الجامعة التكنولوجية

قسم هندسة البناء والإنشاءات

المرحلة الأولى

العـدد :

التاريخ : 13 /6/ 2015

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 2014 – 2015 و الذي تم اجراءه بتاريخ 2015/6/13 مع الاجابة النموذجية الخاصة بها.

مع التقدير

أ.م.د. قيس جواد فريح

مسؤول المرحلة الأولى

13 /6/ 2015

نسخة منه الى/

- ملف اللجنة الامتحانية

University of Technology
Building and Construction Engineering Department
Final Exam 2014-2015

Subject: Material Technology 2
Class: All
Examiner: -

Year: First
Time:3 hours
Date: 13 / 06 /2015

Note: Answer only four questions

Q1/ Data shown below are obtained during tensile test for shaft sample. If the original diameter of the bar is 17mm, its diameter at breaking is 11.5mm, and the gauge length is 200mm, determine the followings:

1. Modulus of elasticity.
2. Modulus of toughness.
3. Maximum load that the shaft can carry without failure.
4. Ductility of the shaft.
5. Yield point

(25%)

Stress, N/mm^2	75	150	225	300	375	450	525	600	450
Strain,mm/mm	0.003	0.006	0.01	0.0125	0.015	0.018	0.05	0.075	0.225

Q2/The following data were obtained during the tensile strength test of mild steel circular bar 13mm diameter:

a. Stress at the point specified maximum permanent deformation =265 N/mm^2
b. Max. load = 65000 N
c. Diameter of the bar at the section where failure occurred = 8.1mm
d. Stress at failure = 350 N/mm^2
e. Maximum elastic strain = 0.0015

Determine:

1. Modulus of elasticity
2. Modulus of resilience
3. Ultimate Strength
4. Percentage reduction in cross sectional area
5. The true breaking strength of the material

(25%)

Q3/ Complete these sentences:

a. The operation of burning in manufacture of clay bricks divided into the followings stages:
b. Composition of cast iron is
c. The raw materials of concrete bricks are:
d. During the manufacture of clay bricks most of the free moisture is removed during
e. The main uses of aluminum in civil engineering works are:

(25%)

Q4/ Differentiate between the followings:

a. Properties of Keen cement and properties quick lime
b. Hardness test and Izod test
c. Creep damage and creep failure
d. The effect of percentage of silicon and manganese on properties of steel
e. Properties of concrete bricks and properties of clay bricks.

Enhance your answers with required drawings

(25%)

Q5/A/ Explain briefly what is meant by:

a. Gypsum rock.
b. Stainless steel.
c. Manufacture of lime.
d. Excess of lime in clay bricks.

(15%)

Q5/B/ Explain briefly the manufacture of:

a. Sand lime bricks.
b. Lime.

(10%)

