

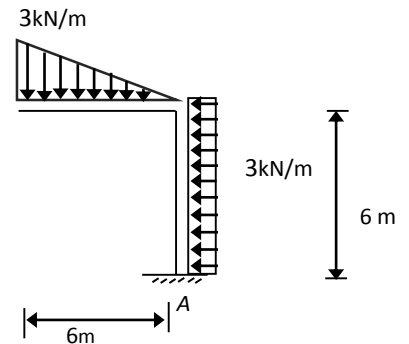


## الأنشآت وتصاميم الخرسانة المسلحة (35%)

### Q1) Choose the correct answer (2 marks for each branch)

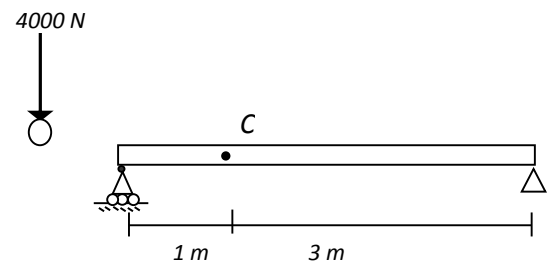
1] The reaction moment in point A ( $M_A$ ) for the frame shown in below is:

- a) 66 kN.m    b) 106 kN.m    c) 90 kN.m    d) 134 kN.m



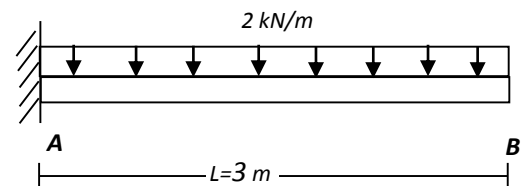
2] The maximum positive shear that can be developed at point C in the beam shown in figure below due to a concentrated moving load of 4000 N is:

- a) 2000 N    b) 3000 N    c) 4000 N    d) 1000 N



3] Using the “virtual work” method, the slop at point “B”  $\theta_B$  for the beam in figure below is: (EI constant)

- a)  $3 \text{ kN.m}^2/EI$                       b)  $6 \text{ kN.m}^2/EI$   
c)  $2 \text{ kN.m}^2/EI$                       c)  $9 \text{ kN.m}^2/EI$



4] The following member can resist a bending moment:

- a) a frame member                      b) a truss member                      c) both

5] The principle of **Force-method** (or consistent deformation method) to analyze the **indeterminate** structures is depending on assumption:

- a) **removing** the extra restraints (or redundant reactions) to make the structure is statically determinate.  
b) assuming a **virtual unit load** applied on the point of the required deformation.  
c) the **moment-area** theorems which depend on the calculating the area under moment diagram of the structure.



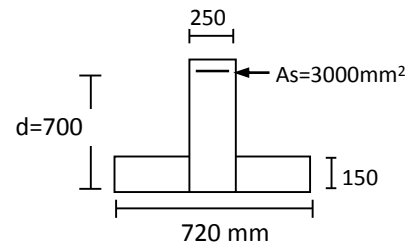
**Q2) Choose the correct answer (1 mark for each branch)**

- 1] The main method to solve and analysis of two way reinforced concrete slabs is:
- a) *Slope deflection*      b) *Area moment*      c) *Yield lines*      d) *Finite difference*
- 2] A reinforced concrete corbel is always designed as a:
- a) *One- way slab*      b) *Simply supported beam*      c) *Short cantilever*      d) *Long cantilever beam*
- 3] For a one-way reinforced concrete slab supported on long edges, the failure cracks formed:
- a) *At mid- span, parallel the short edge.*      b) *At mid-span, parallel the Long edge.*  
c) *At mid-span, parallel to both edges.*      d) *At 45°, diagonal direction with short edge.*
- 4] For a reinforced concrete circular fixed supported edge slab of (R) radius, under a single load (P) at center, the maximum negative bending moment occurs at:
- a) *(1/2)R*      b) *Edge*      c) *Center*      d) *(1/4)R*
- 5] The (  $f_t$  ) represent a :
- a) *Modulus of rupture*      b) *Tensile strength of steel*  
c) *Compressive strength of concrete*      d) *Splitting strength of concrete*
- 6] A steel solid shaft of radius (R= 25mm) and length (L=1m) is under applied torque (T= 10 kN.m), thus the angle of twist is:
- a)  $\theta = 4/GJ$       b)  $\theta = 10/GJ$       c)  $\theta = 1/GJ$       d)  $\theta = 15/GJ$
- 7] For a two ended fixed supported beam under a triangular load, how many plastic hinges will be needed to solve it:
- a) *Two P.H.*      b) *Three P.H.*      c) *One P.H.*      d) *Not needed*
- 8] The main principle of "**working stress**" method in analysis and design of R.C structures is:
- a) *Magnification (increasing) the applied loads.*  
b) *Reducing the used material strength*  
c) *Both of them*
- 9] If the section has stirrups of (UU) shape of diameters  $\Phi$  12mm, then the steel area resists the shear strength is:
- a)  $113mm^2$       b)  $226 mm^2$       c)  $452 mm^2$       d)  $339.12 mm^2$
- 10] A beam section with dimension (300\*300mm) &  $f'_c=22$  MPa , the torsion moment that cause crack in the section.
- a)  $10.55 kN.m$       b)  $22.34 kN.m$       c)  $31.66 kN.m$       d)  $34.78 kN.m$

