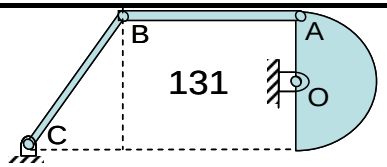
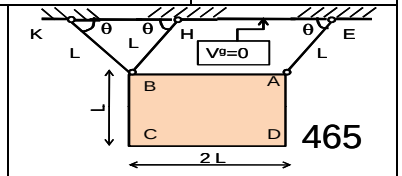
The shown mechanism consists of 3 rigid bodies, a semicircle (OA = 2m) where O is hinged support, Rod AB = 17m and Rod BC =5m. At the shown instant ωOA =7rad/s and αOA=8rad/s^2 both anti-clockwise. Assume all angular velocities and accelerations are C.C.W., Select the correct answer



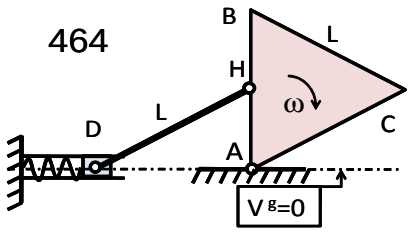
		A	B	C	D
1	$\underline{V}_A$ m/s	-14 i	-17 i	-16 i	-11 i
2	$\underline{V}_B$ m/s	-13i+9.8j	-14i+10.5j	-12i+9j	-17i+12.8j
3	ωAB	-0.618	-0.757	-0.664	-0.711
4	ωBC.	3.5	3	3.3	2.8
5	a_A m/s^2	-14i-86j	-19i-116j	-18i-110j	-16i-98j
6	a_B m/s^2	-11.36i-82.92j	-8.282i-60.43j	-9.515i-69.43j	-8.898i-64.93j
7	αAB	-2.079	-1.814	-1.415	-1.681
8	αBC	-6.319	-8.277	-6.809	-7.788

The shown plate ABCD (m=100kg, L=1.6m) is connected by three similar light rods AE, BH and BK (length=L, θ=35^o). Choose the correct answers in the following cases. Case(1): If the cable KB is broken, choose at θ=90^o. Case(2): the cable AE is broken, choose when BD became vertical. Assume g = 10 m/s^2



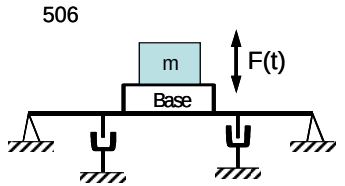
			A	B	C	D
9	Case 1	Total Energy E of the plate	-1355	-1960	-1718	-2081
10		The velocity of the point D	4.554	3.694	3.981	3.407
11		The angular velocity of ωAE	1.801	2.647	2.816	2.309
12		Ang. Accel. of αAE	119.3	79.56	159.1	198.9
13		The force in AE	985.5	926.4	808.2	1045
14	Case 2	IB of the plate	331.8	521.5	489.9	426.7
15		P.E. (V) of the plate	-2707	-2086	-2914	-3121
16		Ang. velocity of the plate ω	2.016	1.879	2.153	2.427
17		The force in cable BH	1595	1707	1482	1257

The shown system is consists of an equilateral triangular plate ABC (m=190m kg, L=4.4m) , a rod HD (mass=m, L m) and a block D (mass=m/3 kg) and the block is connected to a spring (k kN/m). In the shown position (pos. 1) where the spring is not streatched, the angular velocity of the plate is ω1=3.1rad/s (c.w.). If the system stops when the side AC reaches the horizontal position (Pos. 2).Choose the correct answers. Assume g = 10 m/s^2



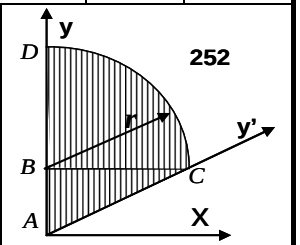
		A	B	C	D
18	IA for the plate (kg.m^2)	1891	1771	1533	1294
19	T K.E. of the plate in pos.1 joule	6457	7364	6003	8272
20	T K.E. of the rod in pos.1 joule	4419	4997	4708	5286
21	T K.E. of the block D in pos.1 joule	1473	1691	1801	1145
22	Vg of the system in pos. 1 joule	5863	7084	6270	5049
23	Vg of the system in pos. 2 joule	4223	3233	3893	4884
24	The stiffness of the spring k kN/m	27.02	36.75	29.45	34.31

A machine (m= 3900kg) is fixed in a base (mb) supported on 6 parallel similar steel frames as shown. The operation of the machine produces a dynamic horizontal force given by F(t)=3350sin (95t) N. The loading test data for one frame is (P=200, displacment=0.06mm). There are 4 dampers (each of 30kN s/m) used to reduce the vibration amplitude. Case 1: neglect base mass and damping. Case 2: neglect base mass. Choose the correct answers,



