國立雲林科技大學
97學年度碩士班入學招生考試試題

系所：機械系
科目：工程數學

1.(25%)

Please find the Laplace transform for the function f(t) shown in the figure 1.

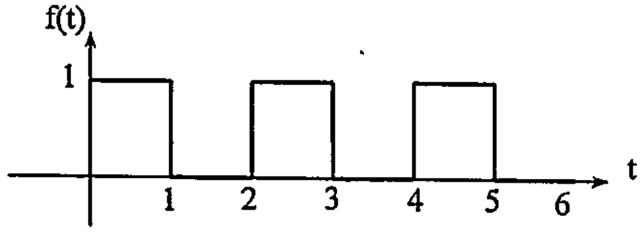

Figure 1.

2.(25%)

Given an equations as below

y'' + 3y' + 2y = 2f(t),

with y(0)=1.5, y'(0) = 0 and a force function f(t) given in figure 1, please find y(t) **in the range 1≦t≦2**. **(Explicit form is required)**

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3. Find parametric equations for the line of intersection of

$$x+y-z=1,$$

$$x-2y+z=5. \quad (10\%)$$

4. Find the eigenvalues and eigenvectors of the matrix

$$\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}. \quad (10\%)$$

5. Find the directional derivative of $f(x,y)=2x^3+xy^2$ at $(1,-1)$ in the direction of $(\mathbf{i}-\mathbf{j})$. (10%)

6. Solve the boundary-value problem

$$\frac{\partial^2 u}{\partial x^2}+2=\frac{\partial u}{\partial t}, \quad 0<x<1,\ t>0$$

$$u(0,t)=0,\ u(1,t)=1, \quad t>0$$

$$u(x,0)=-x^2+2x+3\sin \pi x, \ 0<x<1. \quad (20\%)$$

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系所：機械系
科目：材料力學

1. The A-36 steel rod shown in Fig.1 has a diameter of $5mm$. It is attached to the fixed wall at A, and before it is loaded there is gap between the wall at B' and the rod of 1mm. Determine the reaction at A and B'. $E = 200GPa$ (25%)

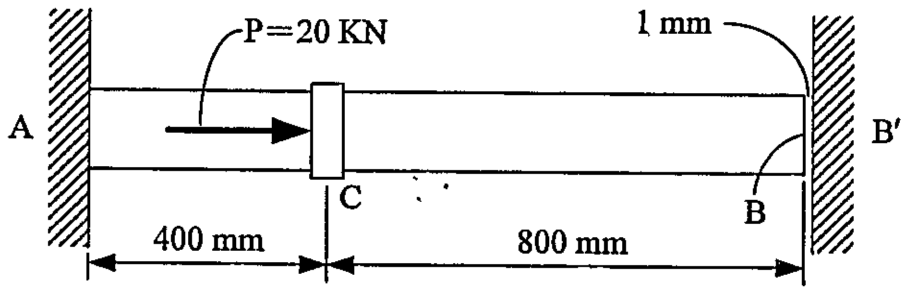

Fig.1

2. A solid steel shaft $ABCD$ (Fig.2) having diameter $d = 75mm$ turns freely in a bearing at D and is loaded at B and C by torques $T_1 = 2260N.m$ and $T_2 = 1356N.m$. The shaft is connected in the gear box at A to gears that are temporarily locked in poison. Determine the maximum shear stress in each part of the shaft and the angle of twist ϕ at end D. (Assume $L_1 = 500mm$, $L_2 = 750mm$, $L_3 = 500mm$, and $G = 79300MPa$) (25%)

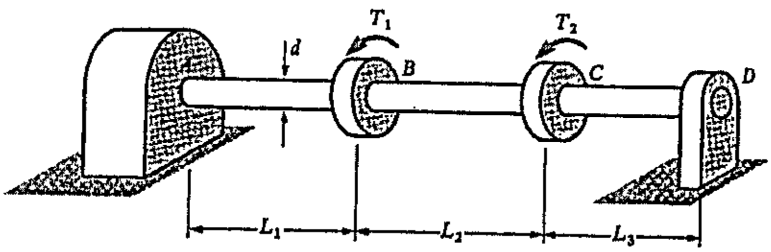

Fig.2

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科目：材料力學

3. The state of plane stress at a point is represented by the element as shown. [a] Determine the state of stress on another element oriented 20° clockwise from the position shown. (答案請畫出來表示之。) Determine: [b] the principal stress and their directions; [c] the maximum in-plane shear stress and their directions. [d] Draw the Mohr's circle for this case. (25%)

