



Course Title: Engineering and Material Testing

Course Code: MPD1206

Year: 1<sup>st</sup> Year Mechanical Engineer

Final Term Exam

Date: 28 -6- 2021.

Allowed time: 3 hrs.

No. of pages: 2

**Answer all the following questions, and assume any missing data**

**Q<sub>1</sub>**

**(45 marks)**

- Indicate the precautions to be taken into consideration upon applying Brinell test of hardness.
- Brinell test is conducted on a steel sample. The diameter of the indentation was equal to 0.35 times the diameter of the used ball. Calculate the Brinell hardness number, as well as the approximate value of the tensile strength of tested steel.
- Brinell test is applied on a sample of steel using ball indenter with diameter of 10 mm. If the diameter of indentation was 3.83 mm, calculate the Brinell number and the approximate value of the tensile strength. Determine the least possible dimensions of the tested sample.
- Draw the shape of fracture for the following materials with an explanation of the cause of fracture: mild steel - brass - cast iron
- A tension test is performed on a sample of steel 8 mm in diameter and gauge length of 8 cm and the following table shows the load and elongation counterparts:

Load (kg)	0	700	1150	1600	1360	1390	1665	1920	2150	1660
Elongation (mm)	0	0.04	0.066	0.091	0.59	1.21	2.53	3.52	14.25	24.12

Draw a curve graph of load and elongation was then appointed as follows: Yield stress - tensile strength - modulus of elasticity - modulus of resilience - the maximum stress - the percentage of elongation - modulus of toughness.

**Q2.**

**(25 marks)**

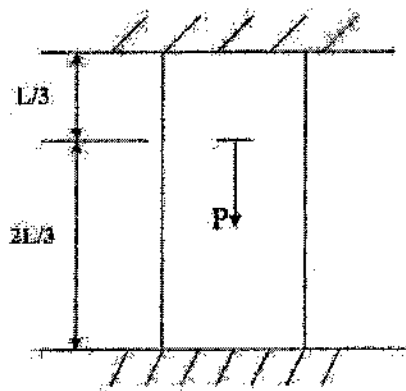
- Define the proof stress - What is the purpose of its determination? Can it be determined for all the materials? Why?

(b) A tension test is made on a sample of steel and the diameter of the sample was  $d = 1.2$  cm. An elongation percent of 34% and 30% for lengths of  $5d$  and  $10d$  respectively were measured. In a tension test on a sample of another type of steel with the same diameter and a gauge length of  $4d$  the elongation percent was 39%. Determine which type of steel is more ductile?

**Q3.**

**(20 marks)**

- A homogeneous bar as described is subjected to an axial load  $P$  at a distance one third of the bar length from its upper end. Determine the maximum stress in the bar. (Fig.1)



**Fig.1**

**Q4.**

**(30 marks)**

- What are the types of shear tests? Explain two of these types in detail.
  - A driving shaft of 3 m long and 10 cm in diameter is made from an alloy steel with a yield strength in torsion of  $3000 \text{ kg/cm}^2$ , modulus of rigidity  $1000 \text{ ton/cm}^2$  and ultimate shear strength  $5000 \text{ kg/cm}^2$ . Determine the following:
    - Twisting moment required to produce yielding
    - Twist angle at yielding
    - The total energy stored at yielding and
    - Explain the shape and reason of fracture in the shaft.

*With my best wishes*

*Dr. Eng. Maher . R. Elgendy*