國立雲林科技大學
96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. Find constants $c_1$ and $c_2$ such that the set of functions $\{x, x^2, x+c_1x^2+c_2x^3\}$ is orthogonal with respect to the weight function $w(x)=1$ on the interval $[-2,2]$. (10%)

2. Find a continuous solution satisfying

$$\frac{dx}{dt}+2x=\begin{cases}0, & 0\le t<1\\ -\int_1^t x(\tau)d\tau, & t\ge 1\end{cases}$$

and the initial condition $x(0)=1$. (20%)

3. Consider the initial-value problem $\frac{d^2x}{dt^2}+2x=2\cos t$, $x(0)=0$, $x'(0)=0$. Find a function $h(t)$ such that $x(t)$ equals the convolution of $h(t)$ and $\cos t$, that is, $x(t)=h(t)*\cos t=\int_0^t h(\tau)\cos(t-\tau)d\tau$. (10%)

4. The Fourier series of $f(t)=\begin{cases}0, & -\pi<t<0\\ \sin t, & 0\le t<\pi\end{cases}$ is given by

$$f(t)=\frac{1}{\pi}+\frac{1}{2}\sin t+\frac{1}{\pi}\sum_{n=2}^{\infty}\frac{(-1)^n+1}{1-n^2}\cos nt.$$

Let us define a function $g(t)=f(t)+t$ on the interval $(-\pi,\pi)$. Expand $g(t)$ in a Fourier series. (10%)

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科目：工程數學

5. (30%)

(a) Please show that the following integral is independent of any path C between (-1,0) and (3,4), and evaluate it.

$$\int_C (y^2 - 6xy + 6)dx + (2xy - 3x^2)dy$$

(b) Please find the work done by $\vec{F} = x\vec{i} + y\vec{j}$ along the curve C traced by

$\vec{r}(t) = \cos(t)\vec{i} + \sin(t)\vec{j}$ from t = 0 to t = π.

(c) Please evaluate the double integral (as shown below) over the region bounded by the graphs of y = 1, y = 2, y = x and y = –x + 5.

$$\iint_R e^{x+3y} dA$$

6. (20%)

Please show the area of triangle defined by two vectors $\vec{A}$ and $\vec{B}$,

which belongs to $R^2$ space is $\frac{1}{2}\sqrt{|\vec{A}|^2|\vec{B}|^2 - (\vec{A}\cdot\vec{B})^2}$

國立雲林科技大學
96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 three steel bars shown in Fig.1 are pin connected to a rigid member. If the applied load on the member is 10 KN, determine the force developed in each bar. Bars AB and EF each have a cross-sectional area of 25 $mm^2$, and bar CD has a cross-sectional area of 15 $mm^2$. $E_{steel}$= 200GPa (25%)

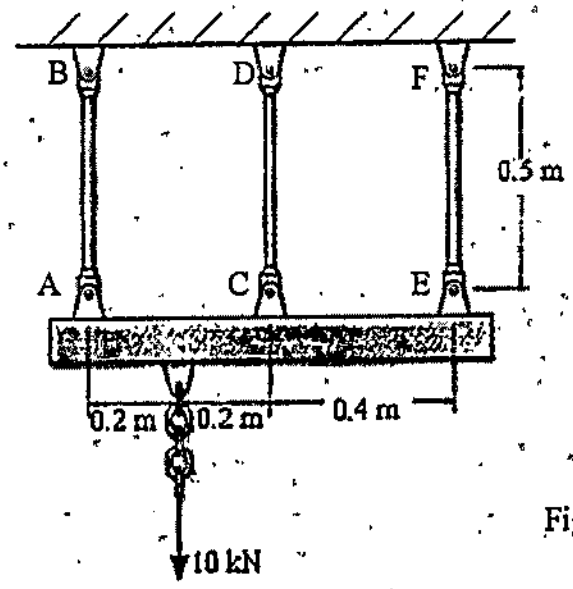



Fig.1

2. The pipe shown in Fig.2 has an inner diameter of 80 mm and an outer diameter of 100 mm. If its end is tightened against the support at A using a torque wrench at B, determine the shear stress developed in the material at the inner and outer walls along the central portion of the pipe when the 60-N forces are applied to the wrench. (25%)