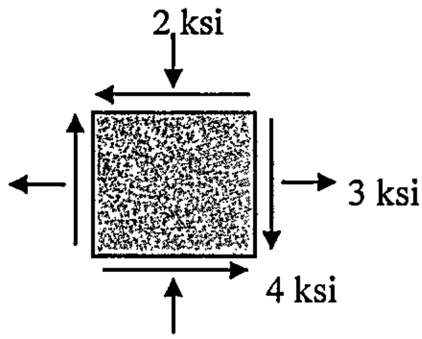

Figure for Problem 3

4. The simply supported beam *AB* supports the triangular distributed loading as shown. [a] Draw the shear and moment diagrams for the beam. Determine: [b] the equations of the elastic curve (i.e. find deflection v and slope θ); [c] the maximum deflection δ_{max}. The beam has length L and constant rigidity EI. (25%)

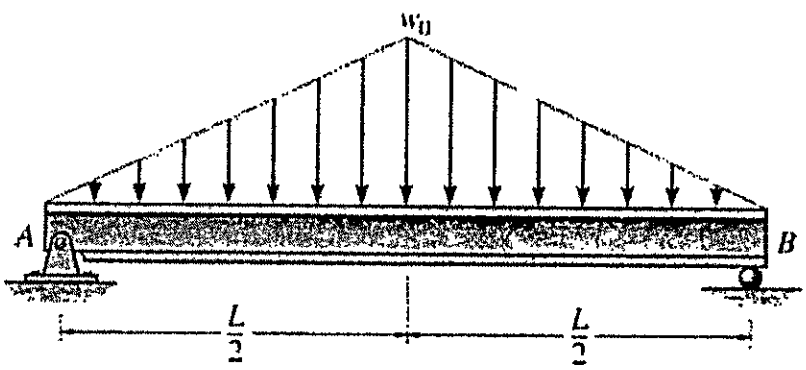

Figure for Problem 4

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系所：機械系
科目：自動控制

1. Consider a system governed by the following differential equation:

$$\frac{d^2y}{dt^2}+\frac{dy}{dt}+2\cos(y)=u$$

where u is the input and y is the output of the system.

(A) Derive the *linearized* equation of the system about $y=\frac{\pi}{2}$. (10%)

(B) Let $u=k(y-\pi/2)$, where k is a constant. Determine the range of k for which the linearized system is stable. (10%)

2. Sketch the *root loci* of the following characteristic equations for $k=0\sim+\infty$. For each root locus please also determine the value of k for which the system is marginally stable.

(A) $1+\frac{k}{(s+3)^2(s+6)}=0$ (10%)

(B) $1+\frac{k(s^2+2s+2)}{(s+2)^2(s-1)}=0$ (10%)

(C) $1+\frac{-k}{(s+1)(s+2)}=0$ (10%)

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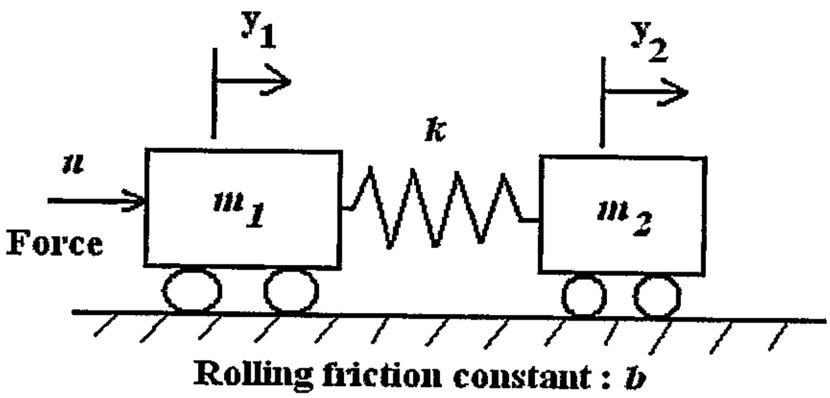
科目：自動控制

3. The transfer function of a unity feedback control system is

$$G(s) = \frac{(s+5)}{(s+2)(s+4)}$$

(a) For the Bode magnitude diagram, find the slopes of asymptotic lines for small frequency and large frequency, respectively. (5%)
(b) Sketch the Bode plots. (15%)
(c) Is this system stable? Why? (5%)

4. For the two-mass system shown below. If the output variable is $y_2(t)$ and the rolling friction constant is b, please determine the State Variable Model for this system. (25%)



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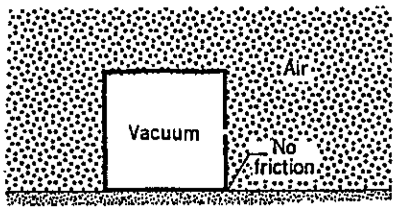
系所：機械系
科目：專業實務

1. An evacuated box is at rest on a frictionless table. You punch a small hole in one face so that air can enter. (See Fig. below.) How will the box move? What argument did you use to arrive at your answer? 20%



