Ans1:

$$S = s^{E} \cdot T + dE \quad \text{——— (1)}$$

$$D = dT + \epsilon^{T} \cdot E \quad \text{——— (2)}$$

STREE (T) vs CHARGE form: $\longrightarrow$

(a) Rewriting eq (1) and (2) in terms of independent variables

Now, we'll multiply eq (1) by c^{E}

We get: $\longrightarrow$

$$-c^{E} \cdot S = T + c^{E} \cdot dE$$

$$\therefore \; T = c^{E} S - c^{E} dE$$

Substituting value of T in equation (1),

We get: $\longrightarrow$

$$-D = d' c^{E} \cdot S + (\epsilon^{T} - d' \cdot c^{E} d) E$$

$$\therefore \; T = c^{E} \cdot S - eE$$

$$D = e' S + \epsilon^{S} E$$

Here, (a) $e = c^{E} \cdot d$ (b) $\epsilon^{S} = \epsilon^{T} - d' c^{E} \cdot d$

(b) STRAIN VOLTAGE:

multiplying equation (2) by β^T, we get:→

$$\boxed{E = -\beta^T.d.T + \beta^T.D}$$

substituting eq (6) in (1), we get →

$$\boxed{S = (s^E - d\beta d')T + d\beta^T.D}$$

Here,

$$\boxed{g = d\beta T}$$

$$\boxed{s^D = s^E - d\beta^T.d'}$$

⟶

(c). Equation (3): ⟶

$$S = s^D T + gD$$

multiplying above equation with c^D, we get:→

$$\boxed{T = c^D S - c^D.g^D} \quad \text{—— (2)}$$

Now, as we know

$$\boxed{E = -g'T + \beta^T.D}$$

substituting the value of T from eq (3),

we get:→

$$E = -g'c^D.S + (\beta^T + g'c\,fg)D$$

$$\boxed{T = c^D S - hD}$$

$$\boxed{E = -h'S + \beta^S D}$$

where, (i) $\boxed{h = c^D . g}$

(ii) $\boxed{\beta^S = \beta^T + g' c^D g}$

Sol^n 6.2: $\longrightarrow$

martensitic fraction $(\xi) = 0$

$T_{ambient} = 25^\circ C$

$\tau_s^{cr} = 105 \times 10^6\, Pa$

$\boxed{\tau_s^{cr} = 105\, MPa}$

$\tau_f^{cr} = 160 \times 10^6\, Pa$

$\boxed{\tau_f^{cr} = 160\, MPa}$

(A) stress required: to lead Austenite ~~martensite~~ : $\xrightarrow{\text{transformation}}$ martensite

$$\boxed{M_f < \theta_0 < A_s}$$

$$\text{Stress } (\tau) = \tau_s^{cr} + C_m (\theta_0 - M_s)$$

$$\tau = 105 + 7(25-17) = 161\, MPa \qquad \boxed{\tau = 161\, MPa}$$

(B) stress required to: martensite : $\xrightarrow{\text{transformation}}$ Austenite

$$\tau = \tau_f^{cr} + C_m \cdot (\theta_0 - M_s)$$

$$= 160 + 7(25-17)$$

$$\boxed{\tau = 216\, MPa}$$

Ans 3: Problem 11.2 : →

Given: →

ⓐ $C = 1.2 \mu f$

ⓑ $V = 100V$

ⓒ $f = 40 Hz$

ⓐ peak power: →

$= P_{peak} = \frac{1}{2} C V^2 \omega$

$= \frac{1}{2} \times (1.20 \times 10^{-6}) \times (100)^2 \times (80\pi)$

$\therefore \boxed{P_{peak} = 1.508 W}$

ⓑ Power dissipated: →

$P_{diss} = \frac{2 V I_0}{\pi}$ ——— ①

$i(t) = \frac{C \cdot dv(t)}{dt}$

$V(t) = V \sin(\omega t)$

$\boxed{V(t) = 100 \sin(80\pi t)}$

$\therefore i(t) = (1.2 \times 10^{-6})(100)(80\pi \cos(80\pi t))\ A$

$\boxed{i(t) = 30.16 mA}$

$P_{diss} = \frac{2 \times 100 \times (30.16 \times 10^{-3})}{\pi}$

$\boxed{P_{diss} = 1.92 W}$

(b) consider,

$V = 200V$ $\quad f = 40Hz$

Peak power $= \frac{1}{2} \times (1.2 \times 10^{-6}) \times (200)^2 \times (80\pi)$

$\boxed{P_{peak} = 6.032W}$

$V(t) = 200 \sin(80\pi t)$

$i(t) = (1.2 \times 10^{-6}) \times (200) \times (80\pi \cos(80\pi t))$ A

$\boxed{i(t) = 60.32 \text{ mA}}$

$P_{dissipated} = \frac{2 \times 200 \times 60.32 \times 10^{-3}}{\pi}$

$= 7.68W$

(c) consider,

$\boxed{V = 100V}$ $\boxed{f = 80Hz}$

$$P_{peak} = \frac{1}{2} \times (1.2 \times 10^{-6}) \times (100)^2 \times (160\pi)$$

$$\boxed{P_{peak} = 3.016 W}$$

$$v(t) = 100 \sin(160\pi)$$

$$i(t) = (1.2 \times 10^{-6}) \times (100) \times (160\pi \cos(160\pi t))$$

$$\boxed{i(t) = 60.32 mA}$$

$$P_{dissipated} = \frac{2 \times 100 \times (60.32 \times 10^{-3})}{\pi}$$

$$\# \boxed{P_{diss} = 3.84 W}$$