OR

b – Proof for valid stress function – 03 marks

Q2 a. $B = 0.03125\ mm^{-1}$ – 01 Marks

$A = 0.02500\ mm^{-1}$ – 01 Mark

$\frac{B}{A} = 1.25$ – 01 Marks

OR

b. $B = 0.01667\ mm^{-1}$ – 01 marks

$A = 0.0050\ mm^{-1}$ – 01 marks

$\frac{B}{A} = 3.33$ – 01 Marks.

Q3 a Fig – 01 mark

Explanation – 01 mark

OR

b Neat diagram – 02 marks.

Q4 a. $A_1 = 200(120) = 24000\ mm^2$

$A_2 = \frac{120(80)}{2} = 4800\ mm^2$ 2 marks.

$T = 2A_1q_1 + 2A_2q_2 = 48000q_1 + 9600q_2$ 2 marks

$\theta = \frac{1}{2G(24000)}\left[\frac{520q_1}{5} + \frac{120(q_1 - q_2)}{4}\right.$ 2 marks.

$= \frac{1}{2G(48000)}\left[\frac{200q_2}{5} + \frac{120(q_2 - q_1)}{4}\right]$

$$T = 48000(1.338 q_2) + 9600 q_2$$

$q_2 = 149.$ N/mm

$q_1 = 199.4$ N/mm

} 02 marks

$\tau_{max} = \frac{q_1}{5} = 39.9$ MPa — 02 marks

$\beta = \theta L =$ ~~0.513~~ 0.0513 rad. — 02 marks

Q5

$A = 0.0076\ m^2$ — 05 marks

$T = 2A\,\tau_{max}\,t_1 = 3000$ N m

$\tau_{max} = 49.34$ MPa

} 06 marks.

$q = 197.4$ kN/m — 03 marks

Q6

$I = 285070\ mm^4$ — 04 marks.

$q_A = 2700$ N/mm

$q_B = 1800$ N/mm

— 02 marks.

$F_1 = 40500$ N — 02 marks

$F_2 = 27000$ N — 02 marks.

$V_e = 60F_1 - 40F_2$ — 02 marks

$e = 4.74\ mm$ — 02 marks.

Q7

$I = 3703000\ mm^4$ — 04 marks.

$q_A = 15600\ N/mm$ — 02 marks

$q_B = q_A + 25\sqrt{2}(4)(62.5) = 23840\ N/mm$

$q_D = q_B + 50(4)(25) = 28840\ N/mm$

— 02 marks

$F_1 = 375000\ N$

$F_2 = 2717300\ N$

] 02 marks

$\sum M_F = 0 = V(50-e) + 150F_1 - 50F_3$

$e = 28.50\ mm$ — 04 marks.

Q8

$\frac{\sigma_m}{E_m} = \frac{\sigma_f}{E_f}$ — 02 marks

$\frac{\sigma_f}{\sigma_m} = 25.71$ — 04 marks

$F_c = f_m + F_f$

$$\frac{f_m + f_f}{} \quad \frac{\sigma_m A_m + \sigma_f A_f}{}$$

$$= \frac{\sigma_f V_f}{\sigma_m V_m + \sigma_f V_f}$$

$$= \frac{V_f}{V_m\left(\frac{\sigma_m}{\sigma_f}\right) + V_f}$$

06 marks

$$\frac{F_f}{f_m + f_f} = 0.92$$

02 marks.

Q 9.

Specific modulus of Al alloy

$$= \frac{60\ GPa}{2.8 \times 10^3\ kg\ m^{-3}}$$

$$= \frac{60 \times 10^9}{2.8 \times 10^3}$$

$$= 20.69 \times 10^6\ m^2/s^2$$

— 04 marks

$$\rho_c = 0.6 \times 2.55 \times 10^3 + (0.4) \times 1.14 \times 10^3$$

$$= 1.986 \times 10^3\ kg/m^3$$

— 04 marks

$$E_c = 44.32\ GPa$$

02 marks

Specific modulus of composite $= 22.9 \times 10^{+6}\ m^2/s^2$

— 02 marks

change in modulus 10%.

and density = 29%.

02 marks.