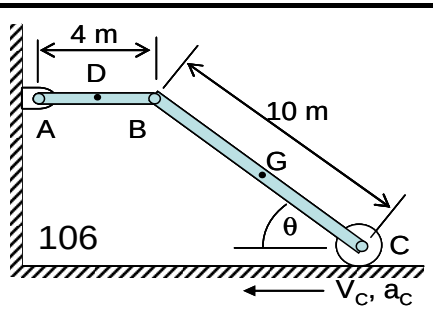
			A	B	C	D
25	Case 1	Natural Circular Freq. ωn (rad/sec)	56.9	71.61	81.42	61.81
26		Max. response Ymax (mm)	0.255	0.169	0.22	0.186
27		Base mass to reduce Ymax by 40%	901.3	1344	1049	1123
28	Case 2	Max. response Y2max (mm)	0.204	0.176	0.148	0.19
29		No. of dampers to stop free vibration	18	21	22	19
30		No. of dampers to reduce Y2max by 40%	10	9	12	8

The shown lamina is composed of a triangle plate ABC (AB= 0.4 m, BC= 0.6 m),and a circular plate BCD with radius r = BC. The density of the Lamina is constant = 200 kg/m^2. Calculate the following.



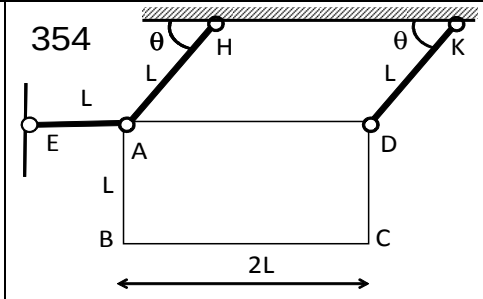
			A	B	C	D
31	Circular BCD	Ixx	22.49	25.66	28.82	30.4
32		Iyy	5.805	4.374	5.089	5.447
33		Ixy	10	11	8	12
34	Triangular ABC	Ixx	2.05	2.31	1.66	1.92
35		Iyy	1.66	1.11	1.33	1.22
36		Ixy	1.24	1.54	1.44	1.34
37	Total Lamina	Xcg	0.271	0.255	0.222	0.238
38		Iyy	6.529	5.62	6.075	7.893
39		Ixy	10.44	11.81	9.75	9.07
40		KA	0.699	0.794	0.603	0.651
41		Iy'y'	10.55	11.46	14.2	12.38

In the position shown, end C of rod BC has a velocity of 6.1 m/s and an acceleration of 8.2 m/s^2, both directed to the left. Points D and G are mid points of rods AB and BC, respectively. At $\theta=57^o$, select the correct answer



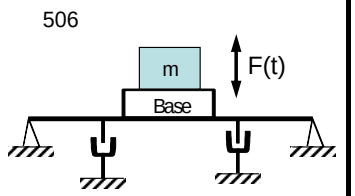
		A	B	C	D
1	ω_{BC} C.C.W.	-0.727	-0.781	-0.834	-0.62
2	ω_{AB} C.C.W.	0.77	1.211	0.917	0.99
3	α_{BC} C.C.W.	-0.166	-0.129	-0.154	-0.142
4	α_{AB} C.C.W.	-0.707	-0.883	-0.941	-1
5	$\underline{V_B}$ [m/s]	4.714j	3.961j	3.711j	3.209j
6	V_G [m/s]	2.978	4.076	4.295	3.417
7	a_B [m/s^2]	-3.668i-3.301j	-4.433i-3.99j	-3.923i-3.53j	-3.413i-3.071j
8	a_C [m/s^2]	6.816	5.811	7.318	5.309
9	a_D [m/s^2]	-1.834i-1.65j	-1.706i-1.535j	-1.962i-1.765j	-1.579i-1.421j

A uniform rectangular plate ABCD (m=215kg, L=3.8m) is fixed in the shown position by three light rods AE, AH and DK each of length L.Given angle $\theta=25^o$. Given G=10 m/s^2, study the motion of the plate and choose the coorrect answers in the following cases: Case A when the rod AE suddenly removed. Case B when the rod DK suddenly removed. Case C when rods AE and AH suddenly removed together.



