國立雲林科技大學
九十三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

Prob. 1 (25%)

(a) By definition, $u(t-a)$ is 0 for $t < a$, has a jump of size 1 at $t = a$, and is 1 for $t > a$.
Please find the Laplace transform for the function shown below

$$f(t) = e^{(-2t)}u(t-1)$$

(b) Solve the system of equations given as below:

$$y_1' + 2y_1 - y_2 = e^{(-2t)}u(t-1),$$
$$y_2' + y_1 = 0,$$

with $y_1(0) = 0$, $y_2(0) = 0$.

Prob. 2 (25%)

An equation is given as below:

$$xy'' + 2y' + xy = 0, \quad \text{for } x > 0$$

Let its homogeneous solution be $y_h(x) = C_1y_1(x) + C_2y_2(x)$, where C_1, C_2 are arbitrary constants, and one of the basis functions is known as $y_1(x) = \sin(x)/x$.

Please find the other basis function, $y_2(x)$, **by the method of reduction of order.**

[Hint: let $y_2(x) = u(x)\, y_1(x)$ and $d(\cot(x))/dx = -\csc^2(x)$]

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Prob. 3 (25%)

Let S be the part of the cylinder $z = 1 - x^2$ for $0 \le x \le 1$, $-2 \le y \le 2$.

Verify Stokes' theorem if $F = xy\vec{i} + yz\vec{j} + xz\vec{k}$

Hint: Stokes' theorem: Let S be a piecewise smooth orientable surface bounded by a piecewise simple closed curve C. F is a vector field.

$\oint_C F \cdot dr = \iint_S \nabla \times F \cdot n dS$, where n is an unit normal vector to S.

Prob. 4 (25%)

Solve the following P.D.E.

$$\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2} \quad \text{for } 0 < x < L, t > 0,$$

$$\frac{\partial u}{\partial x}(0, t) = \frac{\partial u}{\partial x}(L, t) = 0 \quad \text{for } t > 0,$$

$$u(x, 0) = f(x) \quad \text{for } 0 \le x \le L.$$

(a) in terms of $f(x)$

(b) if $f(x) = \begin{cases} A & \text{for} \quad 0 \le x \le \frac{L}{2} \\ 0 & \text{for} \quad \frac{L}{2} \le x \le L \end{cases}$

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系所：機械系
科目：應用微積分

1. Find each limit. [7%+8%]

   (a) $\lim_{x\to 0}\left(\frac{e^x-1-x}{x^2}\right)$ (b) $\lim_{x\to 0}(1-2x)^{1/x}$

2. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ when $xyz=\cos(x+y+z)$. [10%]

3. Expand $\frac{1}{(1+x)^2}$ as a power series when $|x|<1$. [10%]

4. Find the point on the parabola $y^2=2x$ that is closest to the point (1,4).

   [15%]

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5. Find the centroid of the region bounded by the curves $y = \cos x$, $y = 0$, $x = 0$, and $x = \pi/2$. [10%]

6. $\int x\sqrt{x^2 + 2x + 4}\, dx$. [10%]

7. Find $\int_0^{3\sqrt{3}/2} \frac{x^3}{(4x^2 + 9)^{3/2}}\, dx$. [10%]

8. The arc of the parabola $y = x^2$ from (1, 1) to (2, 4) is rotated about the y-axis. Find the area of the resulting surface. [10%]

9. Evaluate $\int \frac{\sqrt{9 - x^2}}{x^2}\, dx$. [10%]

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系所：機械系
科目：動力學

1. The 2-lb smooth collar C is given a velocity of 6 ft/s to the right when s = 3 ft. Determine (a) its velocity at the instant s = 0. (b) the maximum distance, the collar travels before momentarily stopping.
The spring has an unstretched length of 2 ft. (25%)

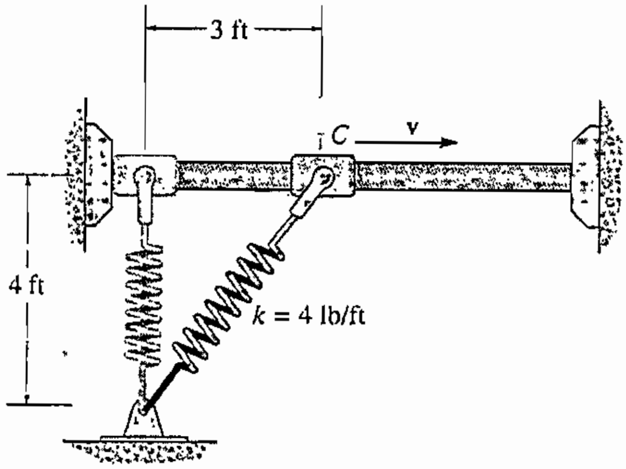

Fig.1

2. Two car A and B, each having a weight of 4000 lb, collide on the icy pavement of an intersection. The direction of motion of each car after collision is measured from snow tracks as shown. If the driver in car A states that he was going 44 ft/s (30 mi/h) just before collision and that after collision he applied the brakes so that his car skidded 10 ft before stopping, determine the approximate speed of car B just before the collision. Assume that the coefficient of kinetic friction between the car wheel and the pavement is $\mu_k = 0.5$. (25%)