2. As to the car speeding checking, please describe the fundamental principle of the speed detection. 15%
3. Please describe what is RFID system and explain its fundamental principle of operation. 15%

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系所：機械系
科目：專業實務

4. 高爾夫球是一項不分年齡與性別的運動，甚受各階層的人所喜愛，從青少年到老年人都可參與。然而，高爾夫球運動的主要器材是打擊球的球桿，球桿由球頭及桿子所構成。球頭可分爲以下二類，(1)傳統的精密脫臘製造，其材料爲不銹鋼，(2)精密閉模鍛造，其材料爲鈦合金。另外桿子的長度約43吋，可分爲以下二類，(1)金屬桿子，(2)碳纖維桿子。請盡你所知詳細回答下列問題：

(A)詳細說明不銹鋼球頭的設計理念，製造流程，所需生產機器設備與品管方式。

(B)詳細說明鈦合金球頭的設計理念，製造流程，所需生產機器設備與品管方式。

(C)詳細說明金屬桿子的設計理念，製造流程，所需生產機器設備與品管方式。

(D)詳細說明碳纖維桿子的設計理念，製造流程，所需生產機器設備與品管方式。

(E)詳細說明球頭和桿子的接合方式。

(50%)

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系所：機械系
科目：熱力學

1. A cylinder is initially filled with saturated liquid-vapor mixture of R-134a at a specified pressure P1 = 200 kPa. At the initial state, the mass of R-134a is 0.2 kg with vapor quality of 0.25. Heat is transferred to the cylinder until the refrigerant vaporizes completely at constant pressure P1. Please determine (a) the initial volume (8%), (b) the work done (8%), and (c) the total heat transfer to R-134a (9%). The specific liquid volume and vapor volume of R-134a at the above condition are 0.07533 and 0.099867 m^3/kg, respectively. The internal liquid and vapor energies of R-134a at the above condition are 38.28 and 224.49 kJ/kg, respectively.

2. A Carnot heat engine receives 500 kJ of heat per cycle from a high-temperature heat reservoir at 652°C and rejects heat to a low-temperature heat reservoir at 30°C. Determine: (a) The thermal efficiency of this Carnot engine, (b) The amount of heat rejected to the low-temperature heat reservoir. (25%)

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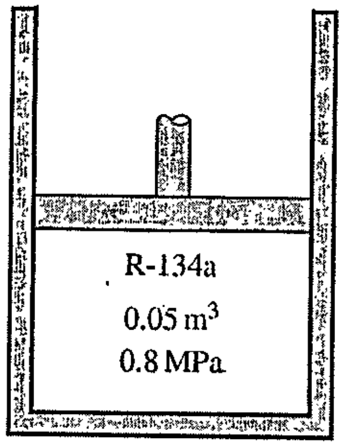
系所：機械系
科目：熱力學

3. An insulated piston–cylinder device contains $0.05\,m^3$ of saturated refrigerant-134a vapor at 0.8 MPa pressure. The refrigerant is now allowed to expand in a reversible manner until the pressure drops to 0.4 MPa. Determine (*a*) the final temperature in the cylinder and (*b*) the work done by the refrigerant. (25%)



4. A gas-turbine power plant operates on the simple Brayton cycle with air as the working fluid and delivers 32 MW of power. The minimum and maximum temperatures in the cycle are 310 and 900 K, and the pressure of air at the compressor exit is 8 times the value at the compressor inlet. Assuming an isentropic efficiency of 80 percent for the compressor and 86 percent for the turbine, determine the mass flow rate of air through the cycle. Account for the variation of specific heats with temperature. (25%)

