الجامعة التكنولوجية

قسم هندسة البناء والإنشاءات

المرحلة الأولى

العـدد : ٤٨ م

التاريخ : ١٩ /٥/ 2016

الى / السيد معاون رئيس القسم

م/ الاجابة النموذجية لمادة (تكنولوجيا مواد البناء 2)

تحية طيبة .....

نرفق لكم طياً نسخة من الأسئلة الخاصة بمادة تكنولوجيا مواد البناء 2 و للإمتحان النهائي للفصل الدراسي الثاني – الدور الأول و للعام الدراسي 2015 – 2016 و الذي تم اجراءه بتاريخ 2016/5/19 مع الاجابة النموذجية الخاصة بها.

مع التقدير

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مسؤول المرحلة الأولى

١٩ /٥/ 2016

نسخة منه الى/

- ملف اللجنة الامتحانية

University of Technology
Building and Construction Engineering Department
Final Exam 1st trial 2015-2016

Subject: Material Technology 2
Class: All
Examiner: -

Year: First
Time: 3 hours
Date: 19 / 05 /2016

Note: Answer only four questions

Q1/ Fig. 1 shows the stress – strain curve for mild steel in tension. If the original diameter of the bar is 19mm, the gauge length is 220 mm. Determine:

1. Yield stress.
2. Ductility.
3. Diameter of the bar at point of ultimate strength.
4. Modulus of elasticity.
5. Maximum load that the material can withstand without permanent deformation. **(25%)**

Q2/ Fig. 2 shows the stress – strain curve for copper in tension. If the original diameter of the bar is 25mm, the gauge length is 200 mm. Determine:

1. Load at Failure
2. Percentage of reduction in cross sectional area if the diameter of the specimen at failure was 11.5mm
3. Stress at yield point
4. Modulus of resilience.
5. Modulus of toughness **(25%)**

Q3/A Complete these sentences:

a. The molding is of clay bricks improved by the following process:
b. Composition of cast iron is:
c. The raw materials of concrete bricks are:
d. The classification of the clay bricks according to Iraqi specification are
e. The main properties of stainless steel are: **(15%)**

Q3/B Show by sketch only:

a. Development of stress during flexural test.
b. Stress – strain diagram for all ferrous metals during tensile test **(10%)**

Q4/ Give the reasons of the followings:

1. Alkalis consider harmful ingredients in clay bricks.
2. When the sulpher content exceeds 0.1%, the steel losses its structural properties.
3. There is no trouble of effloresces in sand lime bricks.
4. One of the important stages in manufacture clay bricks is drying.
5. It is impossible to determine the ultimate compressive strength for ductile steels. **(25%)**

Q5/ Differentiate between the followings:

a. Creep failure and fatigue failure.
b. The purpose of impact test and hardness test.
c. Dimensions of samples for izod and charpy test.
d. Mode of failure during torsion test and compressive test.
e. Initial tangent modulus and secant modulus for determine modulus of elasticity. **(25%)**

