

**I.**

**F**

1. **F.**
2.  $Q_z = 0$      $N = 0$

$$B = \frac{\partial U}{\partial F} = \sum_{i=1}^n \int_{L_i} \frac{M_{yi}}{EI_{yi}} \frac{\partial M_{yi}}{\partial F} dx + \sum_{j=1}^k \int_{L_j} \frac{N_j}{EA_j} \frac{\partial N_j}{\partial F} dx. \quad (1)$$

3. **F.**
4. **F.**
5. **F.**
6. (1) **F;**
7.  $E, I$

**II.**

- 1.
2.  $Q_z = 0$      $N = 0$

$$B = \frac{\partial U}{\partial \Phi} = \sum_{i=1}^n \int_{L_i} \frac{M_{yi}}{EI_{yi}} \frac{\partial M_{yi}}{\partial \Phi} dx + \sum_{j=1}^k \int_{L_j} \frac{N_j}{EA_j} \frac{\partial N_j}{\partial \Phi} dx. \quad (2)$$

- 3.
- 4.
- 5.
6. (2)  $= 0.$
7.  $E, I$

**III.**

- 1.
2.  $Bh$

$$= \sqrt{\frac{2}{B_v} + \frac{2}{B_h}} \quad (3)$$

**IV.**

1. .
2.  $F,$
3.  $( )$  , -

**V.**

1. .
2.  $Q_z = 0 = 0$  ,  $N$  -  $N = 0;$   
 $(i = 1..n)$   $k$   $(j = 1..k):$

$$B = \frac{\partial U}{\partial M} = \sum_{i=1}^n \int_{L_i} \frac{M_{yi}}{EI_{yi}} \frac{\partial M_{yi}}{\partial M} dx + \sum_{j=1}^k \int_{L_j} \frac{N_j}{EA_j} \frac{\partial N_j}{\partial M} dx. \quad (4)$$

3. .
4. .
5. .
6.  $(4)$  ; - ,
7.  $( )$  ,  $E, I$  .

**VI.**

1. .
2.  $Q_z = 0 = 0$  ,  $N$  -  $N = 0;$   
 $(i = 1..n)$   $k$   $(j = 1..k):$

$$B = \frac{\partial U}{\partial M_\Phi} = \sum_{i=1}^n \int_{L_i} \frac{M_{yi}}{EI_{yi}} \frac{\partial M_{yi}}{\partial M_\Phi} dx + \sum_{j=1}^k \int_{L_j} \frac{N_j}{EA_j} \frac{\partial N_j}{\partial M_\Phi} dx. \quad (5)$$

3. .
4.  $M$  .
5. .
6.  $(5)$  ;  $M = 0.$
7.  $( )$  ,  $E, I$  .

**VII.**

**1.**

),  
);  
),

**2.**

**V V.**

( ) ,