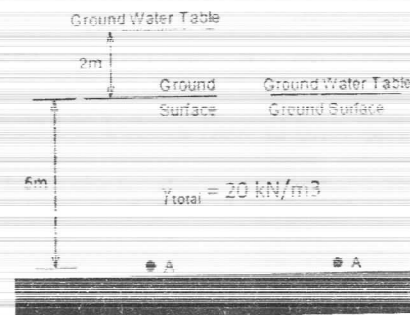


Consider the following Figure for the questions below

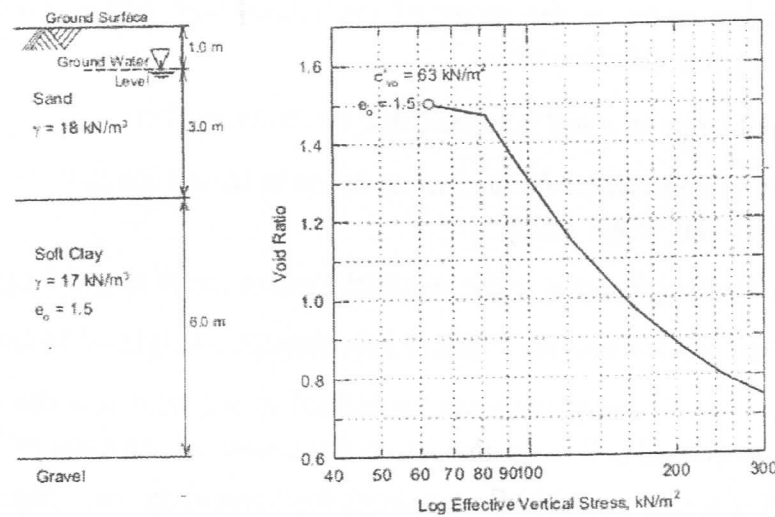
- 40) The change in effective stress from case I to case II at point A is
a) +20 kPa b) 0 kPa c) -20 kPa d) +40 kPa

- 41) The change in water pressure from case I to case II at point A is
a) +20 kPa b) 0 kPa c) -20 kPa d) +40 kPa

- 42) The change in total stress from case I to case II at point A is
a) +20 kPa b) 0 kPa c) -20 kPa d) +40 kPa



Consider the following Figure for the questions below - the void ratio versus log effective vertical stress belongs to point at mid-depth of the soft clay layer



- 43) The clay above is
a) Normally Consolidated b) Over Consolidated
c) Under Consolidated d) None of the above
- 44) The effective overburden pressure at mid depth of the clay layer is
a) 63 kPa b) 82 kPa c) 100 kPa d) 200 kPa
- 45) The preconsolidation pressure, σ'_p of the clay test in the figure is
a) 63 kPa b) 82 kPa c) 100 kPa d) 200 kPa
- 46) The over consolidation ratio, OCR, of the clay is
a) 1.0 b) 1.3 c) 0.8 d) 3.2
- 47) Considering the Figure above, the re-compression index of the clay is
a) 0.22 b) 0.10 c) 0.15 d) 0.5



- 48) If the ground water table was permanently lowered to the top of the soft clay layer (lowered by 1.5m) then the final effective stress at mid depth of the clay layer in the figure above is :
a) 163 kPa b) 78 kPa c) 15 kPa d) 200 kPa

- 49) Considering the final effective stress in the question before, then the soil is said to be in the range of
a) re-compression b) compression c) under-compression d) no-compression

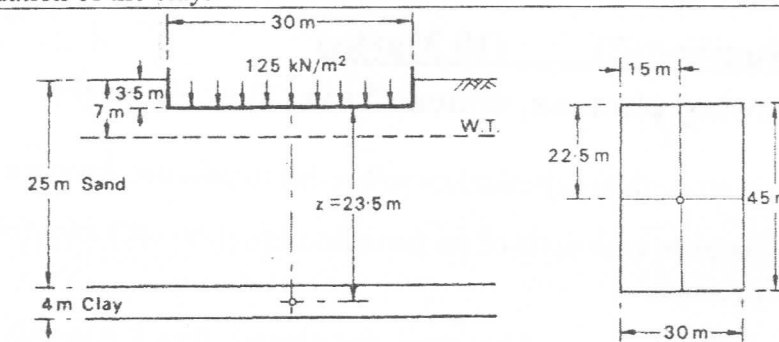
- 50) Considering the final effective stress, then the void ratio after the increase in the effective stress is
a) 1.5 b) 0.95 c) 1.48 d) 1.3

- 51) Considering the final effective stress, then the vertical strain due to the increase in the effective stress is
a) 60% b) 0.8% c) 22% d) 1.5%

- 52) The surface settlement of the clay layer due to end of primary consolidation
a) 360 cm b) 5 cm c) 132 cm d) 9 cm

Consider the following Figure for the questions (53 to 55) below

A building is supported on a raft 45x30m, the net foundation pressure (assumed to be uniformly distributed) being 125kN/m². The soil profile is as shown in Figure below. The value of m_v for the clay is 0.35m²/MN. Determine The final settlement under the centre of the raft due to End Of Primary consolidation of the clay.