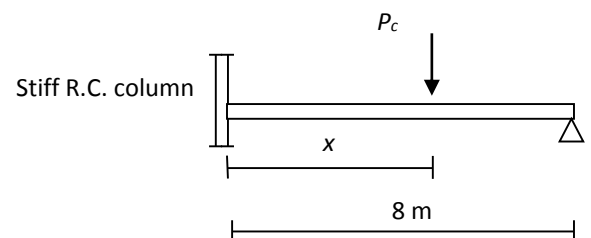


**Q3) Answer the following questions (2.5 marks for each branch)**

a] Check (by computation) if the under reinforcement beam of the section shown for figure below treated as T-section or rectangular section, let  $f'_c=20\text{MPa}$  ,  $f_y= 400 \text{ MPa}$ ,



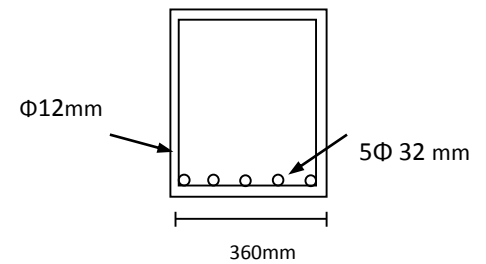
b] For the beam shown in figure below, locate the plastic hinges and determine the maximum collapse load  $P_c$  that cause cracking and failure of the beam, and find  $x$  – distance. Assume ( $M^-_{max} = 40 \text{ kN.m}$  and  $M^+_{max} = 30 \text{ kN.m}$ ).



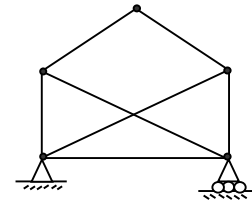


c] Check if the spacing ( $S$ ) between main bars shown in figure below achieves the ACI-code requirements or not.

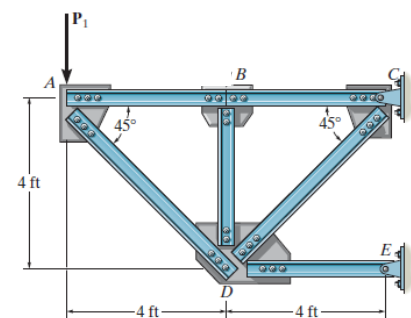
Let clear cover = 40mm.



d] Determine the state of determinacy of the truss in figure below:

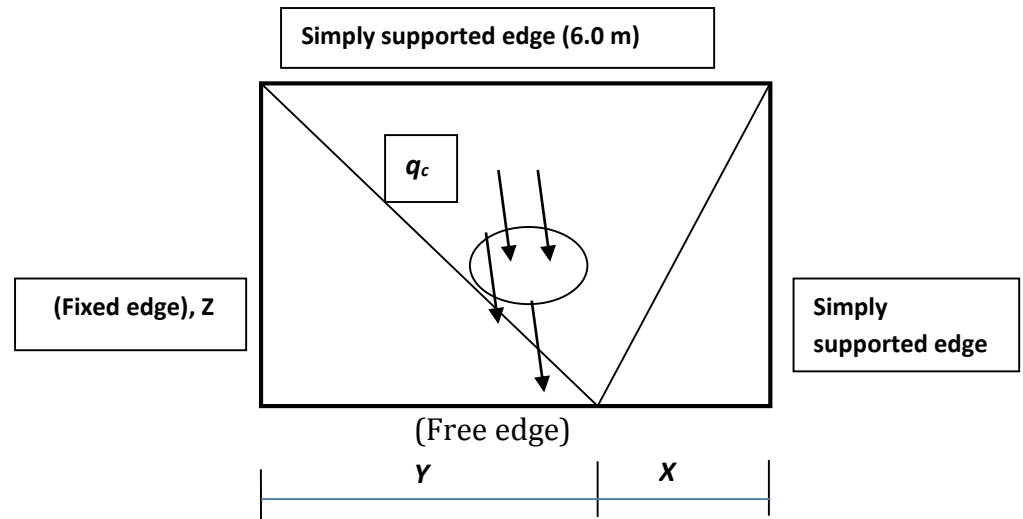


e] Find the force in the member (AB) for the statically determinate truss shown in figure below, Let  $P_1=800$  lb