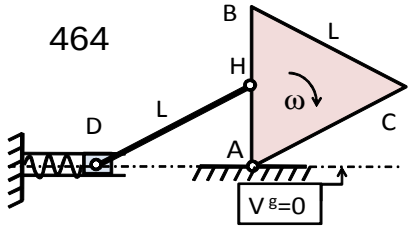
			A	B	C	D
10		ω_{AH} just after breaking	4.96	2.48	3.72	6.2
11		α_{AH} just after breaking	2.916	2.385	2.562	2.031
12		T_{AH} just after breaking	-38.83	-30.82	-32.83	-36.83
13		T_{DK} just after breaking	1166	1016	716.4	941.5
14	Case A	T_{AE} just after breaking	0	57.35	28.67	14.34
15		ω_{AH} at $\theta=80^o$	1.72	1.35	1.597	1.967
16		α_{AH} at $\theta=80^o$	0.489	0.457	0.52	0.362
17		T_{AH} at $\theta=80^o$	1617	2218	2518	1917
18		T_{DK} at $\theta=80^o$	2776	2467	2313	2159
19		α plate just after breaking	1.389	1.484	1.864	1.579
20		T_{AH} just after breaking	1637	1902	2035	1770
21		T_{AE} just after breaking	2323	2987	2489	1991
22	Case B	α plate when AC vertical	28.92	57.85	14.46	0
23		ω plate when AC vertical	1.287	1.397	1.507	1.068
24		T_{AH} when AC vertical	9306	10496.4	9901	7520
25		T_{AE} when AC vertical	7844	10204.2	7253	8434
26		α plate just after breaking	-0.081	-0.087	-0.075	-0.069
27	Case C	α_{DK} just after breaking	2.319	2.006	2.476	2.946
28		T_{DK} just after breaking	1091	721.9	906.6	845

A machine (m= 3900kg) is fixed in a base (mb) supported on 6 parallel similar steel frames as shown. The operation of the machine produces a dynamic horizontal force given by F(t)=3350sin (95t) N. The loading test data for one frame is (P= 200 N, displacment=0.06mm). There are 4 dampers (each of 30kN s/m) used to reduce the vibration amplitude. Case 1: neglect base mass and damping. Case 2: neglect base mass. Choose the correct answers,



			A	B	C	D
29		Natural Circular Freq. ωn (rad/sec)	56.9	71.61	81.42	61.81
30	Case 1	Max. response Ymax (mm)	0.255	0.169	0.22	0.186
31		Base mass to reduce Ymax by 40%	901.3	1344	1049	1123
32		Max. response Y2max (mm)	0.204	0.176	0.148	0.19
33	Case 2	Min. No. of dampers to stop free vibration	17	21	23	19
34		No. of dampers to reduce Y2max by 40%	10	6	12	8

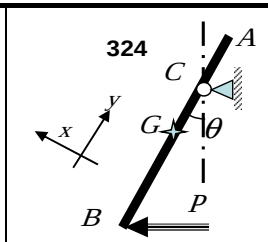
The shown system is consists of an equilateral triangular plate ABC (m=190kg, L=4.4meters) , a rod HD (mass=m) and a block D (mass=m/3 kg) and the block is connected to a spring (k kN/m). In the shown position (pos. 1) where the spring is not streatched, the angular velocity of the plate is ω1=3.1rad/s (c.w.). If the system stops when the side AC reaches the horizontal position (Pos. 2).Choose the correct answers. Assume g = 10 m/s^2



		A	B	C	D
35	IA for the plate (kg.m^2)	1891	1771	1533	1294
36	T K.E. of the plate in pos.1 joule	6457	7364	6003	8272
37	T K.E. of the rod in pos.1 joule	4419	4997	4708	5286
38	T K.E. of the block D in pos.1 joule	1473	1691	1801	1145
39	Vg Total P.E. in pos. 1 joule	5863	7084	6270	5049
40	Vg Total P.E. in pos. 2 joule	4223	3233	3893	4884
41	The stiffness of the spring k kN/m	27.02	36.75	29.45	34.31

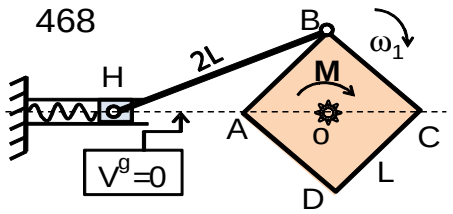
The horizontal force P= 4000N is applied at the end B of the uniform rod AB(L=20m, mass=80kg). The rod is initially at rest at θ=0. Given that point C is the midpoint of AG, where G is the center of mass of the rod AB.

