

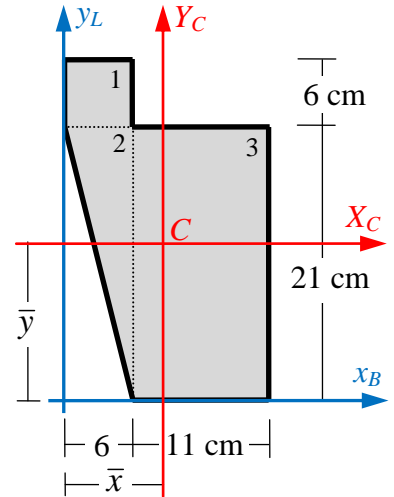
الاسم:

الإسم:

**Answer of Quiz: (10 Marks)**

Choose the nearest answer.

- The shown cross-section is .....  
(A) Symmetrical about  $X_C$ -axis. (B) Symmetrical about horizontal axis. (C) Symmetrical about vertical axis. (D) Symmetrical about vertical axis. (E) Not symmetrical.
- The areas 1, 2 and 3 are:  
(A)  $36 \text{ cm}^2$ ,  $126 \text{ cm}^2$ ,  $231 \text{ cm}^2$  (B)  $30 \text{ cm}^2$ ,  $63 \text{ cm}^2$ ,  $231 \text{ cm}^2$  (C)  $36 \text{ cm}^2$ ,  $60 \text{ cm}^2$ ,  $231 \text{ cm}^2$  (D)  $36 \text{ cm}^2$ ,  $60 \text{ cm}^2$ ,  $321 \text{ cm}^2$  (E)  $36 \text{ cm}^2$ ,  $63 \text{ cm}^2$ ,  $231 \text{ cm}^2$
- The total area of the section is:  
(A)  $393 \text{ cm}^2$  (B)  $324 \text{ cm}^2$  (C)  $327 \text{ cm}^2$  (D)  $427 \text{ cm}^2$  (E)  $330 \text{ cm}^2$
- The first moments of areas 1, 2 and 3 about the  $y_L$ -axis are:  
(A)  $108 \text{ cm}^3$ ,  $252 \text{ cm}^3$ ,  $2656.5 \text{ cm}^3$  (B)  $972 \text{ cm}^3$ ,  $5211 \text{ cm}^3$ ,  $6543 \text{ cm}^3$  (C)  $36 \text{ cm}^3$ ,  $72 \text{ cm}^3$ ,  $288 \text{ cm}^3$  (D)  $864 \text{ cm}^3$ ,  $882 \text{ cm}^3$ ,  $3456 \text{ cm}^3$  (E)  $108 \text{ cm}^3$ ,  $288 \text{ cm}^3$ ,  $3456 \text{ cm}^3$
- The centroid of the cross-section is at  $\bar{x} = \dots$  from  $y_L$ -axis.  
(A)  $9.14 \text{ cm}$  (B)  $12.64 \text{ cm}$  (C)  $10.1 \text{ cm}$  (D)  $-10.1 \text{ cm}$  (E)  $9.73 \text{ cm}$
- The first moments of areas 1, 2 and 3 about the  $x_B$ -axis are:  
(A)  $864 \text{ cm}^3$ ,  $882 \text{ cm}^3$ ,  $2425.5 \text{ cm}^3$  (B)  $972 \text{ cm}^3$ ,  $5211 \text{ cm}^3$ ,  $6543 \text{ cm}^3$  (C)  $36 \text{ cm}^3$ ,  $72 \text{ cm}^3$ ,  $288 \text{ cm}^3$  (D)  $972 \text{ cm}^3$ ,  $1152 \text{ cm}^3$ ,  $3456 \text{ cm}^3$  (E)  $108 \text{ cm}^3$ ,  $288 \text{ cm}^3$ ,  $3456 \text{ cm}^3$
- The centroid of the cross-section is at  $\bar{y} = \dots$  from  $x_B$ -axis.  
(A)  $12.64 \text{ cm}$  (B)  $9.727 \text{ cm}$  (C)  $14.09 \text{ cm}^2$  (D)  $11.11 \text{ cm}$  (E)  $14.09 \text{ cm}$
- The second moments of areas 1, 2 and 3 about their centroidal  $x_c$ -axes are:  
(A)  $108 \text{ cm}^4$ ,  $1543.5 \text{ cm}^4$ ,  $8489.25 \text{ cm}^4$  (B)  $108 \text{ cm}^4$ ,  $4032 \text{ cm}^4$ ,  $42831 \text{ cm}^4$  (C)  $36 \text{ cm}^4$ ,  $72 \text{ cm}^4$ ,  $288 \text{ cm}^4$  (D)  $108 \text{ cm}^4$ ,  $144 \text{ cm}^4$ ,  $3456 \text{ cm}^4$  (E)  $108 \text{ cm}^3$ ,  $2304 \text{ cm}^3$ ,  $13824 \text{ cm}^3$