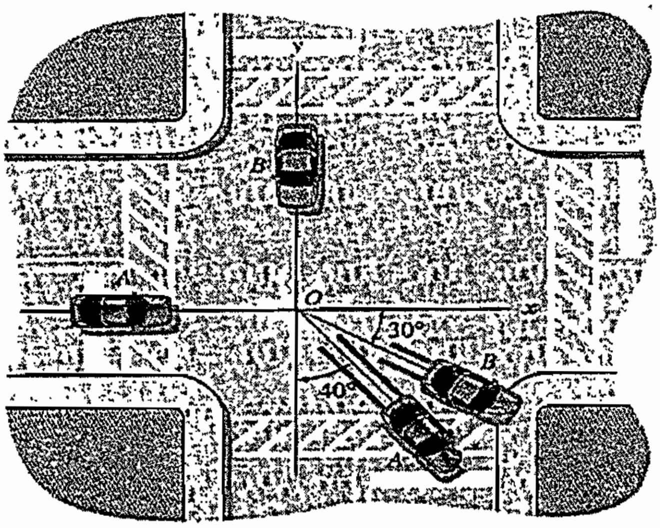

Fig.2

3. Rod AB passes through a collar which is welded to link DE. The angle θ 、angular velocity ω and angular acceleration α of link DE are given as shown in Fig. 3.
   (a) Derive the velocity equation to determine the velocity of block A and the point of the rod in contact with the collar. (12%)
   (b) Derive the acceleration equation to determine the acceleration of block A and the point of the rod in contact with the collar. (13%)

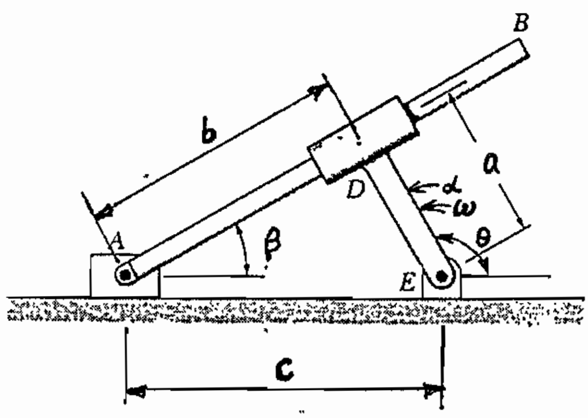

Fig. 3

4. The 4-Kg uniform rod AB is attached to a spring of constant $k = 750$ N/m. A small 0.5-Kg block C is placed on the rod at A as shown in Fig. 4.
   (a) If end A of the rod is then moved down through a small distance δ and released, determine the period of the vibration. (12%)
   (b) Determine the largest allowable value of δ if block C is to remain at all times in contact with the rod. (13%)

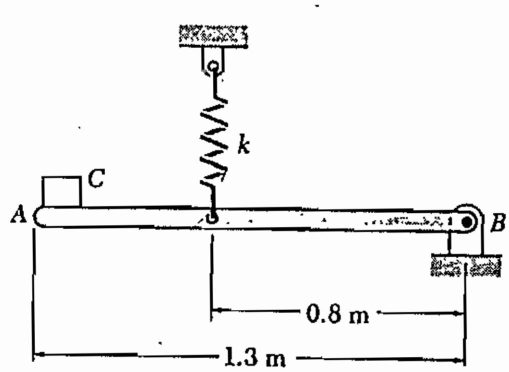

Fig. 4

國立雲林科技大學
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系所：機械系
科目：機械製造

請依題號作答並將答案寫在答案卷上，違者不予計分。

1. Answer the following questions about bulk metal forming:
   (a) Identify some of the ways in which force in flat rolling can be reduced? [5%]
   (b) What is a two-high rolling mill? [5%]
   (c) What is isothermal forging? [5%]
   (d) Distinguish between direct and indirect extrusion. [5%]
   (e) What does the centerburst defect in extrusion have in common with the roll piercing process? [5%]

2. Answer the following questions about nontraditional machining:
   (a) There are four categories of nontraditional machining processes based on principal energy form. Name the four categories? [5%]
   (b) Name the three main types of electrochemical machining. [5%]
   (c) Identify the significant disadvantages of electrochemical machining? [5%]
   (d) Identify two major disadvantages of plasma arc cutting? [5%]
   (e) How does increasing discharge current affect metal removal rate and surface finish in electric discharge machining? [5%]

3. AISI 4340 低合金鋼常用來製作大型設備的軸，經機械加工後，需進行熱處理以達到所要的機械強度與韌性。試回答下列問題：

(a) 繪出 AISI 4340 低合金鋼的連續冷卻變態圖(continuous cooling transformation diagram)。 (10%)

(b) 在不同回火溫度做相同時間回火後，繪圖說明降伏強度和韌性隨著回火溫度的變化情形 (注意：AISI 4340 低合金鋼有回火脆化的現象)。 (8%)

(c) 淬火後，鋼材的微觀組織(microstructure)主要有那些相(phase)？回火過程，鋼材的微觀組織如何變化。 (7%)

4.鋼板工廠滾軋扁鋼胚的工作軋輥，其表面層要有良好的耐磨性，因此其材質為高合金鋼材；而其心部則要有良好的韌性，因此其材質為低合金鋼材；業界通常用離心鑄造方法來製造上述的工作軋輥。試回答下列問題：