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科目：熱力學

Saturated refrigerant-134a—Pressure table

		Specific volume, m^3/kg		Internal energy, kJ/kg			Enthalpy, kJ/kg			Entropy, kJ/kg · K		
Press., P kPa	Sat. temp., T_{sat} °C	Sat. liquid, v_f	Sat. vapor, v_g	Sat. liquid, u_f	Evap., u_{fg}	Sat. vapor, u_g	Sat. liquid, h_f	Evap., h_{fg}	Sat. vapor, h_g	Sat. liquid, s_f	Evap., s_{fg}	Sat. vapor, s_g
60	−36.95	0.0007098	0.31121	3.798	205.32	209.12	3.841	223.95	227.79	0.01634	0.94807	0.96441
70	−33.87	0.0007144	0.26929	7.680	203.20	210.88	7.730	222.00	229.73	0.03267	0.92775	0.96042
80	−31.13	0.0007185	0.23753	11.15	201.30	212.46	11.21	220.25	231.46	0.04711	0.90999	0.95710
90	−28.65	0.0007223	0.21263	14.31	199.57	213.88	14.37	218.65	233.02	0.06008	0.89419	0.95427
100	−26.37	0.0007259	0.19254	17.21	197.98	215.19	17.28	217.16	234.44	0.07188	0.87995	0.95183
120	−22.32	0.0007324	0.16212	22.40	195.11	217.51	22.49	214.48	236.97	0.09275	0.85503	0.94779
140	−18.77	0.0007383	0.14014	26.98	192.57	219.54	27.08	212.08	239.16	0.11087	0.83368	0.94456
160	−15.60	0.0007437	0.12348	31.09	190.27	221.35	31.21	209.90	241.11	0.12693	0.81496	0.94190
180	−12.73	0.0007487	0.11041	34.83	188.16	222.99	34.97	207.90	242.86	0.14139	0.79826	0.93965
200	−10.09	0.0007533	0.099867	38.28	186.21	224.48	38.43	206.03	244.46	0.15457	0.78316	0.93773
240	−5.38	0.0007620	0.083897	44.48	182.67	227.14	44.66	202.62	247.28	0.17794	0.75664	0.93458
280	−1.25	0.0007699	0.072352	49.97	179.50	229.46	50.18	199.54	249.72	0.19829	0.73381	0.93210
320	2.46	0.0007772	0.063604	54.92	176.61	231.52	55.16	196.71	251.88	0.21637	0.71369	0.93006
360	5.82	0.0007841	0.056738	59.44	173.94	233.38	59.72	194.08	253.81	0.23270	0.69566	0.92836
400	8.91	0.0007907	0.051201	63.62	171.45	235.07	63.94	191.62	255.55	0.24761	0.67929	0.92691
450	12.46	0.0007985	0.045619	68.45	168.54	237.00	68.81	188.71	257.53	0.26465	0.66069	0.92535
500	15.71	0.0008059	0.041118	72.93	165.82	238.75	73.33	185.98	259.30	0.28023	0.64377	0.92400
550	18.73	0.0008130	0.037408	77.10	163.25	240.35	77.54	183.38	260.92	0.29461	0.62821	0.92282
600	21.55	0.0008199	0.034295	81.02	160.81	241.83	81.51	180.90	262.40	0.30799	0.61378	0.92177
650	24.20	0.0008266	0.031646	84.72	158.48	243.20	85.26	178.51	263.77	0.32051	0.60030	0.92081
700	26.69	0.0008331	0.029361	88.24	156.24	244.48	88.82	176.21	265.03	0.33230	0.58763	0.91994
750	29.06	0.0008395	0.027371	91.59	154.08	245.67	92.22	173.98	266.20	0.34345	0.57567	0.91912
800	31.31	0.0008458	0.025621	94.79	152.00	246.79	95.47	171.82	267.29	0.35404	0.56431	0.91835
850	33.45	0.0008520	0.024069	97.87	149.98	247.85	98.60	169.71	268.31	0.36413	0.55349	0.91762
900	35.51	0.0008580	0.022683	100.83	148.01	248.85	101.61	167.66	269.26	0.37377	0.54315	0.91692
950	37.48	0.0008641	0.021438	103.69	146.10	249.79	104.51	165.64	270.15	0.38301	0.53323	0.91624
1000	39.37	0.0008700	0.020313	106.45	144.23	250.68	107.32	163.67	270.99	0.39189	0.52368	0.91558
1200	46.29	0.0008934	0.016715	116.70	137.11	253.81	117.77	156.10	273.87	0.42441	0.48863	0.91303
1400	52.40	0.0009166	0.014107	125.94	130.43	256.37	127.22	148.90	276.12	0.45315	0.45734	0.91050
1600	57.88	0.0009400	0.012123	134.43	124.04	258.47	135.93	141.93	277.86	0.47911	0.42873	0.90784
1800	62.87	0.0009639	0.010559	142.33	117.83	260.17	144.07	135.11	279.17	0.50294	0.40204	0.90498
2000	67.45	0.0009886	0.009288	149.78	111.73	261.51	151.76	128.33	280.09	0.52509	0.37675	0.90184
2500	77.54	0.0010566	0.006936	166.99	96.47	263.45	169.63	111.16	280.79	0.57531	0.31695	0.89226
3000	86.16	0.0011406	0.005275	183.04	80.22	263.26	186.46	92.63	279.09	0.62118	0.25776	0.87894