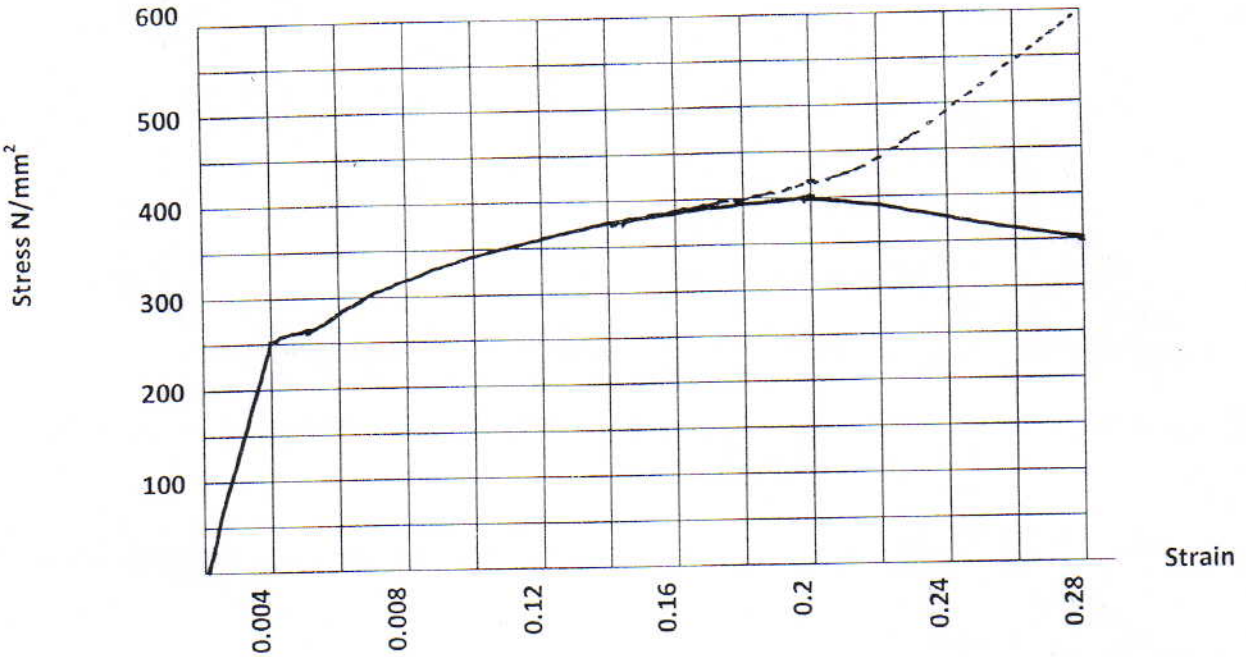

Stress N/mm²
600
500
400
300
200
100
0.004
0.008
0.12
0.16
0.2
0.24
0.28
Strain

Fig. 1

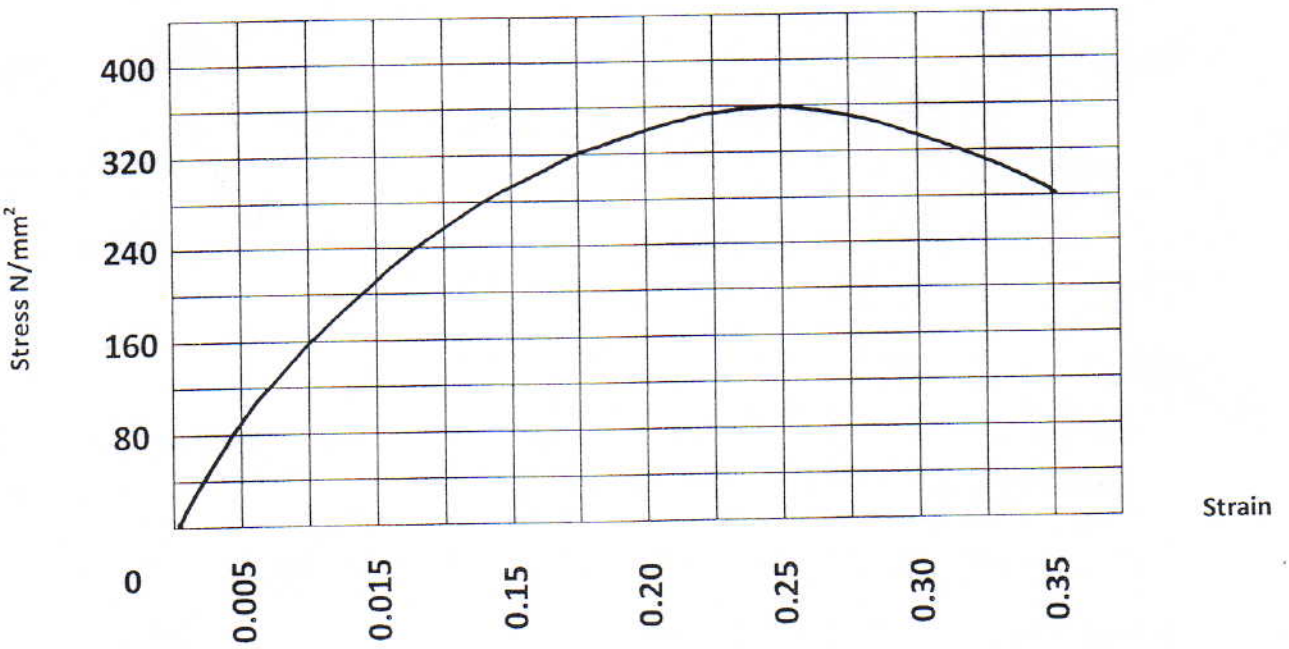

Stress N/mm²
400
320
240
160
80
0
0.005
0.015
0.15
0.20
0.25
0.30
0.35
Strain

Fig.2

Typical answers

Q1:

1. Yield stress = 265 MPa (From Fig. 1 by using 0.2 % offset)
2. Ductility:

   % of elongation = 0.28*100%= 28%

   % of reduction in cross sectional area= $(A_0 - A_f / A_0) *100\%$

   $A_0 = \pi r^2 = 3.147 *(9.5)^2 = 284.02 mm^2$

   A_f from Fig. 1

   $P_{at\ failure} = 350 * 284.02 = 99407$ N

   $A_f = 99407 / 600 = 165.68\ mm^2$

   % of reduction in cross sectional area= ((284.02-165.68)/284.02)*100% = 42 %
3. $P_{at\ ultimate\ strength} = 400 * 284.02 = 113608$ N

   Area of the bar at ultimate strength = $113608/ 420 = 270.5\ mm^2$

   $270.5 = 3.147 * D^2 /4$ $D_{at\ ultimate\ strength} = 15.61$ mm