f] A rectangular reinforced concrete slab with details as shown in figure below. The slab thickness is (150 mm) , the effective cover is (30 mm) , for concrete  $f'_c = 28 \text{ MPa}$  , for steel ;  $f_y = 350 \text{ MPa}$  ,  $A_s (\text{neg.}) = \phi 12 @ 200 \text{ mm} + \phi 12 \text{ mm} @ 400 \text{ mm}$  (added) ,  $M_u^+ = 20.5 \text{ kN.m/m}$  . Find  $x$  ,  $y$  ,  $z$  and  $q_c$  . (solve by equilibrium method ) .





**ميكانيك التربة و هندسة الاساسات (35%)**

**Q1) Choice the correct answer of the following (2 marks for each branch):**

1] The Oedometer test is used to determine:

- a) *Shear strength of soil*                      b) *Consolidation properties*  
b) *Coefficient of uniformity*                      d) *Coefficient of permeability*

2] For steel building has 3 stories, the depth of boring holes should be:

- a) *3m*                      b) *5m*                      c) *7m*                      d) *9m*

3] From the particle size destitution curve, if  $D_{10}=0.36\text{mm}$ ,  $D_{30}=2.35\text{mm}$ ,  $D_{60}=4.8\text{mm}$ , the coefficient of uniformity is:

- a) *13.3*                      b) *6.5*                      c) *2.04*                      d) *11.28*

4] In the field can be fined undrained shear strength from:

- a) *SPT test*                      b) *CBR test*                      c) *CPT test*                      d) *Plate-load test*

5] Foundation engineer has decided to use the pile's foundation if the:

- a)  *$D > B$*                       b)  *$D > 2B$*                       c)  *$D > 4B$*                       d)  *$D > 6B$*

6] To calculate bearing capacity of surface footing under vertical load on cohesionless soil use the following expression :-

- a)  *$cNc$*                       b)  *$qNq$*                       c)  *$0.5 \gamma BN\gamma$*                       d)  *$cNc + 0.33 \gamma BN\gamma$*

7] What is countered in the SPT test?

- a)  *$c$*                       b)  *$\emptyset$*                       d)  *$N$*                       d)  *$e$*

8] A concrete building with  $L=20\text{m}$ ,  $B=30\text{m}$ , for soil investigation, the No. of boring holes required, are:

- a) *3*                      b) *4*                      c) *5*                      d) *6*

9] If excavation is being carried out in a soil with porosity ( $n$ ) = 0.35, and grain specific gravity  $G_s= 2.65$ , the critical hydraulic gradient is:

- a) *1*                      b) *1.072*                      c) *0.927*                      d) *1.245*

10] During a field density test, if 1850g of soil was excavated from a hole has a volume of  $900\text{cm}^3$  and the oven dried mass of the soil was 1630g. The moisture content is:

- a) *13.5%*                      b) *22.2%*                      c) *10.66%*                      d) *8.67%*



**Q2) Answer the following equations (3 marks for each branch):**

a] A square footing is  $1.5\text{m} \times 1.5\text{m}$ , the soil is supporting the footing has  $\phi = 20^\circ$ ,  $c = 15.2 \text{ kN/m}^2$ ,  $\gamma = 17.8 \text{ kN/m}^3$ . Determine the allowable bearing capacity with factor of safety equals to 4? Assume the depth of footing is one meter. ( $N_C=17.69$ ,  $N_q=7.44$ ,  $N_\gamma=3.64$ )

b] Determine the width (B) of rectangular footing ( $L=3\text{m}$ ) carries vertical load of 660 kN on the soil has an ultimate bearing capacity of  $300 \text{ kN/m}^2$ , use a factor of safety equals to 3.

c] The total settlement of clayey layer equal to 130mm occurred after 2 years, while the settlement occurred after 6 month equal to 90mm . What is the degree of consolidation after 6 month? (assume  $H = 8\text{m}$ ,  $m_v = 40 \times 10^{-6} \text{ m}^2/\text{kN}$ ).