Superheated refrigerant-134a

T °C	v m^3/kg	u kJ/kg	h kJ/kg	s kJ/kg · K	v m^3/kg	u kJ/kg	h kJ/kg	s kJ/kg · K	v m^3/kg	u kJ/kg	h kJ/kg	s kJ/kg · K
	P = 0.28 MPa (T_{sat} = −1.25°C)				P = 0.32 MPa (T_{sat} = 2.46°C)				P = 0.40 MPa (T_{sat} = 8.91°C)			
Sat.	0.07235	229.46	249.72	0.9321	0.06360	231.52	251.88	0.9301	0.051201	235.07	255.55	0.9269
0	0.07282	230.44	250.83	0.9362								
10	0.07646	238.27	259.68	0.9680	0.06609	237.54	258.69	0.9544	0.051506	235.97	256.58	0.9305
20	0.07997	246.13	268.52	0.9987	0.06925	245.50	267.66	0.9856	0.054213	244.18	265.86	0.9628
30	0.08338	254.06	277.41	1.0285	0.07231	253.50	276.65	1.0157	0.056796	252.36	275.07	0.9937
40	0.08672	262.10	286.38	1.0576	0.07530	261.60	285.70	1.0451	0.059292	260.58	284.30	1.0236
50	0.09000	270.27	295.47	1.0862	0.07823	269.82	294.85	1.0739	0.061724	268.90	293.59	1.0528
60	0.09324	278.56	304.67	1.1142	0.08111	278.15	304.11	1.1021	0.064104	277.32	302.96	1.0814
70	0.09644	286.99	314.00	1.1418	0.08395	286.62	313.48	1.1298	0.066443	285.86	312.44	1.1094
80	0.09961	295.57	323.46	1.1690	0.08675	295.22	322.98	1.1571	0.068747	294.53	322.02	1.1369
90	0.10275	304.29	333.06	1.1958	0.08953	303.97	332.62	1.1840	0.071023	303.32	331.73	1.1640
100	0.10587	313.15	342.80	1.2222	0.09229	312.86	342.39	1.2105	0.073274	312.26	341.57	1.1907
110	0.10897	322.16	352.68	1.2483	0.09503	321.89	352.30	1.2367	0.075504	321.33	351.53	1.2171
120	0.11205	331.32	362.70	1.2742	0.09775	331.07	362.35	1.2626	0.077717	330.55	361.63	1.2431
130	0.11512	340.63	372.87	1.2997	0.10045	340.39	372.54	1.2882	0.079913	339.90	371.87	1.2688
140	0.11818	350.09	383.18	1.3250	0.10314	349.86	382.87	1.3135	0.082096	349.41	382.24	1.2942

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科目：熱力學

Superheated refrigerant-134a

T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg·K	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg·K	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg·K
	P = 0.80 MPa (T_{sat} = 31.31°C)				P = 0.90 MPa (T_{sat} = 35.51°C)				P = 1.00 MPa (T_{sat} = 39.37°C)			
Sat.	0.025621	246.79	267.29	0.9183	0.022683	248.85	269.26	0.9169	0.020313	250.68	270.99	0.9156
40	0.027035	254.82	276.45	0.9480	0.023375	253.13	274.17	0.9327	0.020406	251.30	271.71	0.9179
50	0.028547	263.86	286.69	0.9802	0.024809	262.44	284.77	0.9660	0.021796	260.94	282.74	0.9525
60	0.029973	272.83	296.81	1.0110	0.026146	271.60	295.13	0.9976	0.023068	270.32	293.38	0.9850
70	0.031340	281.81	306.88	1.0408	0.027413	280.72	305.39	1.0280	0.024261	279.59	303.85	1.0160
80	0.032659	290.84	316.97	1.0698	0.028630	289.86	315.63	1.0574	0.025398	288.86	314.25	1.0458
90	0.033941	299.95	327.10	1.0981	0.029806	299.06	325.89	1.0860	0.026492	298.15	324.64	1.0748
100	0.035193	309.15	337.30	1.1258	0.030951	308.34	336.19	1.1140	0.027552	307.51	335.06	1.1031
110	0.036420	318.45	347.59	1.1530	0.032068	317.70	346.56	1.1414	0.028584	316.94	345.53	1.1308
120	0.037625	327.87	357.97	1.1798	0.033164	327.18	357.02	1.1684	0.029592	326.47	356.06	1.1580
130	0.038813	337.40	368.45	1.2061	0.034241	336.76	367.58	1.1949	0.030581	336.11	366.69	1.1846
140	0.039985	347.06	379.05	1.2321	0.035302	346.46	378.23	1.2210	0.031554	345.85	377.40	1.2109
150	0.041143	356.85	389.76	1.2577	0.036349	356.28	389.00	1.2467	0.032512	355.71	388.22	1.2368
160	0.042290	366.76	400.59	1.2830	0.037384	366.23	399.88	1.2721	0.033457	365.70	399.15	1.2623
170	0.043427	376.81	411.55	1.3080	0.038408	376.31	410.88	1.2972	0.034392	375.81	410.20	1.2875
180	0.044554	386.99	422.64	1.3327	0.039423	386.52	422.00	1.3221	0.035317	386.04	421.36	1.3124