4. E = 250/0.004 = 62500 MPa
5. P at P.L. = 300 * 284.02 = 85206 N

Q2:

1. $A_0 = 3.147 *12.5^2 = 491.72\ mm^2$

   $P_{at\ failure} = 280 * 491.72 = 137681.6$ N
2. $A_f = 3.147 * 6.75^2 = 143.37\ mm^2$
3. % of reduction in cross sectional area= ((491.72- 143.37)/491.72))*100% = 71 %
4. Modulus of resilience = 0.5 * 200*0.015 = 1.5 MPa
5. Modulus of toughness = (2/3)*280*0.35 = 65.33 MPa

Q3:A:

a. a. Dry press process b. Stiff mud process c. Soft mud process

b. Iron – 92-95%, Carbon – 2- 4.5 %, Silicon- 1-3 % and sulpher, phosphorus and manganese in varying proportions

c. Portland cement and aggregate for use in brick masonry. Typical aggregate include sand, gravel, crushed stone and blast furnace slag. Mix proportion varies from 1:2:4 to 1:8:16 according to the required bearing capacity

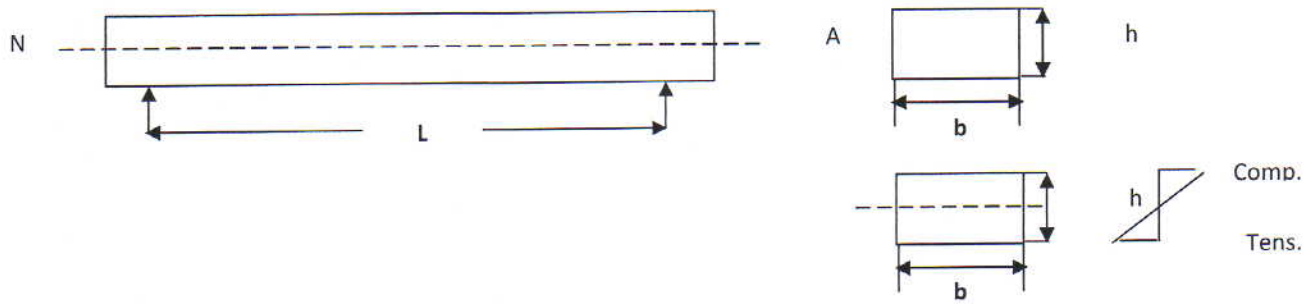
d. A, B, and C

e.