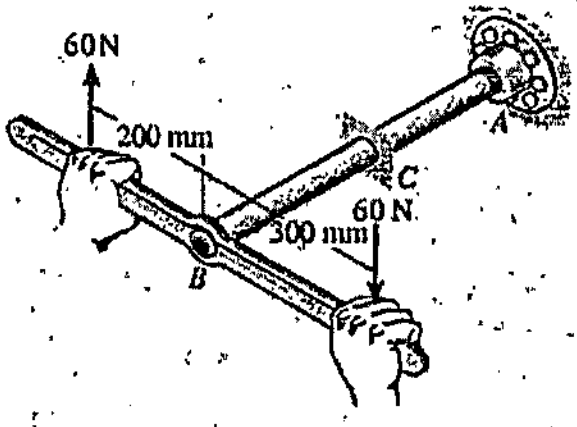



Fig.2

國立雲林科技大學
96 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

3. An axial force of 900 N and a torque of 2.5 N-m are applied to the shaft having a diameter of 40 mm. At point *P* on its surface, determine: [a] the state of stress; [b] draw Mohr's circle for this case (圖上必須標示出你所能知道的相關資料); [c]求在 maximum in-plane shear stress 面上所作用的 normal stress 大小; [d] 求在 principal stress 面上所作用的 shear stress 大小。 (25%)

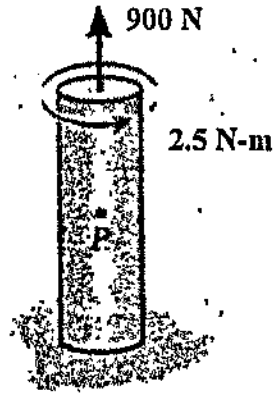



Figure for Problem 3

4. The beam is subjected to a load **P** at its end. Both Young's modulus *E* and the moment of inertia of the cross-sectional area *I* are constant. [a] Draw the shear and moment diagrams for the beam. [b] Determine the equations of the elastic curve ($v_1$ and $v_2$) for the beam using the $x_1$ $(0 \le x_1 < 2a)$ and $x_2$ $(0 \le x_2 < a)$ coordinates. [c] Determine the displacement at *C*. [d] Determine the maximum deflection of the beam between *A* and *B*. (25%)

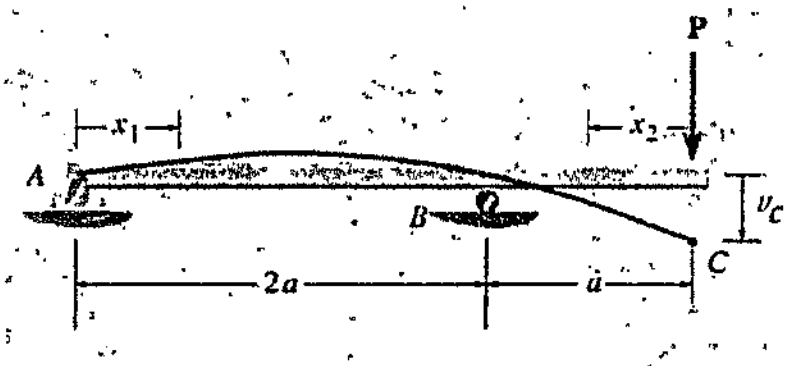



Figure for Problem 4

# 國立雲林科技大學
96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

本試題共四題，共計 100 分，請依題號作答並將答案寫在答案卷上，違者不予計分。

1. For the DC motor system shown below, the electrical circuit generates a current $i$ which is proportional to the torque $\tau_m$ applied on the motor shaft with inertia $J$:

$$\tau_m = K \cdot i$$

The back-EMF voltage $v_m$ generated by the motor is proportional to the motor speed $\omega$:

$$v_m = K \cdot \omega$$

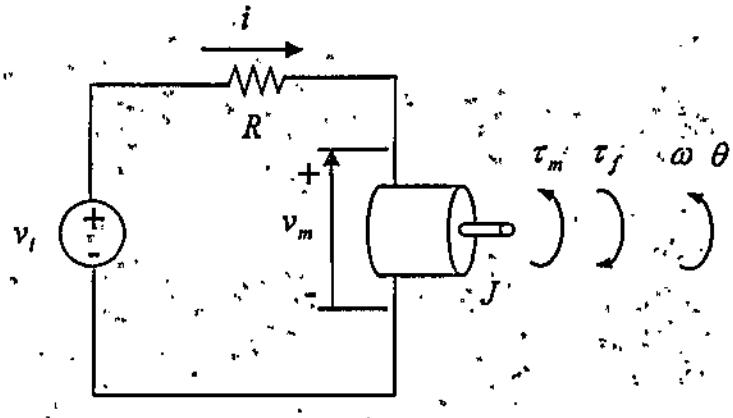
The friction torque $\tau_f$ applied to the motor is proportional to the motor speed $\omega$:

$$\tau_f = B \cdot \omega$$

(1) Find the transfer function between the shaft angle $\theta(s)$ and the motor torque $\tau_m(s)$, i.e. $\theta(s)/\tau_m(s)$. (10%)