Ideal-gas properties of air

T K	h kJ/kg	P_r	u kJ/kg	v_r	s° kJ/kg·K
200	199.97	0.3363	142.56	1707.0	1.29559
210	209.97	0.3987	149.69	1512.0	1.34444
220	219.97	0.4690	156.82	1346.0	1.39105
230	230.02	0.5477	164.00	1205.0	1.43557
240	240.02	0.6355	171.13	1084.0	1.47824
250	250.05	0.7329	178.28	979.0	1.51917
260	260.09	0.8405	185.45	887.8	1.55848
270	270.11	0.9590	192.60	808.0	1.59634
280	280.13	1.0889	199.75	738.0	1.63279
285	285.14	1.1584	203.33	706.1	1.65055
290	290.16	1.2311	206.91	676.1	1.66802
295	295.17	1.3068	210.49	647.9	1.68515
298	298.18	1.3543	212.64	631.9	1.69528
300	300.19	1.3860	214.07	621.2	1.70203
305	305.22	1.4686	217.67	596.0	1.71865
310	310.24	1.5546	221.25	572.3	1.73498
315	315.27	1.6442	224.85	549.8	1.75106
320	320.29	1.7375	228.42	528.6	1.76690
325	325.31	1.8345	232.02	508.4	1.78249
330	330.34	1.9352	235.61	489.4	1.79783
340	340.42	2.149	242.82	454.1	1.82790
350	350.49	2.379	250.02	422.2	1.85708
360	360.58	2.626	257.24	393.4	1.88543
370	370.67	2.892	264.46	367.2	1.91313
380	380.77	3.176	271.69	343.4	1.94001
390	390.88	3.481	278.93	321.5	1.96633
400	400.98	3.806	286.16	301.6	1.99194
410	411.12	4.153	293.43	283.3	2.01699
420	421.26	4.522	300.69	266.6	2.04142
430	431.43	4.915	307.99	251.1	2.06533
440	441.61	5.332	315.30	236.8	2.08870
450	451.80	5.775	322.62	223.6	2.11161
460	462.02	6.245	329.97	211.4	2.13407
470	472.24	6.742	337.32	200.1	2.15604
480	482.49	7.268	344.70	189.5	2.17760
490	492.74	7.824	352.08	179.7	2.19876
500	503.02	8.411	359.49	170.6	2.21952
510	513.32	9.031	366.92	162.1	2.23993
520	523.63	9.684	374.36	154.1	2.25997
530	533.98	10.37	381.84	146.7	2.27967
540	544.35	11.10	389.34	139.7	2.29906
550	555.74	11.86	396.86	133.1	2.31809
560	565.17	12.66	404.42	127.0	2.33685
570	575.59	13.50	411.97	121.2	2.35531

T K	h kJ/kg	P_r	u kJ/kg	v_r	s° kJ/kg·K
580	586.04	14.38	419.55	115.7	2.37348
590	596.52	15.31	427.15	110.6	2.39140
600	607.02	16.28	434.78	105.8	2.40902
610	617.53	17.30	442.42	101.2	2.42644
620	628.07	18.36	450.09	96.92	2.44356
630	638.63	19.84	457.78	92.84	2.46048
640	649.22	20.64	465.50	88.99	2.47716
650	659.84	21.86	473.25	85.34	2.49364
660	670.47	23.13	481.01	81.89	2.50985
670	681.14	24.46	488.81	78.61	2.52589
680	691.82	25.85	496.62	75.50	2.54175
690	702.52	27.29	504.45	72.56	2.55731
700	713.27	28.80	512.33	69.76	2.57277
710	724.04	30.38	520.23	67.07	2.58810
720	734.82	32.02	528.14	64.53	2.60319
730	745.62	33.72	536.07	62.13	2.61803
740	756.44	35.50	544.02	59.82	2.63280
750	767.29	37.35	551.99	57.63	2.64737
760	778.18	39.27	560.01	55.54	2.66176
780	800.03	43.35	576.12	51.64	2.69013
800	821.95	47.75	592.30	48.08	2.71787
820	843.98	52.59	608.59	44.84	2.74504
840	866.08	57.60	624.95	41.85	2.77170
860	888.27	63.09	641.40	39.12	2.79783
880	910.56	68.98	657.95	36.61	2.82344
900	932.93	75.29	674.58	34.31	2.84856
920	955.38	82.05	691.28	32.18	2.87324
940	977.92	89.28	708.08	30.22	2.89748
960	1000.55	97.00	725.02	28.40	2.92128
980	1023.25	105.2	741.98	26.73	2.94468
1000	1046.04	114.0	758.94	25.17	2.96770
1020	1068.89	123.4	776.10	23.72	2.99034
1040	1091.85	133.3	793.36	23.29	3.01260
1060	1114.86	143.9	810.62	21.14	3.03449
1080	1137.89	155.2	827.88	19.98	3.05608
1100	1161.07	167.1	845.33	18.896	3.07732
1120	1184.28	179.7	862.79	17.886	3.09825
1140	1207.57	193.1	880.35	16.946	3.11883
1160	1230.92	207.2	897.91	16.064	3.13916
1180	1254.34	222.2	915.57	15.241	3.15916
1200	1277.79	238.0	933.33	14.470	3.17888
1220	1301.31	254.7	951.09	13.747	3.19834
1240	1324.93	272.3	968.95	13.069	3.21751