- 53) The increase in the effective vertical stress at mid depth of the clay layer (using the approximate method) is
a) 125 kPa b) 100 kPa c) 75 kPa d) 45 kPa
- 54) The final settlement under the centre of the raft due to End of Primary consolidation of the clay is
a) 175 mm b) 140 mm c) 105 mm d) 65 mm
- 55) If there is a gravel under the clay layer in the Figure above then, the maximum drainage distance in the clay layer
a) 4 m b) 2 m c) 1 m d) 23.5 m



- 56) The ratio of settlement at any time 't' to the final settlement, is known as
 a-) Co-efficient of consolidation b- Degree of consolidation c- Consolidation index d- Consolidation of undisturbed soil
- 57) Clay Layer "A" with a single drainage and coefficient of consolidation c_v takes 6 months to achieve 50% consolidation. The time taken by clay layer "B" of the same thickness with double drainage and coefficient of consolidation $c_v/2$ to achieve the same degree of consolidation is
 a-) 3 months b- 6 months c- 12 months d- 24 months
- 58) If the unconfined compressive strength of clay sample is 50 kPa, then the undrained shear strength is
 a- 60 kPa b- 30 kPa c- 100 kPa d- 25 kPa
- 59) The normal stresses acting on planes of a soil sample in the triaxial test are known as _____
 a- Major principal stresses b- Principal stresses c- Minor principal stresses d- Principal planes
- 60) In the standard penetration test, the dropped hammer
 a- weights 62.5 kg and drops from a height of 76 cm b- weights 76 kg and drops from a height of 62.5 cm c- weights 62.5 kg and drops from a height of 67 cm d- None of the above

Question Number (2) (10 Marks)

For the following phrases, choose True (T) or False (F):

- The shear strength in cohesionless soil is due to cohesion between particles.
- A soil specimen with most of the particles have size in the range of 0.5 to 0.9 mm is a gravel specimen.
- If a fine-grained specimen has a low dry strength, then it is mostly clay.
- If a fine-grained specimen reaction to a shaking test is very slow, then it is clay.
- Organic soil and Peat has dark color and very bad smell.
- The fines content is the percentage of soil passing sieve # 200.
- The soil is said to be in a semi-solid state if the water content of the soil is between the liquid and the plastic limits.
- Effective size is D_{30} .



- If the liquidity index of a soil is greater than 1, then the soil is classified as soft to very soft.
- The soil is classified as clay if it plots below the A-line on the plasticity chart.
- The sand is well graded if $1 < CC < 3$ and if $CU < 6$
- The gravel is poorly graded if $1 < CC < 3$ and if $CU > 6$
- Terzaghi theory of consolidation is concerned with the time rate of settlement
- The unconfined compressive strength test is used for sandy soil.
- The field vane shear test is used to determine the compressibility of clay.
- If the maximum value of effective stress in the past divided by the present value is defined as over consolidation ratio (OCR), then the OCR of an over consolidated clay is 1.0.
- The compression index is the slope of the relationship between void ratio and logarithm of vertical effective stress.
- Major principal stress in a soil is represented by the symbol σ_1
- Consolidation of soil can be defined as an increase in soil density by squeezing out the water from voids of the soil.
- The weight of falling hammer in the standard Proctor test is only 2.5 kg.
- In the modified proctor test, the hammer falls through a height of 54 cm.
- The efficiency of soil compaction can be defined as the ratio between the field bulk density of a compacted soil to the maximum dry density of the same soil.
- The sand cone test can be used for evaluating the compaction of cohesive soil.
- The modified proctor test consists of compacting soil in five equal layers, each layer given 25 blows of hammer.

If a series of Direct Shear Box tests were run to determine the shear strength parameters of a soil. The tests results are:

Test No.	Normal Stress σ'_n (kN/m ²)	Shear Stress at Failure τ (kN/m ²)
1	50	56
2	100	90
3	200	157

- According to the above table, the angle of internal friction for the soil is 34 degrees.
- According to the above table, the cohesion of the soil is 32 kN/m².



27) If the tested soil (according to the above table) has a bulk density of 17.5 kN/m^3 and is located at a depth of 6 m below the ground surface and the water table is 2.0 m below the ground surface, then the shear strength of the soil at this position is 100 kN/m^2 .

For the following three phrases (No. 28 to 30), results of a compaction test are given in the following Table. If the minimum allowed degree of compaction is 95%, then;

Moisture content (%)	6.2	8.1	9.8	11.5	12.3	13.2
Bulk density (t/m^3)	1.69	18.7	19.5	20.5	20.4	20.1

28) The maximum dry density is 1.84 t/m^3 .

29) Assuming that the in-situ compaction is carried out using the same energy used in the laboratory test, then the range of water content which can be applied in the field shall be between 8.5 to 9.5 % for a relative compaction of 95%.

30) If the specific gravity of the soil is 2.70 then the degree of saturation at the maximum dry density is 71%.

Question Number (3) (3 Marks)

Answer the following in your answer book

- a) Describe using only clear sketches with full details, the different components of :
 - i. The direct shear apparatus.
 - ii. The triaxial apparatus.

Given the U-T relationship

U(t) %	T	U(t) %	T
0	0	60	0.286
10	0.008	70	0.403
20	0.031	80	0.567
30	0.071	90	0.848
40	0.126	95	1.129
50	0.197		

End of questions Best Wishes

Prof. Dr. Marawan Shahien

Dr. Ahmed farouk