- The second moments of areas 1, 2 and 3 about the  $X_C$ -axis are:  
(A)  $324 \text{ cm}^4$ ,  $1152 \text{ cm}^4$ ,  $41472 \text{ cm}^4$  (B)  $4753 \text{ cm}^4$ ,  $1660 \text{ cm}^4$ ,  $9548 \text{ cm}^4$  (C)  $26244 \text{ cm}^3$ ,  $18432 \text{ cm}^3$ ,  $41472 \text{ cm}^3$  (D)  $44262 \text{ cm}^4$ ,  $23481 \text{ cm}^4$ ,  $27414 \text{ cm}^4$  (E)  $108 \text{ cm}^4$ ,  $2304 \text{ cm}^4$ ,  $13824 \text{ cm}^4$
- The second moment of the cross-section about its centroidal  $X_C$ -axis is:  
(A)  $16236 \text{ cm}^4$  (B)  $15961 \text{ cm}^4$  (C)  $86148 \text{ cm}^4$  (D)  $102384 \text{ cm}^3$  (E)  $46656 \text{ cm}^4$
- The second moments of areas 1, 2 and 3 about their centroidal  $y_c$ -axes are:  
(A)  $108 \text{ cm}^4$ ,  $441 \text{ cm}^4$ ,  $6543 \text{ cm}^4$  (B)  $36 \text{ cm}^4$ ,  $72 \text{ cm}^4$ ,  $288 \text{ cm}^4$  (C)  $108 \text{ cm}^4$ ,  $126 \text{ cm}^4$ ,  $2329.25 \text{ cm}^4$  (D)  $108 \text{ cm}^4$ ,  $2304 \text{ cm}^4$ ,  $13824 \text{ cm}^4$  (E)  $108 \text{ cm}^3$ ,  $144 \text{ cm}^3$ ,  $3456 \text{ cm}^3$
- The second moments of areas 1, 2 and 3 about the  $Y_C$ -axis are:  
(A)  $26244 \text{ cm}^4$ ,  $18432 \text{ cm}^4$ ,  $41472 \text{ cm}^4$  (B)  $423 \text{ cm}^4$ ,  $2511 \text{ cm}^4$ ,  $27414 \text{ cm}^4$  (C)  $1466 \text{ cm}^4$ ,  $1791 \text{ cm}^4$ ,  $3615 \text{ cm}^4$  (D)  $423 \text{ cm}^3$ ,  $2511 \text{ cm}^3$ ,  $27414 \text{ cm}^3$  (E)  $324 \text{ cm}^4$ ,  $1152 \text{ cm}^4$ ,  $41472 \text{ cm}^4$
- The second moment of the cross-section about its centroidal  $Y_C$ -axis is:  
(A)  $42948 \text{ cm}^4$  (B)  $46656 \text{ cm}^4$  (C)  $6871 \text{ cm}^4$  (D)  $9186.55 \text{ cm}^3$  (E)  $23756.73 \text{ cm}^4$
- The product (mixed) moments of areas 1, 2 and 3 about their centroidal  $x_c$  and  $y_c$ -axes are:  
(A) 0, 0, 0 (B)  $36 \text{ cm}^4$ ,  $-288 \text{ cm}^4$ ,  $288 \text{ cm}^4$  (C) 0,  $-221 \text{ cm}^4$ , 0 (D)  $36 \text{ cm}^3$ ,  $-288 \text{ cm}^3$ ,  $288 \text{ cm}^3$  (E) 0,  $72 \text{ cm}^4$ , 0
- The product (mixed) moments of areas 1, 2 and 3 about the  $X_C$  and  $Y_C$ -axes are:  
(A)  $3126.35 \text{ cm}^4$ ,  $787.99 \text{ cm}^4$ ,  $1368.60 \text{ cm}^4$  (B) 0,  $-288 \text{ cm}^4$ , 0 (C)  $-2511.2 \text{ cm}^4$ ,  $-661 \text{ cm}^4$ ,  $-1166.7 \text{ cm}^4$  (D)  $-3126.35 \text{ cm}^3$ ,  $-787.99 \text{ cm}^3$ ,  $-1368.60 \text{ cm}^3$  (E)  $36 \text{ cm}^4$ ,  $-288 \text{ cm}^4$ ,  $288 \text{ cm}^4$