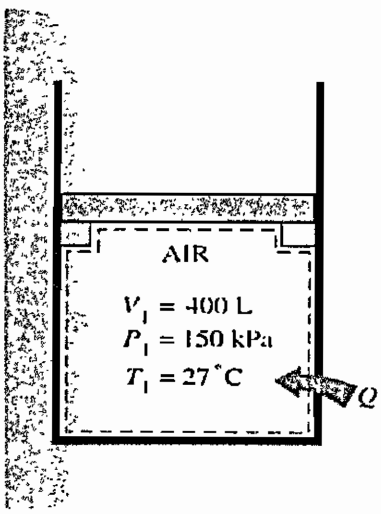
(a) 說明離心鑄造的原理；並比較離心鑄造產品與砂模鑄造產品的品質差異。 (12%)

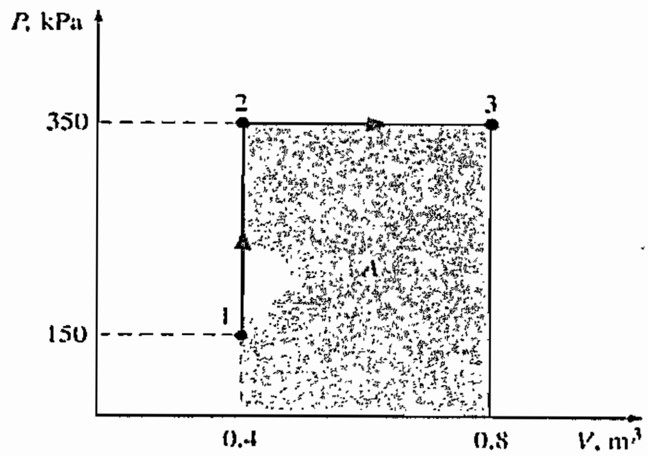
(b) 說明用離心鑄造方法製造上述工作軋輥的流程。 (13%)

國立雲林科技大學
九十三學年度碩士班入學招生考試試題
系所：機械系
科目：熱力學

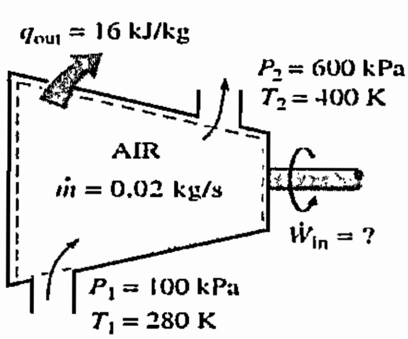
本試題共四大題每題 25 分，請依題號作答並將答案寫在答案卷上，違者不予計分。

1. A piston-cylinder device initially contains at 150 kPa and 27°C. At this state, the piston is resting on a pair of stops, as shown in figure, and the enclosed volume is 400 L. The mass of the piston is such that a 350-kPa pressure is required to move it. The air is now heated until its volume has doubled. Determine (a) the final temperature, (b) the work done by the air, and (c) the total heat transferred to the air. (R=0.287 kPa.m^3/kg, the internal energy of air u=214.07 kJ/kg @ 300°K, 1113.52kJ/kg @ 1400°K)





2. Air at 100 kPa and 280°K is compressed steadily to 600 kPa and 400°K. The mass flow rate of the air is 0.02 kg/s, and a heat loss of 16kJ/kg occurs during the process. Assuming the changes in kinetic and potential energies are negligible, determine the necessary power input to the compressor. (enthalpies of the air h=280.13 kJ/kg @ 280°K, 400.98 kJ/kg @ 400°K)



3. There is an ideal vapor-compression refrigeration cycle using R-134a refrigerant absorbed heat from 25°C cooled space and rejected heat to 35°C warm environment. Leaving from the evaporator, the saturated refrigerant vapor at 10°C with a rate of 0.1 kg/s enters the compressor, and it leaves at 1.2 MPa and 80°C. The refrigerant vapor is cooled in the condenser and becomes a saturated liquid at the outlet. The refrigerant liquid is throttled through an expansion valve to 0.4153 MPa and then flows into the evaporator. Determine:

   (a) the power input to the compressor, (b) the heat transfer rate absorbed by the evaporator, (c) the coefficient of performance of this cycle, (d) the vapor quality at the inlet to the evaporator.

   Assuming a Carnot refrigeration cycle is operated at the same 25°C cooled space and the 35°C warm environment. (e) What is the coefficient of performance for this Carnot refrigeration cycle?

4. (a) Please briefly describe the four internally reversible processes for the Otto cycle and (b) show the Otto cycle in the P-v and T-s diagrams. State 1 has the smallest temperature and pressure for piston at its lowest position (BDC). State 3 has the greatest temperature and pressure for piston at its highest position (TDC). State 2 is at TDC just before heat absorption and State 4 is at BDC just before heat rejection. (c) Please show the thermal efficiency of the Otto cycle using the absolute temperatures of T1, T2, T3 and T4.

   (d) For an isentropic process between state 1 and state 2, there is a relationship between the temperature and specific volume (v) of states 1 and 2:

   $T1/T2 = (v2/v1)^{k-1}$, where k is the air specific heat ratio Cp/Cv.

   Please show the thermal efficiency of the Otto cycle in terms of k and the compression ratio r, where r = v1/v2.