國立雲林科技大學
97學年度碩士班入學招生考試試題

系所：機械系
科目：機械製造

1．一般鋼管分爲有縫及無縫兩種，試問其製造方法有那些(各舉出三種)？並簡述原理(15%)

2．試說明逆向工程流程?並舉出五種不同快速成型技術(RP)，並分別說明其原理及優、缺點(20%)

3.說明 CMP(Chemical-Mechanical Polishing)及 MCP(Mechano-chemical Polishing)之原理及其差異(15%)

4. Describe each of the processes listed below:
   (a) Thermal spray
   (b) Chemical Vapor Deposition, CVD
   (c) Electroplating
   (d) Thermal evaporation
   (e) Nitriding

(15%)

5. List two different applications that favor the use of single-crystal materials. For each application explain what advantages the single crystal offers over competing polycrystalline materials.

(10%)

6. Explain why metal alloys designed for use in high-temperature environments often contain Cr additions.

(10%)

7. Explain the relationship between each of the following strengthening mechanism and mechanical property pairs in metal
   (a) precipitation hardening/ toughness
   (b) solid solution strengthening/ yield strength
   (c) cold working/ ductility
   (d) grain refinement/ modulus of elasticity
   (e) work hardening/ stiffness

(15%)

國立雲林科技大學 系所：機械系
97學年度碩士班入學招生考試試題 科目：動力學

1. Verify that $L_1 + I = L_2$, here $L_1 = mv_1; L_2 = mv_2; I = \sum \int F dt$ and $V = V_1$ at $t = t_1$; $V = V_2$ at $t = t_2$.

(a) For a single particle, by $\sum F = ma$ (15%)

(b) For system of particles, by $\sum F_i = \sum m_i a_i$ (express the final equation by V_G, velocity of the mass center for system of particles) (10%)

2. Plate A and B have the same mass of 4 kg and are restricted to move along the smooth guides (Fig. 1). If the coefficient of restitution between the plates is e = 0.75, determine (a) the speed of both plates just after collision (15%) and (b) the maximum compression of the spring (10%). Plate A has a velocity of 4 m/s just before striking B. Plate B is originally at rest and the spring is initially unstretched.

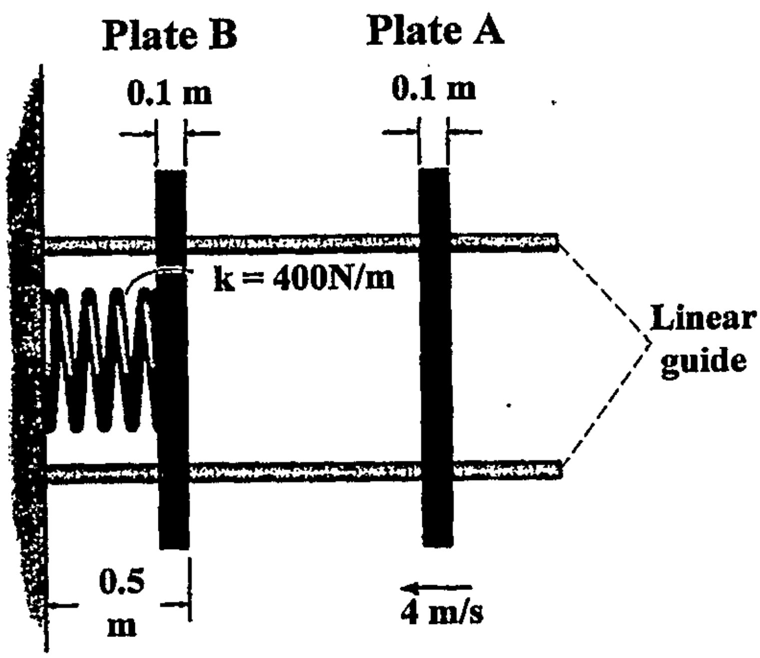


Fig. 1

國立雲林科技大學
97學年度碩士班入學招生考試試題
系所：機械系
科目：動力學

3. Knowing that collar C moves to the right with a constant velocity v_0 as shown in the Fig. 3, derive expressions for
   (a) The angular velocity of rod AB. (12%)
   (b) The angular acceleration of rod AB. (13%).