**Please turn over**

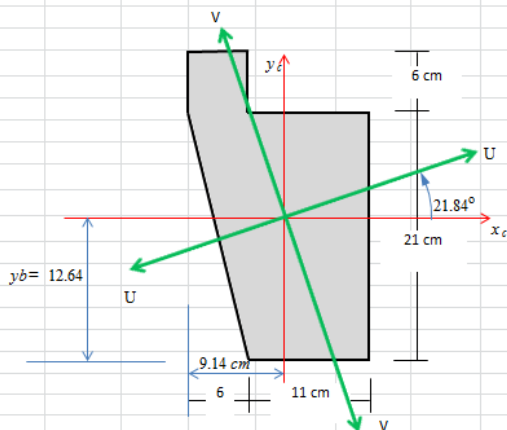
16. The product (mixed) moment of the cross-section about its centroidal  $X_C$  and  $Y_C$ -axis is:  
 (A)  $-7055.81 \text{ cm}^4$  (B)  $5570.18 \text{ cm}^4$  (C)  $-4339 \text{ cm}^4$  (D)  $5570.18 \text{ cm}^3$  (E)  $-557.80 \text{ cm}^4$
17. The direction of the principal axes is:  
 (A)  $54.5^\circ$  (B)  $36.1^\circ$  (C)  $45.0^\circ$  (D)  $21.84^\circ$  (E)  $18.7 \text{ cm}$
18. The principal moments of inertia are:  
 (A)  $7301.06 \text{ cm}^4$  (B)  $2564.21 \text{ cm}^4$  (C)  $25642.21 \text{ cm}^3$  (D)  $18407 \text{ cm}^4$  (E)  $-25642.21 \text{ cm}^4$   
 $310.76 \text{ cm}^4$   $730.06 \text{ cm}^4$   $7301.06 \text{ cm}^3$   $5133 \text{ cm}^4$   $-7301.06 \text{ cm}^4$
19. The polar moment of inertia is:  
 (A)  $7611.82 \text{ cm}^4$  (B)  $3294.28 \text{ cm}^4$  (C)  $32943.28 \text{ cm}^3$  (D)  $22832 \text{ cm}^4$  (E)  $-32943.28 \text{ cm}^4$
20. The radiuses of gyration for the cross-section about their centroidal  $X_C$  &  $Y_C$ -axes are:  
 (A)  $4.57 \text{ cm}^2$  (B)  $7.12 \text{ cm}^4$  (C)  $60 \text{ cm}$  (D)  $6.95 \text{ cm}$  (E)  $-4.57 \text{ cm}$   
 $7.12 \text{ cm}^2$   $7.12 \text{ cm}$   $60 \text{ cm}$   $4.56 \text{ cm}$   $-7.12 \text{ cm}$

**Answer:**

- |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1.  | (A) | (B) | (C) | (D) | ●   | 11. | (A) | (B) | ●   | (D) | (E) |
| 2.  | (A) | (B) | (C) | (D) | ●   | 12. | (A) | (B) | ●   | (D) | (E) |
| 3.  | (A) | (B) | (C) | (D) | ●   | 13. | (A) | (B) | ●   | (D) | (E) |
| 4.  | ●   | (B) | (C) | (D) | (E) | 14. | (A) | (B) | ●   | (D) | (E) |
| 5.  | ●   | (B) | (C) | (D) | (E) | 15. | (A) | (B) | ●   | (D) | (E) |
| 6.  | ●   | (B) | (C) | (D) | (E) | 16. | (A) | (B) | ●   | (D) | (E) |
| 7.  | ●   | (B) | (C) | (D) | (E) | 17. | (A) | (B) | (C) | ●   | (E) |
| 8.  | ●   | (B) | (C) | (D) | (E) | 18. | (A) | (B) | (C) | ●   | (E) |
| 9.  | (A) | ●   | (C) | (D) | (E) | 19. | (A) | (B) | (C) | ●   | (E) |
| 10. | (A) | ●   | (C) | (D) | (E) | 20. | (A) | (B) | (C) | ●   | (E) |

Element	A	x	y	Ax	Ay	x-xb	y-yb	$I_x$	$A(y-yb)^2$	$I_y$	$A(x-xb)^2$	$I_{xyc}$	$I_{xy}$		$I_x + A(y-yb)^2$	$I_y + A(x-xb)^2$
1	36.00	3.00	24.00	108.00	864.00	-6.14	11.36	108.00	4645.04	108.00	1357.59	0.00	-2511.19		4753.04	1465.59
2	63.00	4.00	14.00	252.00	882.00	-5.14	1.36	1543.50	116.37	126.00	1665.02	-220.50	-660.68		1659.87	1791.02
3	231.00	11.50	10.50	2656.50	2425.50	2.36	-2.14	8489.25	1058.79	2329.25	1285.59	0.00	-1166.69		9548.04	3614.84
	330.00			3016.50	4171.50			10140.75	5820.20	2563.25	4308.20		-4338.55		15960.95	6871.45

$x\bar{b} = 9.14 \text{ cm}$	$I_x = 15960.95 \text{ cm}^4$	$I_u = 17699.33 \text{ cm}^4$	$\tan(2 \text{ Theta}) = 0.9546295$	$I_p = 22832.40$
$y\bar{b} = 12.64 \text{ cm}$	$I_y = 6871.45 \text{ cm}^4$	$I_v = 5133.06 \text{ cm}^4$	$2 \text{ Theta} = 43.67$	$r_x = 6.9546$
			$\text{Theta} = 21.84$	$r_y = 4.56318$



With best wishes

Dr. M. Abdel-Kader