R-134a

TABLE A-11

Saturated refrigerant-134a—Temperature table

Temp., T °C	Press., P_{sat} MPa	Specific volume, m³/kg: Sat. liquid, v_f	Sat. vapor, v_g	Internal energy, kJ/kg: Sat. liquid, u_f	Sat. vapor, u_g	Enthalpy, kJ/kg: Sat. liquid, h_f	Evap., h_{fg}	Sat. vapor, h_g	Entropy, kJ/kg · K: Sat. liquid, s_f	Sat. vapor, s_g
−40	0.05164	0.0007055	0.3569	−0.04	204.45	0.00	222.88	222.88	0.0000	0.9560
−36	0.06332	0.0007113	0.2947	4.68	206.73	4.73	220.67	225.40	0.0201	0.9506
−32	0.07704	0.0007172	0.2451	9.47	209.01	9.52	218.37	227.90	0.0401	0.9456
−28	0.09305	0.0007233	0.2052	14.31	211.29	14.37	216.01	230.38	0.0600	0.9411
−26	0.10199	0.0007265	0.1882	16.75	212.43	16.82	214.80	231.62	0.0699	0.9390
−24	0.11160	0.0007296	0.1728	19.21	213.57	19.29	213.57	232.85	0.0798	0.9370
−22	0.12192	0.0007328	0.1590	21.68	214.70	21.77	212.32	234.08	0.0897	0.9351
−20	0.13299	0.0007361	0.1464	24.17	215.84	24.26	211.05	235.31	0.0996	0.9332
−18	0.14483	0.0007395	0.1350	26.67	216.97	26.77	209.76	236.53	0.1094	0.9315
−16	0.15748	0.0007428	0.1247	29.18	218.10	29.30	208.45	237.74	0.1192	0.9298
−12	0.18540	0.0007498	0.1068	34.25	220.36	34.39	205.77	240.15	0.1388	0.9267
−8	0.21704	0.0007569	0.0919	39.38	222.60	39.54	203.00	242.54	0.1583	0.9239
−4	0.25274	0.0007644	0.0794	44.56	224.84	44.75	200.15	244.90	0.1777	0.9213
0	0.29282	0.0007721	0.0689	49.79	227.06	50.02	197.21	247.23	0.1970	0.9190
4	0.33765	0.0007801	0.0600	55.08	229.27	55.35	194.19	249.53	0.2162	0.9169
8	0.38756	0.0007884	0.0525	60.43	231.46	60.73	191.07	251.80	0.2354	0.9150
12	0.44294	0.0007971	0.0460	65.83	233.63	66.18	187.85	254.03	0.2545	0.9132
16	0.50416	0.0008062	0.0405	71.29	235.78	71.69	184.52	256.22	0.2735	0.9116
20	0.57160	0.0008157	0.0358	76.80	237.91	77.26	181.09	258.35	0.2924	0.9102
24	0.64566	0.0008257	0.0317	82.37	240.01	82.90	177.55	260.45	0.3113	0.9089
26	0.68530	0.0008309	0.0298	85.18	241.05	85.75	175.73	261.48	0.3208	0.9082
28	0.72675	0.0008362	0.0281	88.00	242.08	88.61	173.89	262.50	0.3302	0.9076
30	0.77006	0.0008417	0.0265	90.84	243.10	91.49	172.00	263.50	0.3396	0.9070
32	0.81528	0.0008473	0.0250	93.70	244.12	94.39	170.09	264.48	0.3490	0.9064
34	0.86247	0.0008530	0.0236	96.58	245.12	97.31	168.14	265.45	0.3584	0.9058
36	0.91168	0.0008590	0.0223	99.47	246.11	100.25	166.15	266.40	0.3678	0.9053
38	0.96298	0.0008651	0.0210	102.38	247.09	103.21	164.12	267.33	0.3772	0.9047
40	1.0164	0.0008714	0.0199	105.30	248.06	106.19	162.05	268.24	0.3866	0.9041
42	1.0720	0.0008780	0.0188	108.25	249.02	109.19	159.94	269.14	0.3960	0.9035
44	1.1299	0.0008847	0.0177	111.22	249.96	112.22	157.79	270.01	0.4054	0.9030
48	1.2526	0.0008989	0.0159	117.22	251.79	118.35	153.33	271.68	0.4243	0.9017
52	1.3851	0.0009142	0.0142	123.31	253.55	124.58	148.66	273.24	0.4432	0.9004
56	1.5278	0.0009308	0.0127	129.51	255.23	130.93	143.75	274.68	0.4622	0.8990
60	1.6813	0.0009488	0.0114	135.82	256.81	137.42	138.57	275.99	0.4814	0.8973

TABLE A-13

Superheated refrigerant-134a (*Concluded*)