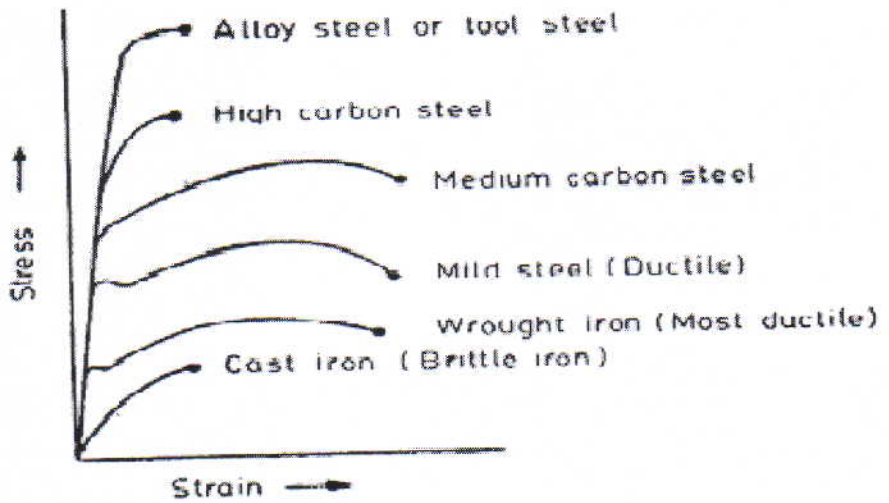
1. low carbon steel (0.2-2.1) %
2. high strength and elongation
3. good welding
4. non-magnetic, G.S = 8
5. long time shiny surface
6. low thermal expansion

Q3:B:

a.



b.



Q4:

1.

I. It lowers the fusion temperature and molts bricks.
II. Changes the shape of bricks or get twisted.
III. These salts have hygroscopic action, they absorb moisture, present in the atmosphere and keep brick damp which is harmful for health and decays the structure.

$MgO + H_2O \rightarrow Mg(OH)_2$

$K_2O + H_2O \rightarrow 2\ KOH$

2. Because the strength, ductility and resistance to impact are decreased.
3. The raw materials of these bricks do not contain any soluble salt
4. As wet clay bricks come from different brick machine, they contain from 7-50% moisture depend on whether dry press stiff mud or soft mud process has been used moisture in clay may be classified as:

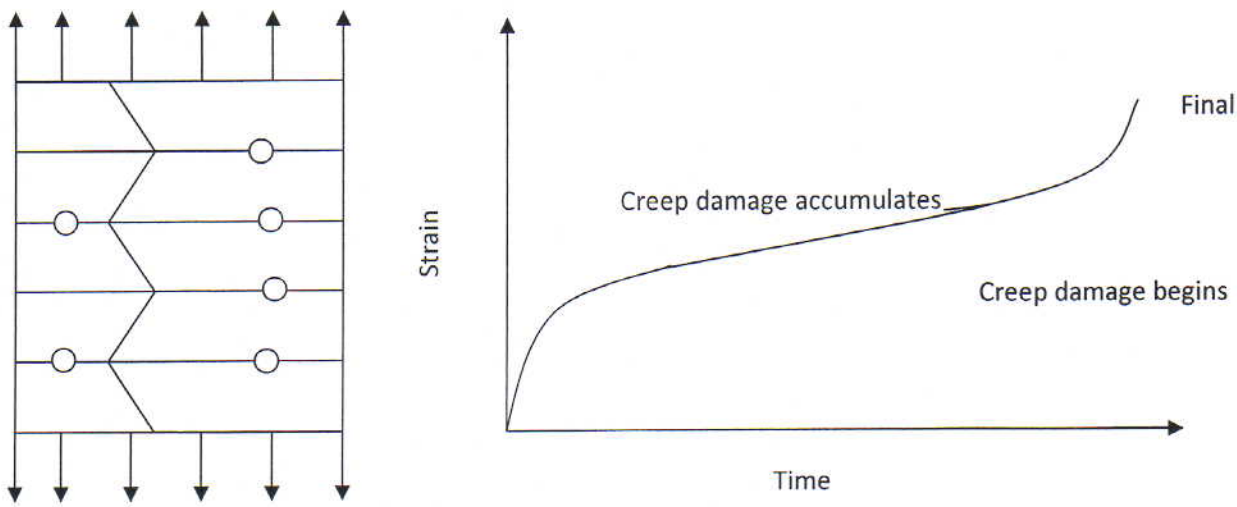
- Equilibrium moisture: is that moisture in the material which exerts a vapor pressure equal to that exerted by the surrounding air of a given temperature and humidity.
- Free moisture: is held strongly in the pore spaces.