Typical answers

Q1/

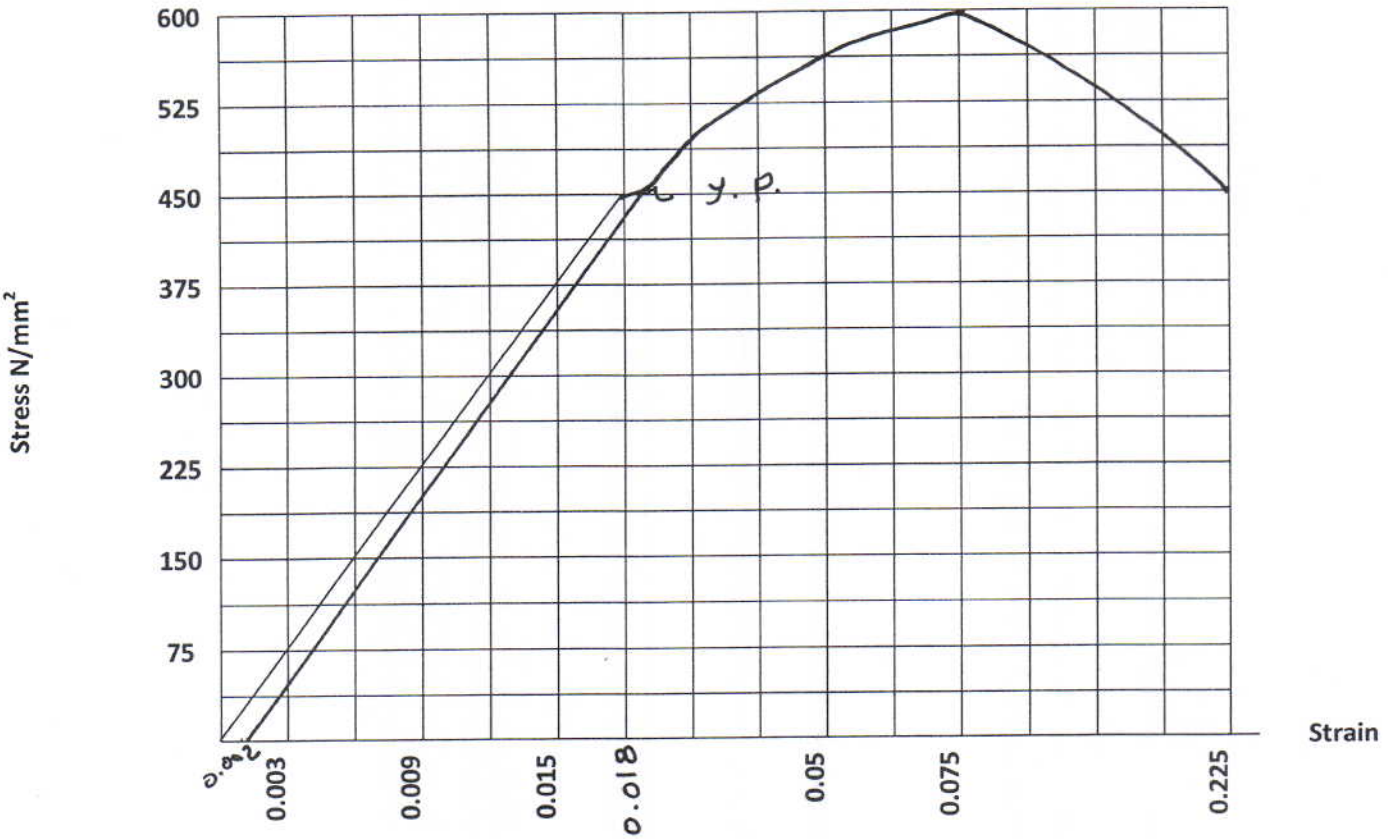


Fig. 1

a. Modulus of elasticity= $(\sigma_2-\sigma_1)/(\epsilon_2-\epsilon_1)=(450-0)/(0.018-0)=25000$ N/mm^2
b. Modulus of toughness $\angle$ 2/3 (ϵ_f * σ_f) $\angle$ (2/3)*450*0.225=67.5 N/mm^2
c. $A_0= \pi D^2/4= \pi*17*17/4= 227.3708$ mm^2
   So, Maximum load that the shaft can carry without failure = 600*227.3708 = 136422.5 N
d. % of elongation = 0.225*100% = 22.5%
   % reduction in area = $\{(A_0 - A_f)/ A_0\} * 100=$ (227.3708-104.0477)/227.3708*100% = = 54.2%
e. Yield point (0.019, 460)

Q2/

a. Modulus of elasticity= 265/0.0015= 176666.7 N/mm^2
b. Modulus of resilience = 1/2 ($\epsilon_{P.L.}$ * $\sigma_{P.L.}$) = ½(265*0.0015) = 0.19875 N/mm^2
c. Ult. Str. For apparent stress – strain curve = max. Load/ A_0
   A_0= π*13*13/4= 132.96 mm^2
   So, Ult. Str.= 488.86 N/mm^2
d. % reduction in area = {($A_0 - A_f$)/ A_0} * 100= (132.96-51.618)/132.96*100%
   =61.17%
e. True breaking strength = 65000/51.618 = 1259.25 N

Q3/

a. water smoking , dehydration, and oxidation
b. iron – 92-95%, Carbon – 2- 4.5 %, Silicon- 1-3 %, sulpher, phosphorus and manganese in varying proportions
c. Portland cement and aggregate. Typical aggregate include sand, gravel, crushed stone and blast furnace slag.
d. drying stage.
e.

1) It is most suitable for making door and window frames, railings of shops and corrugated sheets for roofing system.
2) Aluminum sheets are used over doors in bathrooms to protect them from getting rot and for stamping into a variety of shapes.
3) Aluminum powder is used for making paint.
4) Aluminum is extensively used in making parts of internal combustion engine, airplanes, utensils and packing's for medicines, chocolates, etc.

Q4/

a.