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 = 1.20 MPa (T_{sat} = 46.32°C)				P = 1.40 MPa (T_{sat} = 52.43°C)				P = 1.60 MPa (T_{sat} = 57.92°C)			
Sat.	0.01663	251.03	270.99	0.9023	0.01405	253.74	273.40	0.9003	0.01208	256.00	275.33	0.8982
50	0.01712	254.98	275.52	0.9164								
60	0.01835	265.42	287.44	0.9527	0.01495	262.17	283.10	0.9297	0.01233	258.48	278.20	0.9069
70	0.01947	275.59	298.96	0.9868	0.01603	272.87	295.31	0.9658	0.01340	269.89	291.33	0.9457
80	0.02051	285.62	310.24	1.0192	0.01701	283.29	307.10	0.9997	0.01435	280.78	303.74	0.9813
90	0.02150	295.59	321.39	1.0503	0.01792	293.55	318.63	1.0319	0.01521	291.39	315.72	1.0148
100	0.02244	305.54	332.47	1.0804	0.01878	303.73	330.02	1.0628	0.01601	301.84	327.46	1.0467
110	0.02335	315.50	343.52	1.1096	0.01960	313.88	341.32	1.0927	0.01677	312.20	339.04	1.0773
120	0.02423	325.51	354.58	1.1381	0.02039	324.05	352.59	1.1218	0.01750	322.53	350.53	1.1069
130	0.02508	335.58	365.68	1.1660	0.02115	334.25	363.86	1.1501	0.01820	332.87	361.99	1.1357
140	0.02592	345.73	376.83	1.1933	0.02189	344.50	375.15	1.1777	0.01887	343.24	373.44	1.1638
150	0.02674	355.95	388.04	1.2201	0.02262	354.82	386.49	1.2048	0.01953	353.66	384.91	1.1912
160	0.02754	366.27	399.33	1.2465	0.02333	365.22	397.89	1.2315	0.02017	364.15	396.43	1.2181
170	0.02834	376.69	410.70	1.2724	0.02403	375.71	409.36	1.2576	0.02080	374.71	407.99	1.2445
180	0.02912	387.21	422.16	1.2980	0.02472	386.29	420.90	1.2834	0.02142	385.35	419.62	1.2704
190					0.02541	396.96	432.53	1.3088	0.02203	396.08	431.33	1.2960
200					0.02608	407.73	444.24	1.3338	0.02263	406.90	443.11	1.3212

國立雲林科技大學
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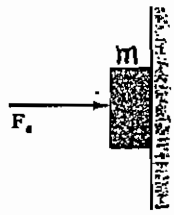
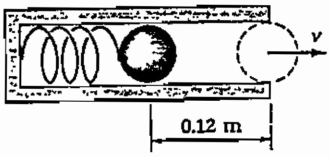
系所：機械系
科目：專業實務

請依題號作答並將答案寫在答案卷上，違者不予計分。

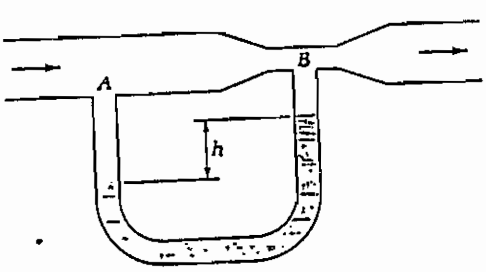
1. 如圖 1 所示，求 F_a 最少需為多少？圖中之方塊可免於向下滑落。方塊之質量 m=6.4 Kg，方塊與牆壁間之摩擦係數 μ=0.75。(15%)



2. 一顆 0.015Kg 的銅珠裝載於彈簧槍之腔室內、如圖；彈簧之彈性係數 K=120 N/m、彈簧之壓縮量為 0.12m，若忽略所有的摩擦力，求彈簧釋放後、銅珠至槍口時之速度是多少。(15%)



3. 請說明下圖之壓差現象，為何 A 點與 B 點之壓力不同？ (10%)



4. 一彈簧-質量系統，如圖 (A) 所示；其質量 m 之運動可能有三種模式，描述如圖 (B) 和圖 (C) 之 (i) 及 (ii)；試說明此三種運動模式，及其屬於何種系統？ (10%)

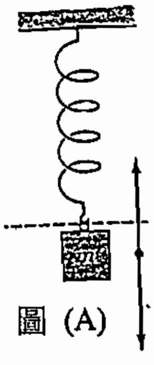


圖 (A)

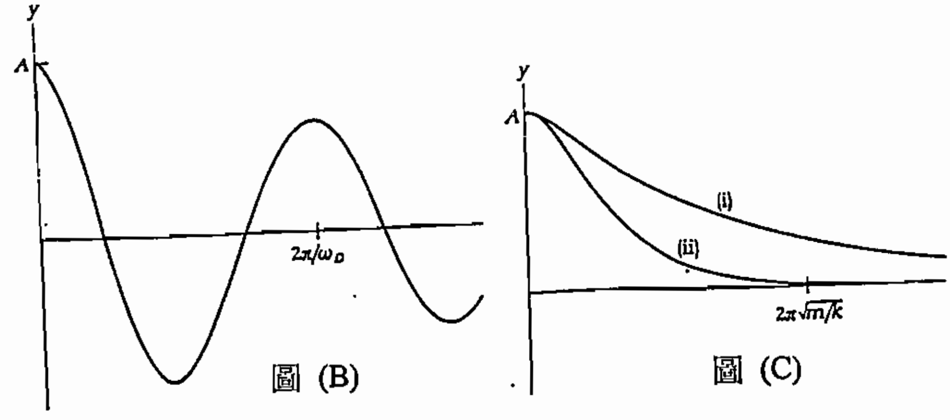


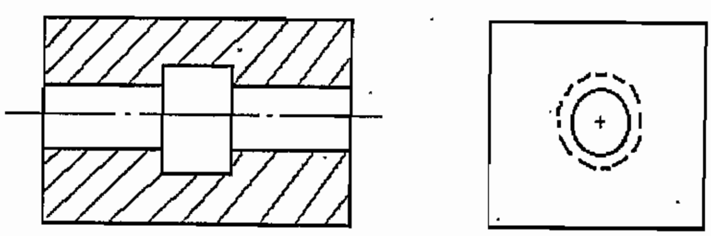
圖 (B)　圖 (C)