5. Since all ductile steel are greatly deformed under load and show no well defined fracture.

Q5:

a.

During creep, damage, in the form of internal cavities, accumulates. The damage first appears at the start of the tertiary stage of the creep curve reflects this as the holes grows. The section of the sample decreases and (at constant load) the strains goes up and the creep rate goes up even faster than the stress does.



Fatigue failure appears to begin with a crack at a point of weakness in the material, with the crack. Progressing long crystal boundaries. During the stress cycle, these small cracks open and close. The cracks cause highest stress at the base of the crack as compared to the stress if there is no crack. Under this repeated concentration of stress, the cracks will gradually extend a cross the section of the member, finally causing complete failure of the member

b.

Impact tests may be performed for two purposes:

1. to determine the ability of the material to resist impact under service conditions.
2. to determine weather a metal has resistance to failure due to brittleness under service conditions in a machine or structure.

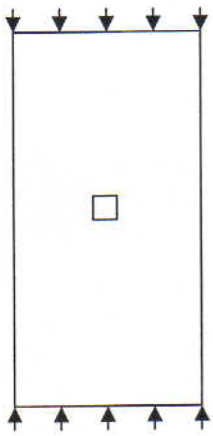
Hardness may be performed as resistance (1) to abrasion, (2) to scratching, or (3) to indentation of a cone or ball.

c.

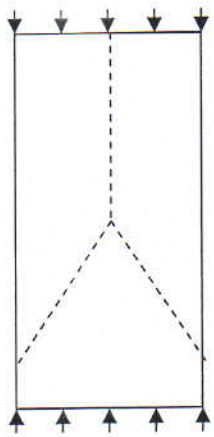
Sample for Charpy test with dimensions 55*10*10 mm, while for Izod 75*10*10 mm

d.

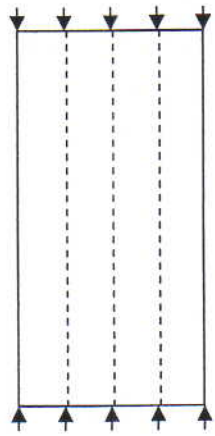
Model of failure during compression test



Shear Failure

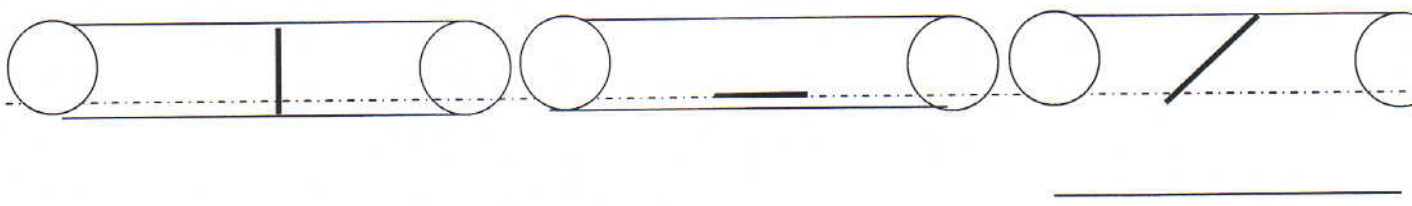


Combination shear Failure and splitting failure



Splitting Failure

Model of failure during torsion test



Shear plane perpendicular

Shear plane parallel

Shear plane making an angle

e.

Initial tangent modulus:

It is the tangent to the curve at the original, but it is little practical importance.

Secant modulus

It is the slop of the line drawn from the origin to any point on the stress – strain curve. There is no standard method of determining the secant modulus, in some laboratories; it is measured at stress ranging from 3 to 14 N/mm^2, in others at stresses representing 15, 25, 33 or 50% of the ultimate strength