Ministry of Higher Education
& Scientific Research
University of Technology
Department of Materials Eng.
Class: Fourth class
Subject: Failure analysis
Final Exam.: 2014-2015

وزارة التعليم العالي والبحث العلمي
الجامعة التكنولوجية
قسم هندسة المواد

Date: Thu.15.6.2015
Allowed time: **3 hours.**
Examiner: Dr. Alaa Abdulhassan + L. Hashim Shareef
Signature:

ANSWER FIVE QUESTIONS ONLY

All the equstions are of equal marks

Q1) CHOOSE THE *CORRECT* ANSWER.

1- If a force of 6 N is applied to a flat tensile specimen of length 6 cm ,width 1 cm and Thickness 0.3 cm, the stress on the specimen is:

A- 1.8 N cm² **B-**1.8*10 MN m² **C-** 20N/m² **D-**0.2MN/m² **[10 MARK]**
E- 1 MN/m² **F-** none of the above

2-The elastic strian obtianed on applying a stress to a material is :

A-time –dependent **B-** instantaneous **C-** partially permanent
D- reversible **E-** directly proportional to the stress
F- inversely proportional to the stress

3- Poisson,s ratio is the ratio of trasverse strian to tensile strian during elastic Deformation :

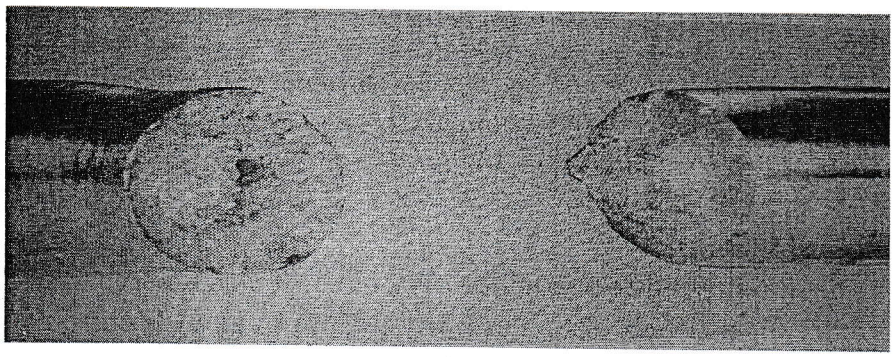
A- true **B-** false

4- The elastic resilience of a material is :

A- the stored energy per unite volume during elastic deformation
B- the stored energy per unite volume associated with dislocation.
C- given by $1/2\varepsilon^2E$
D- given by $1/2\ \sigma\varepsilon$
E- given by $E\ \delta\varepsilon/\delta t$ where $\sigma,\varepsilon.E$, are stress ,strian and young modulus

5-This fracture resulted from a tensile test ,the fracture

A- is a brittle fracture. **B-** is a ductile fracture
C- was preceded by considerable plastic deformation
D- probably started at a surface crack
E- is called a "cup and cone " fracture
F- none of the above

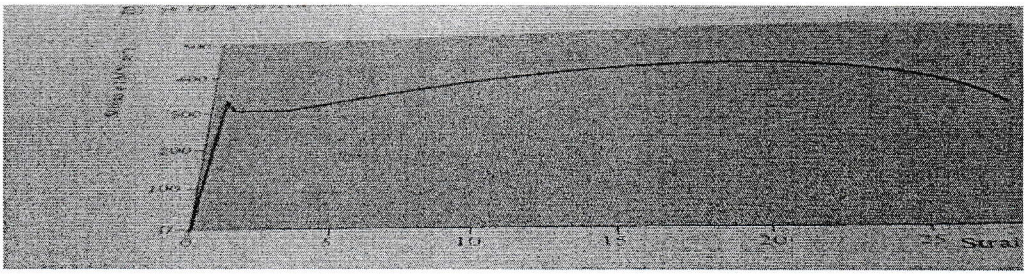


6- The true strian is given by :

A- ln LI/L0 **B-**$\Delta L/L0$ **C-**$\varepsilon/L0$ **D-**$\ln(1+\varepsilon)$ **E-**$\int d\ L/L$
where **ε, L0.L1** are the engineering strian,the intial length ,and current length

7- this stress strian curve:

A- is for pour copper **B-** is for mild steel **C-**shows an upper yield point
D- shows a lower yield stress **E-**is for a brittle material



8- The Ftigue resistance of a material is reduce by **:**
A-permanent residual compressive stresses
B- a mean positive (tensile) stress
C-chemically and mechanically hardening the surface
D- poor surface finish.

9- in faigue the mean stress σm
A-is equal to twice the stress amplitude
B- is equal to one –quarter of the stress amplitude
C- does not effect fatigue life
D- is determined by the easeof dislocation climb
E- has an effect on fatigue life which can be analysed of the Goodman Relationship
F- none of the above

10- in secondary creep the
A- recovery rate is greater than the work-hardening rate
B- recovery rate is equal to the work hardening rate
C- creep strian is given by **ε=Kt** where K is a constant and t is the time
D- creep strian is given by **ε=Kt⅓**
E- none of the above

Q2)

A- What is the creep failure ?is a creep faliure of a material is considered at high temperture ?explian how creep failure could be minimized ?use well know case example. [4mark]

B- What is the difference between ultimate strength of the material and its faliure load? [2 mark]

C- Two engineers were discussing fatigue failure ,and one stated ,"fatigue failures are brittle "while the other stated,"fatigue failures are ductile ". discuss the pros and cons of the two arguments. [4 mark]

Q3)

A- **What types of loading modes(e.g . axial,torsion,bending,combined benbing – torsion , pressure) that experienced at the following component:** [5 mark]
1- jet engine turbine
2- a rear leg of the chair you frequently use
3- motorcycle front axle

B- How would you distinguish between a ductile fracture and brittle fracture ?why is the fracture strenght of the real material is lower than the ideal breaking strenght? [5 mark]

Q4)

A-State the four actual fatigue ,creep failure? [4 mark]

B-What are the charasteristics of brittle fracture? [3 mark]

C-Explian brifly the crack modes? [3 mark]

Q5)

A- a round bar of metal is 9 mm diameter and it is observed that a length of 250mm extends by an amount of 0.225 under a load of 11.8KN .at the same Time its diameter contracts by 0.00227mm .determine Young modulus and the shear modulus for the metal? [5mark]

B- why study fracture mechanics? [5mark]

Q6)

A- Explian how can random stress affects the fatigue? [4 mark]

B- What are the deformatiom mechanisims are involved during the elastic and plastic of thermoplastics? [3 mark]

C- Who does the SN curve of carbon steel differ from that of ahigh strength Aluminum alloy ? [3 mark]

GOOD LUCK