(2) Find the transfer function between the shaft speed $\omega(s)$ and the input voltage $v_i(s)$, i.e. $\omega(s)/v_i(s)$. (10%)

(3) Given $V$ as the input voltage, what will be the motor speed at steady-state? (5%)



國立雲林科技大學
96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

2. A single-input, single-output system has the following state-space equations:

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 10 & 0 \end{bmatrix} x$$

(1) Determine the transfer function $G(s) = Y(s)/U(s)$. (15%)

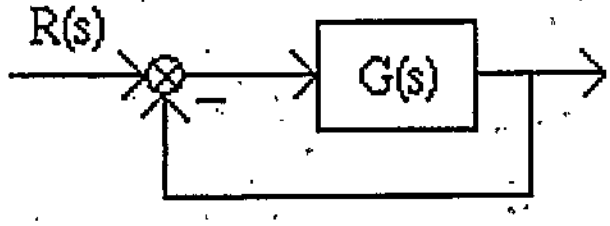
(2) Find the system poles. (10%)

國立雲林科技大學
96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. Find the range of gain, $K$, to ensure stability in the unity feedback system with (25%)

$$G(s)=\frac{K(s+2)}{(s^2+1)(s+4)(s-1)}$$




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

$$G(s)=\frac{50}{s^2+11s+10}$$

(a) Find the corner frequencies (break frequency). (7%)
(b) Find the slopes of asymptotic lines for small frequency and large frequency, respectively. (8%)
(c) Sketch the Bode plot. (10%)

國立雲林科技大學
96學年度碩士班入學招生考試試題

系所：機械系
科目：專業實務

1. 利用圖解說明雷射光（laser beam）如何產生？（10%）

   和一般的太陽光比較，雷射光（laser beam）主要的特徵為何？（10%）

   何謂 laser cladding?（10%）

2. 利用圖解說明利用放電加工法，加工導電及非導電性材料的原理？（10%）並比較兩者，其不同的特徵為何？（10%）

國立雲林科技大學
96學年度碩士班入學招生考試試題

系所：機械系
科目：專業實務

3. An ideal spring with stiffness constant K= 400 N/m is attached to a stationary block of mass 4kg as in Fig. 1. A 2-kg block approaches at 8 m/s. (a) What is the maximum compression of the spring? (b) What are the final velocities of the two blocks? The motion occurs on a horizontal frictionless surface. (25%)

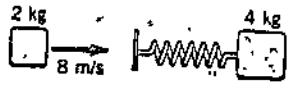


Fig. 1

4. A proton, of mass $1.67 \times 10^{-27}$ kg, enters the region between two parallel plates a distance 20 cm apart. There is a uniform electric field of $3 \times 10^5$ V/m between the plates, as shown in Fig. 2. If the initial speed of the proton is 5 x 106 m/s, what is the final speed? (25%)

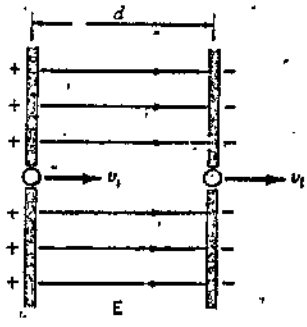
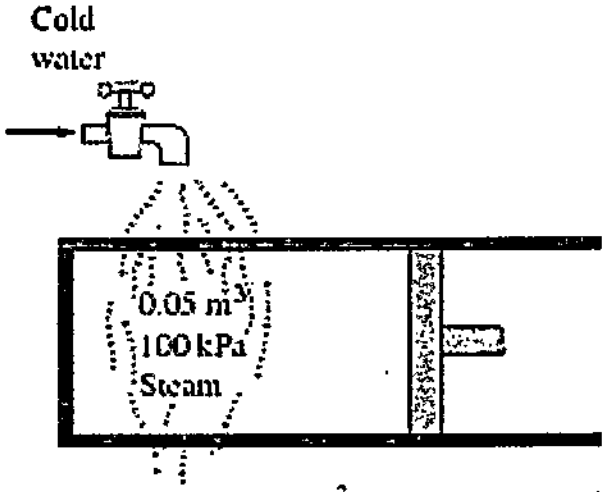