d] The soil behinds the vertical back of retaining wall 9m high, consist of soft clay ( $c=10$  kN/m<sup>2</sup>,  $\phi=20^\circ$ ,  $\gamma=15.7$  kN/m<sup>3</sup>). Determine the total active pressure on the wall.

e] For square footing (2m\*2m) carries vertical load 400kN, what is the increase in vertical stress due to load at point on the depth 2m? (use 2:1 method)





## تكنولوجيا الخرسانة (10%)

### السؤال الاول: ضع دائرة حول الاجابة الصحيحة (1 درجة لكل فرع)

1. عند صب أساس في تربة غنية بأملاح الكبريتات باستخدام السمنت العادي، يراعى مايلي:  
أ. زيادة محتوى السمنت في المتر المكعب.  
ب. زيادة نفاذية الخرسانة.  
ج. طلاء الخرسانة بالاصباغ الدهنية.  
د. عدم مراعاة اي من الخيارات اعلاه.
2. سمنت له نفس التركيب الكيميائي تماماً، أي من الاجابات التالية صحيحة لغرض استخدامه لصب جدار يراد رفع القالب منه باسرع مايمكن؟  
أ. نو نعومة 5000 سم<sup>2</sup>/غم.  
ب. نو نعومة 2000 سم<sup>2</sup>/غم.  
ج. نو نعومة 3000 سم<sup>2</sup>/غم.  
د. نو نعومة 4000 سم<sup>2</sup>/غم.
3. سمنت متحجر نتيجة امتصاصه كمية كبيرة من الرطوبة، ماهو الاجراء الصحيح قبل استخدامه؟  
أ. حرقه للتخلص من الرطوبة.  
ب. طحن السمنت.  
ج. عدم استخدامه اطلاقاً.  
د. عدم اجراء اي من الخيارات اعلاه.
4. ماهو تأثير املاح الكلوريدات على الخرسانة؟  
أ. تسبب تآكل التربة المحيطة بالخرسانة.  
ب. تسبب تآكل الخرسانة.  
ج. تسبب تآكل حديد التسليح.  
د. لا تسبب اي تأثير يذكر.
5. كم تكافئ مقاومة انضغاط مقدارها 300 باوند/انج<sup>2</sup> بوحدات نت/ملم<sup>2</sup>؟  
أ. 25 نت/ملم<sup>2</sup>.  
ب. 30 نت/ملم<sup>2</sup>.  
ج. 35 نت/ملم<sup>2</sup>.  
د. 21 نت/ملم<sup>2</sup>.
6. أعطى فحص لباب خرساني بابعاد 10 سم (قطر) × 20 سم (ارتفاع) نتيجة مقدارها 35 نت/ملم<sup>2</sup>، ماهو مقدار نتيجة الفحص وهل تعد ناجحة اذا كانت المقاومة التصميمية المطلوبة للمكعب 50 نت/ملم<sup>2</sup>؟  
أ. 20 نت/ملم<sup>2</sup>.  
ب. 25 نت/ملم<sup>2</sup>.  
ج. 30 نت/ملم<sup>2</sup>.  
د. 51.4 نت/ملم<sup>2</sup>.



السؤال الثاني: اجب عن الاسئلة التالية (1 درجة لكل فرع)

أ) هل يؤدي غسل الرمال بالماء الى تخليصها من املاح الكبريتات ولماذا؟

ب) لماذا توجد محاذير من استخدام مادة كلوريد الكالسيوم كمادة مضافة للخرسانة؟

ج) أذكر اثنين من الفحوصات اللا اتلافية للخرسانة.

د) أيهما يعطي نتيجة أعلى فحص الشد المباشر أم فحص معايير الكسر للخرسانة؟



**مقاومة المواد (10%)**

Q1: Choose the correct answer (1 mark for each branch):

1] Stress Transformation Equation is:

a)  $\sigma_{x'} = \frac{\sigma_x - \sigma_y}{2} + \frac{\sigma_x + \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta$

b)  $\sigma_{x'} = \frac{\sigma_x - \sigma_y}{2} + \frac{\sigma_x + \sigma_y}{2} \sin 2\theta + \tau_{xy} \cos 2\theta$

c)  $\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta$

d)  $\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \sin 2\theta + \tau_{xy} \cos 2\theta$