5. 機械領域專業實務簡答題: (30%)

(1) 請問您在過去的工作經驗中，最得意解決之工程問題為何？請簡述您遇到的工程問題以及您所採用的解決方法；並請說明為何採用這些方法？（15%）

(2) 下雨天除濕可用除濕機或冷氣機，但前者會造成室溫上升而後者卻會造成室溫下降，為什麼？請說明除濕機及冷氣機之工作原理有何不同？（15%）

6. 下圖一所示之工程圖，請用 CNS 工程製圖標準來進行尺寸標註。(相關尺寸請直接用尺量，精度取至 mm 即可)(20%)



圖一

國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：機械系
科目：自動控制

請依題號作答並將答案寫在答案卷上，違者不予計分。

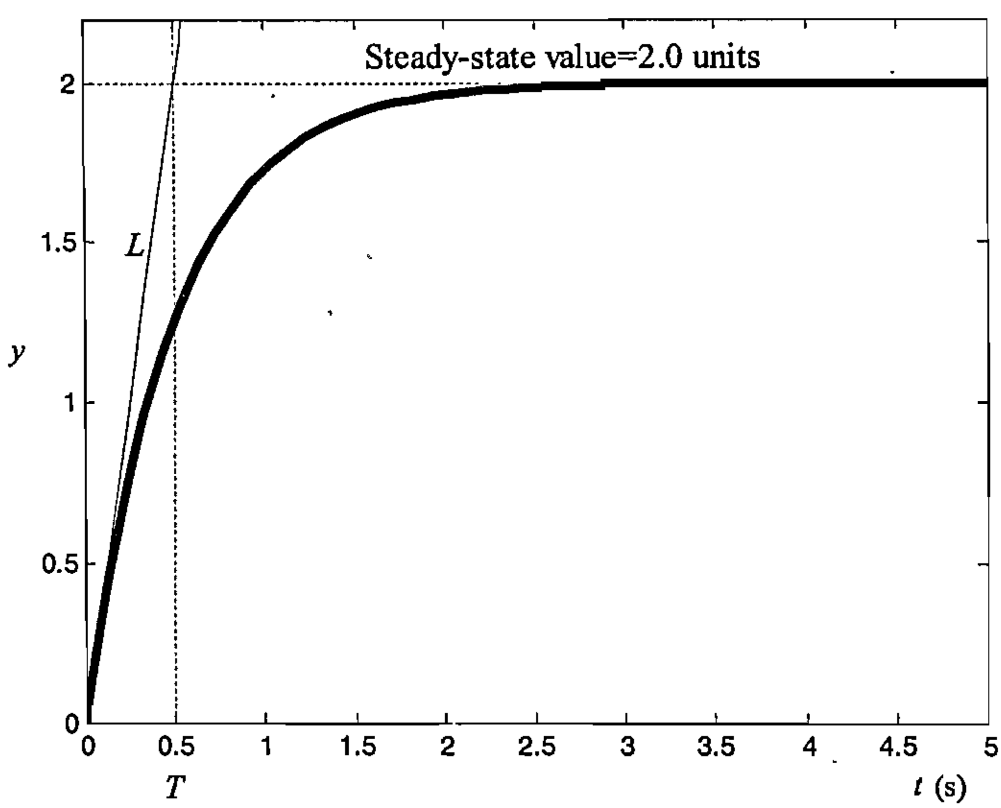
1. 考慮某一受控體(plant)之轉移函數型式為 $Y(s)/U(s) = b/(s+a)$，其中參數 a 與 b 為未知常數。圖一顯示此受控體之單位步階響應(the output response of the plant subject to a unit step input)，其中直線 L 為輸出響應曲線於原點($y = t = 0$)之切線，且 $T = 0.5$。

   (1) 試證 $T = 2/b$。(10%)

   (2) 試求參數 a 與 b 之值。(5%)

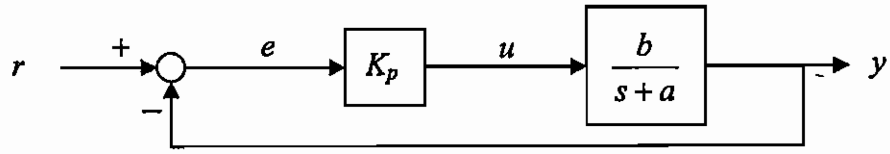
   (3) 請利用圖二所示之比例控制(proportional control)架構，試決定參數 K_p 之值，使得閉迴路系統之極點(the closed-loop pole)等於 -6。(5%)

   (4) 試求圖二所示系統之相位裕度值(phase margin)。(10%)