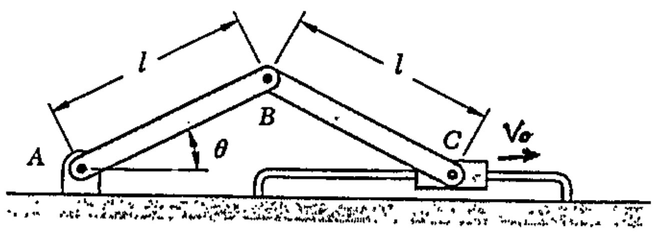


Fig. 3

4. A cylinder of weight w and radius r rolls without slipping on a cylindrical surface of radius R as shown in Fig. 4. Determine the period of motion for small oscillations. (25%)

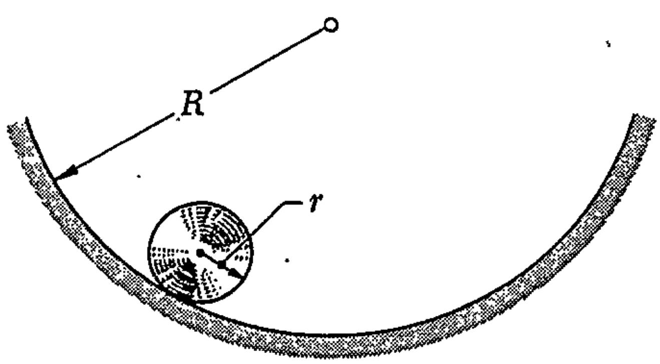


Fig. 4

國立雲林科技大學
97 學年度碩士班入學招生考試試題

系所：機械系
科目：應用微積分

1. Find $\frac{dy}{dx}=?$

(a) if $y=\cos^2 x^2$ (15%)

(b) if $y=x^{\sin x}$ (10%)

2. Find $\frac{dy}{dx}=?$

(a) if $y=e^{3x^2}+\log_2(3x)$ (15%)

(b) if $y=\frac{1}{x^2+2x-1}$ (10%)

3. Find $\int_0^{3\sqrt{3}/2} \frac{x^3}{(4x^2+9)^{3/2}} dx$. (25%)

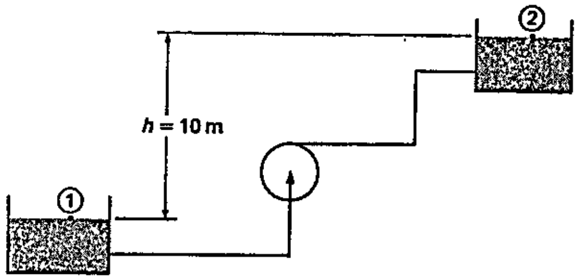
4. Find the centroid of the region bounded by the line $y = x$ and the parabola $y = x^2$. (25%)

國立雲林科技大學
97 學年度碩士班入學招生考試試題

系所：機械系
科目：流體力學

1. A little boy puts his thumb in a hole in a dam. If the sea level is 3m above the boy's thumb, estimate the force in newtons that the boy must exert to keep the water from coming out the hole.(25%) (The boy's thumb has a cross-sectional area of 3.0 cm^2; assume the density of sea water is 1000 kg/m^3)

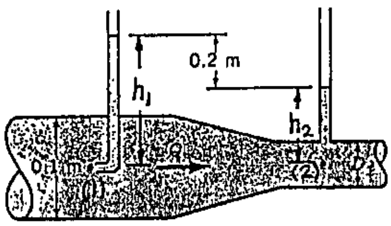
2. As shown in the figure below, a piping system with head losses of $h_{L1\text{-}2}=1.5Q^2$, with $h_{L1\text{-}2}$ in m and Q in m^3/s. The pump's head curve is given by $h_p=50-2.0Q^2$, with h_p in m and Q in m^3/s. Calculate the flow rate Q. (25%)



國立雲林科技大學
97學年度碩士班入學招生考試試題

系所：機械系
科目：流體力學

3. Water flows through the pipe contraction shown in the following figure. For the given 0.2-m difference in the manometer level, determine the flow-rate as a function of the diameter of the small pipe, D. **25%**



4. Water flows as two free jets from the tee attached to the pipe as shown in the following figure. The exit speed is 15 m/s. IF viscous effects and gravity are negligible, determine the x and y components of the forces that the pipe exerts on the tee. **25%**