2] Generalized Hooke's law is:

a)  $\epsilon_x = \frac{1}{E} [\sigma_y - \nu(\sigma_x + \sigma_z)]$

b)  $\epsilon_y = \frac{1}{E} [\sigma_y - \nu(\sigma_x + \sigma_z)]$

b) c)  $\epsilon_z = \frac{1}{E} [\sigma_y - \nu(\sigma_x + \sigma_z)]$

d) None of above

3] For Principal Stress:

a)  $\tan 2\theta_p = \frac{\tau_{xy}}{(\sigma_x - \sigma_y)/2}$

b)  $\tan 2\theta_p = \frac{\tau_{xy}}{(\sigma_x + \sigma_y)/2}$

c)  $\tan 2\theta_p = \frac{\tau_{xy}}{(\sigma_x - \sigma_y)}$

d)  $\tan 2\theta_p = \frac{\tau_{xy}}{(\sigma_x + \sigma_y)}$

4] For Circular Area:

a)  $I_x = \frac{1}{2} \pi r^4$

b)  $I_x = \frac{1}{4} \pi r^4$

c)  $I_x = \frac{1}{6} \pi r^4$

d)  $I_x = \frac{1}{8} \pi r^4$

5] In conjugate-beam method to find the beam deflection the actual slope is equal to:

a) The fictitious shear

b) The fictitious moment

c) The fictitious load

d) The fictitious deflection



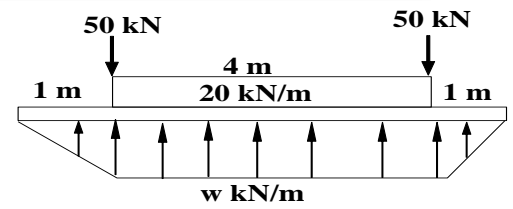
6] For beam loaded as shown in the figure, the value of  $w$  is:

a)  $20 \text{ kN/m}$

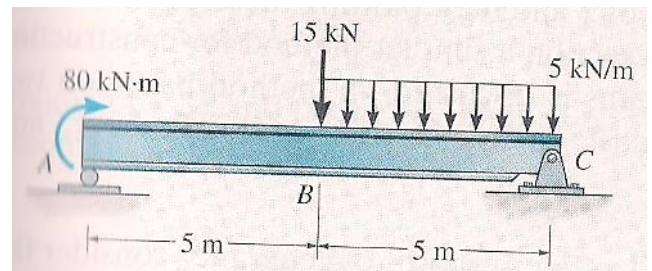
b)  $24 \text{ kN/m}$

c)  $30 \text{ kN/m}$

d)  $36 \text{ kN/m}$



Q2: Draw the shear and moment diagram for the beam shown (4 marks):





**التحليلات الهندسية (%10)**

Q1: Choose the correct answer (1 mark for each branch):

1] The solution of,  $\frac{d^4 y}{dx^4} = y$  is:

a)  $y = ae^x + be^{-x} + cxe^x + dxe^{-x}$

b)  $y = ae^x + be^{-x} + c \cos x + d \sin x$

c)  $y = a \cos x + b \sin x + cx \cos x + dx \sin x$

d) None of above

2] Euler's Formula is:

a)  $e^{i\theta} = \cos \theta + i \sin \theta$

b)  $e^{i\theta} = \cos \theta - i \sin \theta$

c)  $e^{i\theta} = \sin \theta + i \cos \theta$

d)  $e^{i\theta} = \sin \theta - i \cos \theta$

3] If A and B, are matrices, then  $(AB)^T$  is equal:

a)  $A^T B^T$

b)  $(BA)^T$

c)  $B^T A^T$

d)  $\left(\frac{B}{A}\right)^T$

4] The result of  $\int_0^{2\pi} \sin^2 nx dx$  is equal to:

a) zero

b)  $\frac{\pi}{2}$

c)  $\pi$

d)  $2\pi$

5] The complex form exponential form of Fourier series is:

a)  $f(t) = \sum_0^{\infty} C_n e^{ni\pi \frac{t}{p}}$

b)  $f(t) = \sum_0^{\infty} C_n e^{-ni\pi \frac{t}{p}}$

c)  $f(t) = \sum_{-\infty}^{\infty} C_n e^{ni\pi \frac{t}{p}}$

d)  $f(t) = \sum_{-\infty}^{\infty} C_n e^{-ni\pi \frac{t}{p}}$

6] The Laplace transformation of  $t^n$  is;

a)  $\frac{(n+1)!}{s^n}$

b)  $\frac{n!}{s^n}$

c)  $\frac{(n+1)!}{s^{n+1}}$

d)  $\frac{n!}{s^{n+1}}$



Q2: Solve the following PDE (4 marks):

$$\frac{\partial^2 z}{\partial x \partial y} = \frac{1}{x+y} \quad \text{given that} \quad z = y \ln y \quad \text{and} \quad \frac{\partial z}{\partial y} = 1 + \ln y \quad \text{when } x = 0$$