Assume g=9.8 m/s^2, Select the correct answer



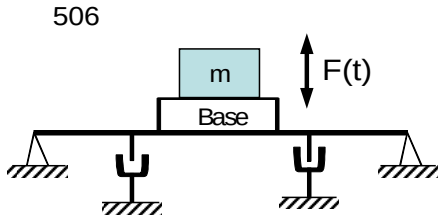
		A	B	C	D
1	Ic(Polar)	7105	8717	4667	3843
2	α at θ=0^o	12.86	19.57	2.731	24.02
3	Cx Reaction at θ=0^o	1285	2135	1143	242.7
4	Cy Reaction at θ=0^o	166.5	784	558.7	881.7
5	ω at θ=50^o	5.998	4.915	4.37	3.114
6	α at θ=50^o	1.305	10.46	5.431	7.621
7	Cx Reaction at θ=50^o	1078	2013	184.6	1479
8	Cy Reaction at θ=50^o	15898.9	1919	11207.4	20935

In Problem 468, a square plate ABCD (m=67.5 kg, L=2 m), a rod HB (m/2 kg, 2 L m) and a block H (m/5 kg) and the block is connected to a spring (k N/m). The system starts its motion from rest when the rod HB is horizontal (Pos. 1) under the action of a moment M=2200 where the spring is unstretched. In the shown position (pos. 2) where BD is vertical, the angular velocity of the plate becomes ω2=2.7 rad/sec (c.w.). Given g=10 m/s^2



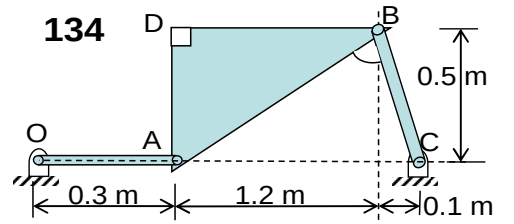
		A	B	C	D
9	Io for ABCD	42	39	45	36
10	T2 ABCD	125.9	202.2	176.7	151.3
11	T2 BH	212.3	246	262.9	296.7
12	T2 Block H	98.42	112.7	91.26	119.9
13	W1-2 (non-conservative)	3456	2724	3212	3943
14	Vg2	275	256.8	238.6	184.1
15	K	2076	1937	1658	1797

In Fig. 506, a machine (m= 3900kg) is fixed in a base (mb) supported on 6 beams, parallel similar as shown. The operation of the machine produces a dynamic vertical force given by F(t)=3350sin (95t) N. The loading test data for a beam is (P= 200 N, displacment=0.06mm). There are 4 dampers (each of C=30kN s/m) used to reduce the vibration amplitude. Case 1: neglect base mass and damping. Case 2: neglect base mass. Choose the correct answers,



			A	B	C	D
16		Natural Circular Freq. ωn (rad/sec)	56.9	71.61	81.42	61.81
17	Case 1	Max. vertical response Ymax (mm)	0.255	0.169	0.22	0.186
18		Base mass to reduce Ymax by 40%	901.3	1344	1049	1123
19		Max. vertical response Ymax2 (mm)	0.204	0.176	0.148	0.19
20	Case 2	Min. No. of dampers to stop free vibration	18	21	22	19
21		Min. No. of dampers to reduce Ymax2 by 40%	10	9	12	8

The shown mechanism consists of 3 rigid bodies, a right angle Triangle ABD, a Rod OA and a Rod BC At the shown instant the Rod OA is horizontal. Given ωOA =7rad/s and αOA=8rad/s^2 both anti-clockwise. Points C and O are hinged supports. Assume all angular velocities and accelerations are C.C.W., Select the correct answer



		A	B	C	D
22	V_A [m/s]	2.5j	1.8j	2.1j	2 j
23	V_B [m/s]	0.956i+0.191j	0.659i+0.132j	0.857i+0.171j	0.808i+0.162j
24	ωAB	-1.259	-1.497	-1.378	-1.734
25	ωBC	-1.859	-1.737	-1.493	-1.615
26	a_A [m/s^2]	-14.7i+2.4j	-15.8i+2.6j	-11.5i+1.9j	-16.8i+2.7j
27	a_B [m/s^2]	-17.97i-5.166j	-13.06i-3.755j	-15.52i-4.46j	-19.2i-5.518j
28	αAB	-3.78	-4.63	-5.196	-5.479
29	αBC	36.39	33.97	24.31	31.56
30	a_D [m/s^2]	-14.28i+1.262j	-11.44i+1.012j	-12.39i+1.095j	-15.22i+1.346j

QN	Exam		
	1	2	3
	Answers		
1	a	a	c
2	b	d	a
3	a	a	c
4	a	b	b
5	d	b	c
6	c	e	d
7	d	c	a
8	c	e	c
9	c	c	c
10	b	e	e
11	d	b	b
12	e	c	a
13	b	d	ae
14	d	a	c
15	a	a	b
16	c	b	b
17	a	e	c
18	c	b	d
19	b	d	b
20	a	c	d
21	a	c	a
22	c	d	c
23	a	b	d
24	d	a	e
25	b	d	d
26	c	a	a
27	d	c	c
28	b	c	b
29	d	b	d
30	a	c	c
31	b	d	
32	c	b	
33	e	d	
34	d	a	
35	e	c	
36	c	b	
37	d	a	
38	a	a	
39	a	c	
40	d	a	
41	b	d	