

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination

Winter Semester: 2022-2023

Course Number: ME 6105

Full Marks: 75

Course Title: Mechanical Behavior of Materials

Time: 1 hour and 30 mins

Answer all the 3 (three) questions below. The distribution of marks is given in brackets.

- Q1. (a) Briefly explain the different modes to fracture? Describe the fatigue fracture stages with a schematic diagram of the fatigue fracture surface. [12.5]
(c) Define creep. With strain-time plot, discuss different stages of creep. What are the effects of temperature and applied stress on the creep behavior? [12.5]

Q2. (a) The following data were obtained in a tensile test on a specimen with 50 mm gauge length and a cross-sectional area of 160 mm^2. [25]

Table with 2 rows: Extension (mm) and Load (kN). Columns contain numerical data points for each row.

The total elongation of the specimen just before final fracture was 16%, and the reduction in area at the fracture was 64%.

- Compare the engineering and true stress - strain curves in a graph.
- Calculate: i) Tensile strength, ii) 0.2% proof stress, and iii) Resilience of the material of the specimen.

- Q3. (a) Explain principal planes and principal stresses. What is the special characteristic of the principal stress tensor? How is Mohr's circle used to determine the principal stresses? [10]
(b) What is ductile to brittle transition? What are the reasons that many materials show such behavior? Explain. [8]
(c) Derive the constitutive equation with overall stress, stress rate, strain, and strain rate for the linear viscoelastic model below using the Maxwell and Kelvin-Voigt models. [7]