Properties of keen cement:

a. Its set is extremely slow, usually between 1-7 hours.
b. It gains in strength very gradually, but ultimately attains a great degree of hardness and a strength exceeding that of any ordinary gypsum plaster.
c. Its plasticity is high.
d. Its resistance to water is higher than ordinary plaster.

Properties of quick lime:

1. Plasticity:

The term "plasticity "is commonly used to describe the spreading quality of the material of the material in plastering. If it spreads easily and smoothly, it is plastic, if it sticks under the trowel, or cracks, and drops behind the trowel, it is non plastic.

2. Sand- carrying capacity:

Practically all lime used structurally is made up in the form of mortar by the addition of sand to lime paste for the following reasons:

a. Sand is cheaper than lime.
b. To diminish the great shrinkage which accompanies the setting and hardening of lime, and to prevent the consequent cracking.
c. To counteract the extreme stickiness' of some high- calcium limes.

It is important that the "sand- carrying capacity" of the lime be properly established. If too little sand is used, excessive shrinkage will cause a weakening of bond between the plaster or mortar and the masonry materials or plastered surface. On the other hand, too much sand produces a non plastic and weak mortar.

3. Setting time:

The setting of lime and lime mortar is a chemical process involving the evaporation of the large excess of water used in forming the lime paste, followed by the gradual replacement of the water of hydroxide by CO2 in the atmosphere, causing the lime hydrate to revert to the original calcium carbonate.

$$CaO + H2O \rightarrow Ca(OH)2$$

$$Ca(OH)2 + CO2 \rightarrow CaCO3 + H2O$$

4. Tensile and compressive strength of lime mortars:

The physical properties of lime mortar vary with the:

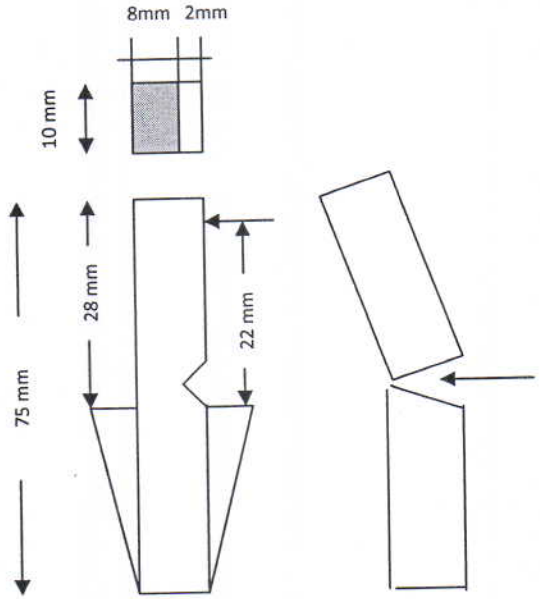
a. Chemical composition of the lime: Magnesia lime makes it stronger than calcium limes.
b. Character of the sand: Fine sand makes stronger mortar than coarse sand.
c. The amount of water: Suitable amount of water produces stronger lime mortar.

d. The conditions under which the mortar sets: The humidity and amount of CO2 in the atmosphere influence the rate of setting of lime drying the air and charging it with carbon dioxide, greatly accelerating the setting process.

b.

Izod method

For tough metals the notched Izod type of specimen tested as a cantilever is used. For extremely brittle metal that test specimen requires no notched, because the first suddenly applied stress causes a brittle failure.



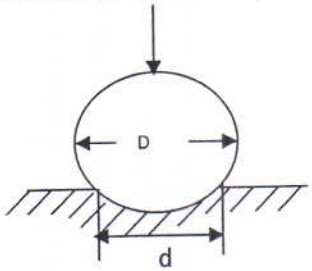
Fracture surface

Hardness

Hardness is resistance to plastic deformation. Thus a hard material may have a high elastic limit. Other meanings are given to term, however, such as resistance (1) to abrasion, (2) to scratching, or (3) to indentation of a cone or ball.

Hardness of metals is determined by measuring the resistance to penetration of a ball, cone, or pyramid. The brinell method is based upon determining the resistance offered to indentation by a hardened sphere that is subjected to a given pressure. The pressure used in testing steel is 3000 kg and a diameter of the ball is 10mm. When softer materials a pressure of 500 kg is used. Brinell numbers can be computed by the formula:

$$BHN = 2P/\pi D(D - (D^2 - d^2))$$



Where P- pressure in kg

D- Diameter of the ball

d- Diameter of the impression, mm

The harder the steel, the smaller the indentation under the load and the greater the BHN.