圖一

國立雲林科技大學
九十三學年度碩士班入學招生考試試題
系所：機械系
科目：自動控制

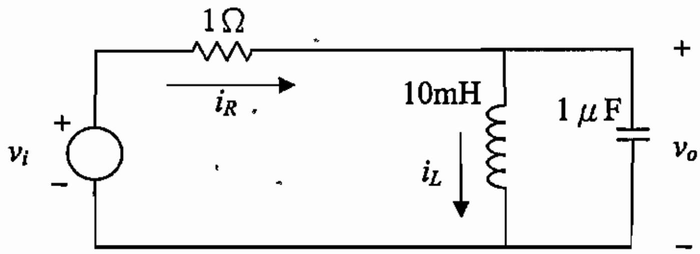


圖二

2. 在圖三所示之電路中，$v_i(t)$ 爲系統輸入電壓，$v_o(t)$ 爲系統輸出電壓。令 $V_i(s)$ 與 $V_o(s)$ 分別代表 $v_i(t)$ 與 $v_o(t)$ 之 Laplace transform。

(1) 試求轉移函數 $V_o(s)/V_i(s)$。(10%)

(2) 加入電源 $v_i(t)=10\cos(\omega t)$ 伏特，其中 t 代表時間，ω 代表某一固定之電源頻率。當 $i_R(t)$ 之穩態值(the steady-state value of i_R)爲零時，試求 $i_L(t)$ 之穩態響應(the steady-state response of i_L)。(10%)



圖三

國立雲林科技大學
九十三學年度碩士班入學招生考試試題
系所：機械系
科目：自動控制

3. 根據圖四回答下列問題

(A)令 r 爲單位步級函數(unit step function)，若要求穩態誤差小於 0.1 ($|e(\infty)|< 0.1$)，則 k_p 與 k_d 的可能範圍爲何？ (9 %)

(B)若 $k_p = k_d = 3$, $r = \sin 20t$, 則穩態時 y 爲何？ (8 %)

(C)若 $k_p = k_d = 3$， r 爲單位步級函數，畫出 y 的時間響應(time response)圖。 (8 %)

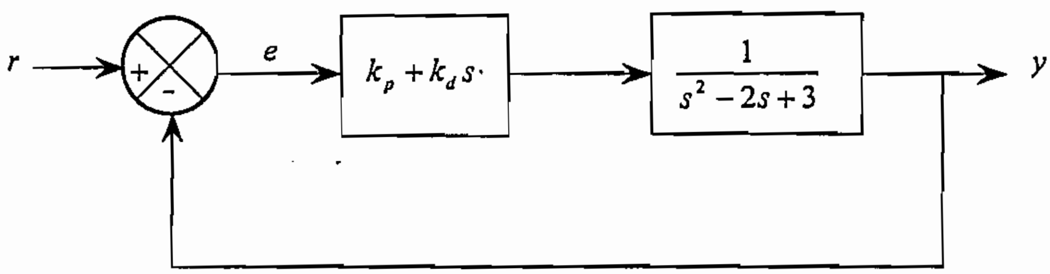


圖 四

4. 考慮下列的動態系統

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

$$y = \begin{bmatrix} 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

(A)令 $u_1 = k_1 x_1$, $u_2 = k_2 x_2$, 若閉迴路系統爲穩定，k_1 與 k_2 的範圍爲何？ (12 %)

(B)令 $u_1 = u_2 = k_3 y$, 若閉迴路系統爲穩定，k_3 的範圍爲何？ (13 %)

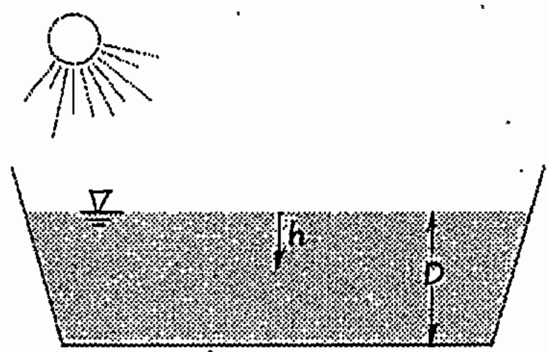
國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：機械系
科目：流體力學

1. The solar pond as shown in the figure has a salt concentration that increases with water depth (h). The resulting water density increases with depth and can be described by the following equation

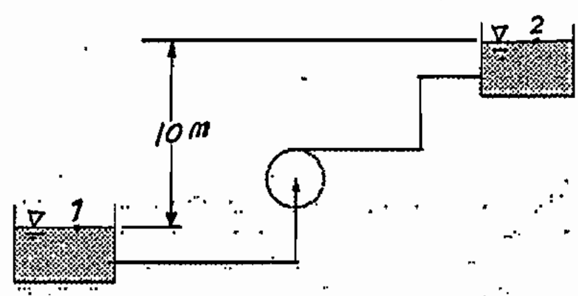
$\rho = 1150 - 150e^{-2h}\ (kg/m^3)$

Find the gage pressure at the bottom of the solar pond (D=3m), and compare it with the gage pressure if there were no salt in the pond. (25%)



solar pond

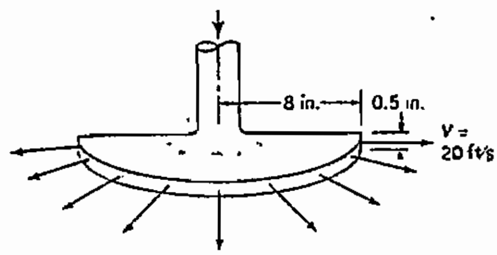
2. A piping system shown in the figure has losses of $h_{L,1\text{-}2} = 1.5Q^2$. The pump head curve is given by $h_A = 50 - 2.0Q^2$. Calculate the flow rate Q. (h_A and $h_{L,1\text{-}2}$ in m and Q in m^3/s) (25%)



