Assignment 7

The due date for submitting this assignment has passed. Due on 2018-03-14, 23:59 IST.

Submitted assignment

Based on the data given in question 1, answer the following up to question 3

1) Assume that a constant shear stress $\tau_{yx}$ is being applied for a creep test. Following is the expression for Voigt model.

$$G \varepsilon_{yx} + \eta \frac{\partial \varepsilon_{yx}}{\partial t} = \tau_{yx}.$$  

(1)

The simplified form of Voigt model for creep will be

$$\mathcal{A} \varepsilon_{yx} + \mathcal{B} \frac{\partial \varepsilon_{yx}}{\partial t} = \mathcal{C} \tau_{yx}.$$  

(2)

$\mathcal{A}$, $\mathcal{B}$ and $\mathcal{C}$ in Eq. 2 will be,

- $\mathcal{A} = G$, $\mathcal{B} = 0$, $\mathcal{C} = 1$
- $\mathcal{A} = G$, $\mathcal{B} = \eta$, $\mathcal{C} = 0$
- $\mathcal{A} = 1$, $\mathcal{B} = 0$, $\mathcal{C} = 1$
- $\mathcal{A} = G$, $\mathcal{B} = \eta$, $\mathcal{C} = 1$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\mathcal{A} = G$, $\mathcal{B} = \eta$, $\mathcal{C} = 1$

2) Solution to Eq.2 will be of the form

$$\varepsilon_{yx} = \mathcal{A} + \mathcal{B} \frac{\tau_{yx}}{G} \left[ 1 - \exp \left( -\frac{t}{\mathcal{C}} \right) \right]$$

2 points

- $\mathcal{A} = 1$, $\mathcal{B} = 0$, $\mathcal{C} = \frac{\eta}{G}$
- $\mathcal{A} = 0$, $\mathcal{B} = 1$, $\mathcal{C} = \frac{G}{\eta}$
- $\mathcal{A} = 0$, $\mathcal{B} = 1$, $\mathcal{C} = \frac{\eta}{G}$
- $\mathcal{A} = G$, $\mathcal{B} = \eta$, $\mathcal{C} = 1$

No, the answer is incorrect.

Score: 0

Accepted Answers:
\[ \mathcal{A} = 0, \quad \mathcal{B} = 1, \quad \mathcal{C} = \frac{n}{G} \]

3) As \( t \to \infty \), the strain will be

\[ \frac{\tau_0}{G}, \quad \frac{\gamma_{yx} t}{\eta}, \quad 0, \quad \infty \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ \frac{\tau_0}{G} \]

Based on the data given in question 4, answer the following

4) Consider the following integral model,

\[ \tau_{yx}(t) = \int_{-\infty}^{t} \left[ \frac{\eta_0}{\lambda_1} \left( 1 - \frac{\lambda_2}{\lambda_3} \right) \exp \left( \frac{t - t'}{\lambda_1} \right) \right] \gamma_{yx} dt' + \frac{\eta_0 \lambda_2}{\lambda_1} \gamma_{yx} . \]

- Voigt
- Maxwell
- Carreau Yasuda
- Power law

No, the answer is incorrect.
Score: 0
Accepted Answers:
Maxwell

5) The response of this model to steady shear is,

- Constant viscosity given by \( \eta_0 \frac{\lambda_2}{\lambda_1} \)
- Constant viscosity given by \( \eta_0 \left( 1 - \frac{\lambda_2}{\lambda_1} \right) \)
- Constant viscosity given by \( \eta_0 \frac{\lambda_1}{\lambda_2} \)
- Constant viscosity given by \( \eta_0 \frac{\lambda_1}{\lambda_2} \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
Constant viscosity given by \( \eta_0 \)

6) The differential form of the above model is given by

\[ \tau_{yx} + \lambda_1 \frac{\partial \tau_{yx}}{\partial t} = \eta_0 \gamma_{yx} + \eta_0 \lambda_2 \frac{\partial \gamma_{yx}}{\partial t} . \]

The response of this model to stress relaxation is: the stress

- decreases exponentially with time.
- increases exponentially with time.
- remains constant.
decreases exponentially and then becomes constant to a non-zero value.

No, the answer is incorrect.
Score: 0
Accepted Answers:
decreases exponentially with time.

7) The storage and loss moduli based on this model are

\[ G' = \frac{G_0^2 \lambda_1 (\lambda_1 - \lambda_2)}{1 + \omega^2 \lambda_1^2}; \quad G'' = \frac{G_0 \lambda_1 (1 + \lambda_1 \lambda_2 \omega^2)}{1 + \omega^2 \lambda_1^2}. \]

Based on this model, the low frequency loss modulus and the high frequency loss modulus, are

- inversely proportional and proportional to frequency, respectively
- proportional and inversely proportional to frequency, respectively
- both inversely proportional to frequency
- both proportional to frequency

No, the answer is incorrect.
Score: 0
Accepted Answers:
both proportional to frequency

8) From the following graph, value of \( \lambda_1 \) is \( \_ \_ \_ \_ \_ \) s (to 3 decimal places)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.800, 1.200

9) Based on the graph given in question 8, answer this question.

value of \( \lambda_2 \) is \( \_ \_ \_ \_ \_ \) s (to 3 decimal places).
Based on the data given in question 10, answer the following

10) The following graph shows Cole-Cole plot (also called the Nyquist plot) of loss modulus Vs storage modulus for various materials. Enter the curve number next to the type of the material:

- Gel ___________ (enter an integer value)

- Newtonian fluid ___________. (enter an integer value)

- Generalized Newtonian fluid __________ (enter an integer value)
13) Maxwell fluid ________ (enter an integer value)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 3

14) Glassy solid ________ (enter an integer value)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 5

Based on the data given in the question 15, answer the following

15)

Following equation is $\theta$ direction equation of motion, that can be used for shear flow in concentric cylinder geometry:

$$0 = \rho \ddot{\theta} - \frac{1}{r} \frac{\partial}{\partial \theta} \left[ \frac{1}{r^2} \frac{\partial (r^2 \tau_{r\theta})}{\partial r} + \frac{1}{r} \frac{\partial \tau_{r\theta}}{\partial \theta} + \frac{\partial \tau_{\theta\theta}}{\partial z} + \frac{\tau_{\theta r}}{r} \right]$$

Following set of forces being shown as arrows will be acting on a fluid element in the concentric cylinder geometry:

$$\rho \ddot{\theta} \quad \text{. (enter an integer value)}$$

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 0

16) $\frac{1}{r} \frac{\partial}{\partial \theta} \quad \text{. (enter an integer value)}$
No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 3

\[ \frac{1}{r^2} \frac{\partial (r^2 \tau e)}{\partial r} + \frac{\tau e - \tau \dot{e}}{r} \quad . \quad \text{enter an integer value} \]

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1

\[ \frac{1}{r} \frac{\partial \tau e}{\partial \theta} \quad . \quad \text{enter an integer value} \]

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0
(Type: Numeric) 3

\[ \frac{\partial \tau e}{\partial z} \quad . \quad \text{enter an integer value} \]

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0
(Type: Numeric) 2