

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination

Summer Semester, A.Y. 2021-2022

Course No. ME 4225

Time : 1½ hours

Course Title: Material Engineering

Full Marks : 75

There are 3 (Three) Questions. Answers all the 3 (Three) questions. Marks in the margin indicate the full marks.

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1. a) It is essential to interpret and study stress-strain curves properly for successful material design. Number of important mechanical properties of materials can be investigated from such curves. Sketch typical stress-strain curves for both ductile and brittle materials. Define the yield strength from such curves and distinguish between resilience and toughness. Determine if a ductile and a brittle material can have equal toughness values with necessary sketches. (15)
(CO1, CO2)
(PO1, PO2)
- b) What do you mean by ductility and explain how the ductility can be measured? (10)
(CO1, CO2)
(PO1, PO2)
2. a) In two-dimension (2-D) four different crystal structures exist with total five Bravais lattices and in three-dimension (3-D), seven different crystal structures exist with total fourteen Bravais lattices. Distinguish among the four different crystal structures in 2-D and seven different crystal structures in 3-D. Also, with necessary sketches show why both face-centered tetragonal and body-centered structures don't exist together. (15)
(CO1, CO2)
(PO1, PO2)
- b) The same metallic material that fails in ductile mode at or above room temperature may fail in brittle mode at lower temperature. Predict the mechanism of such failure and suggest preventive measurements to be taken to avoid this sort catastrophic brittle failure. (10)
(CO1, CO2)
(PO1, PO2)
3. a) For a simple cubic (SC) structure, list the planes for the plane group {100}, {110} and {111}. With necessary sketches show that plane (hkl) is always perpendicular to the direction [hkl]. Sketch a unit cell and draw the direction [123] within this unit cell and also draw this direction when it is not necessary to limit the direction vector within the unit cell only. (15)
(CO1, CO2)
(PO1, PO2)
- b) With schematics, show the specific metallographic feature that helps to differentiate between fatigue and creep failure. Between fatigue life and endurance limit which one is important for product design for life time duration? (10)
(CO1, CO2)
(PO1, PO2)