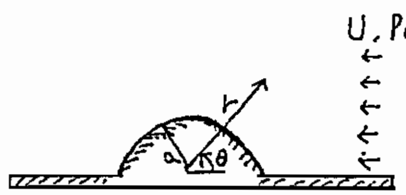
國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：機械系
科目：流體力學

3. Water is sprayed radially outward over 180° as indicated in the following figure. The jet sheet is in the horizontal plane. If the jet velocity at the nozzle exit is 20 ft/s. determine the direction and the magnitude of the resultant horizontal anchoring force required to hold the nozzle in place. (25%)



4. An ideal fluid flows past an infinitely long semicircular "hump" located along a plane boundary as shown in the following figure. Far from the hump the velocity field is uniform, and the pressure is P_O. (a) Determine expressions for the maximum and minimum values of the pressure along the hump, and indicated where these points are located. (13%) (b) If the solid surface is the $\psi = 0$ streamline, determine the equation of the streamline passing through the point $\theta = \pi/2$, r = 2a. (12%)



國立雲林科技大學
九十三學年度碩士班入學招生考試試題

系所：機械系
科目：材料力學

1.The bottom member in Fig. 1 is of uniform cross section. Its hinge is frictionless. The rods are of steel. Find the distance point A drops upon attachment of the weight. E=206,900MPa. (25%)

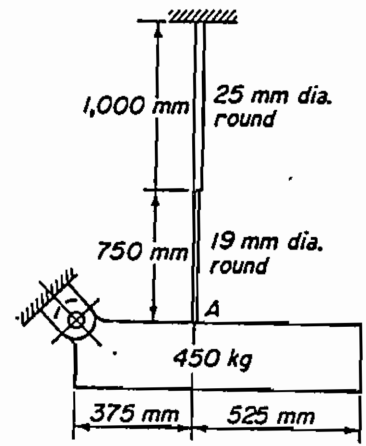


Fig. 1

2.The shaft of Fig. 2 is simply supported at A and B and is keyed against rotation at A.

(a) Draw a view of the element on the top surface of the shaft at B with sides parallel to the x and y axes. Show arrows and numerical values for all stresses acting.

(b)Draw the element at B properly oriented to give the maximum shearing stresses. Show arrows and numerical values for all stresses.

(25%)

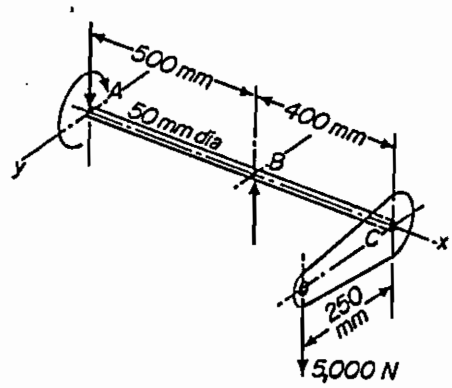


Fig. 2

國立雲林科技大學
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系所：機械系
科目：材料力學

3. The bar has a diameter of 40 mm. It is subjected to the two force components at its end as shown. At the point B, determine: [a] the internal forces and moments; [b] the state of stress and show the results on a differential volume element located at this point; [c] the principal stresses and their directions; [d] the maximum in-plane shear stress and their directions; and [e] draw the Mohr's circle. (25%)

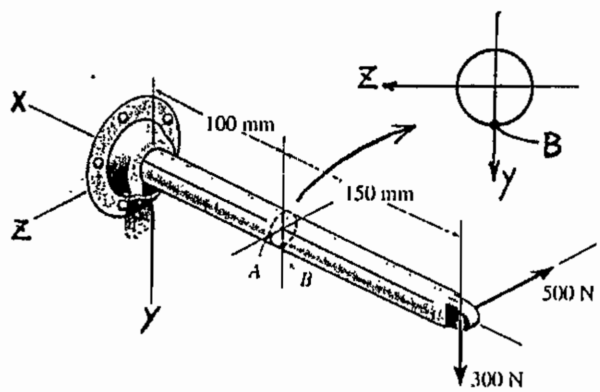

Figure for Problem 3

4. The beam is loaded as shown. Both Young's modulus E and the moment of inertia of the cross-sectional area I are constant. [a] Determine the equations of the elastic curve using the coordinates x_1 and x_2; [b] specify the slope at C; and [c] determine the displacement at B. [d] Solve parts [a] using the x_1 and x_3 coordinates. (25%)

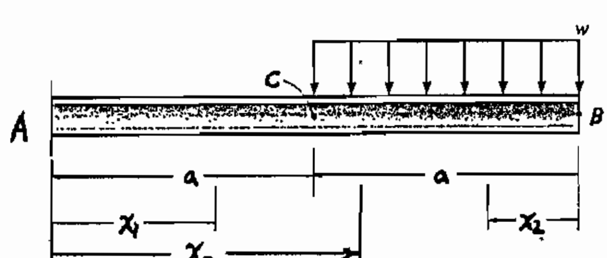

Figure for Problem 4