Fig. 2

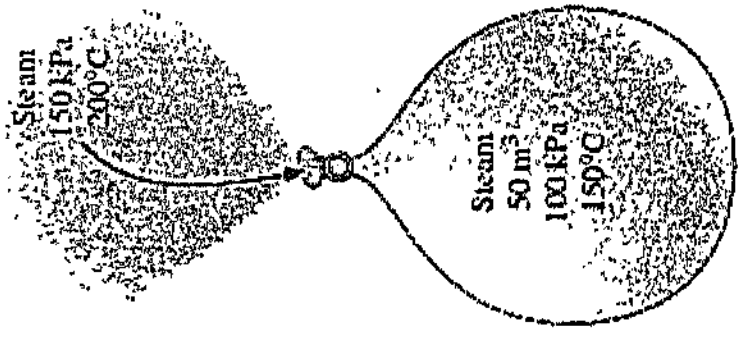
國立雲林科技大學
96 學年度碩士班入學招生考試試題

系所：機械系
科目：熱力學

1. Consider a piston–cylinder device with a piston surface area of 0.1 $m^2$ initially filled with 0.05 $m^3$ of saturated water vapor at the atmospheric pressure of 100 kPa. Now cold water is poured outside the cylinder, and the steam inside starts condensing as a result of heat transfer to the cooling water outside. If the piston is stuck at its initial position, determine the friction force acting on the piston and the amount of heat transfer when the temperature inside the cylinder drops to 30°C. (25%)




2. A balloon that initially contains 50 $m^3$ of steam at 100 kPa and 150°C is connected by a valve to a large reservoir that supplies steam at 150 kPa and 200°C. Now the valve is opened, and steam is allowed to enter the balloon until the pressure equilibrium with the steam at the supply line is reached. The material of the balloon is such that its volume increases linearly with pressure. Heat transfer also takes place between the balloon and the surroundings, and the mass of the steam in the balloon doubles at the end of the process. Determine the final temperature and the boundary work during this process. (25%)



3. Air enters an adiabatic compressor at 100 kPa and 17°C at a rate of 2.4 $m^3/s$, and it exits at 257°C. The compressor has an isentropic efficiency of 84 percent. Neglecting the changes in kinetic and potential energies, determine (*a*) the exit pressure of air and (*b*) the power required to drive the compressor. gas constant, R=0.2870 kJ/kg.k (25%)

4. Consider a steam power plant that operates on a simple ideal Rankine cycle and has a net power output of 45 MW. Steam enters the turbine at 7 MPa and 500°C and is cooled in the condenser at a pressure of 10 kPa by running cooling water from a lake through the tubes of the condenser at a rate of 2000 kg/s. (a) Show the cycle on a *T-s* diagram with respect to saturation lines (5%), and determine (b) the thermal efficiency of the cycle (10 %), (c) the mass flow rate of the steam (5%), and (d) the temperature rise of the cooling water (5%).

國立雲林科技大學
96學年度碩士班入學招生考試試題

系所：機械系
科目：熱力學

Ideal-gas properties of air

| T K | h kJ/kg | $P_r$ | u kJ/kg | $v_r$ | $s^\circ$ kJ/kg · K | T K | h kJ/kg | $P_r$ | u kJ/kg | $v_r$ | $s^\circ$ kJ/kg · K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 199.97 | 0.3363 | 142.56 | 1707.0 | 1.29559 | 580 | 586.04 | 14.38 | 419.55 | 115.7 | 2.37348 |
| 210 | 209.97 | 0.3987 | 149.69 | 1512.0 | 1.34444 | 590 | 596.52 | 15.31 | 427.15 | 110.6 | 2.39140 |
| 220 | 219.97 | 0.4690 | 156.82 | 1346.0 | 1.39105 | 600 | 607.02 | 16.28 | 434.78 | 105.8 | 2.40902 |
| 230 | 230.02 | 0.5477 | 164.00 | 1205.0 | 1.43557 | 610 | 617.53 | 17.30 | 442.42 | 101.2 | 2.42644 |
| 240 | 240.02 | 0.6355 | 171.13 | 1084.0 | 1.47824 | 620 | 628.07 | 18.36 | 450.09 | 96.92 | 2.44356 |
| 250 | 250.05 | 0.7329 | 178.28 | 979.0 | 1.51917 | 630 | 638.63 | 19.84 | 457.78 | 92.84 | 2.46048 |
| 260 | 260.09 | 0.8405 | 185.45 | 887.8 | 1.55848 | 640 | 649.22 | 20.64 | 465.50 | 88.99 | 2.47716 |
| 270 | 270.11 | 0.9590 | 192.60 | 808.0 | 1.59634 | 650 | 659.84 | 21.86 | 473.25 | 85.34 | 2.49364 |
| 280 | 280.13 | 1.0889 | 199.75 | 738.0 | 1.63279 | 660 | 670.47 | 23.13 | 481.01 | 81.89 | 2.50985 |
| 285 | 285.14 | 1.1584 | 203.33 | 706.1 | 1.65055 | 670 | 681.14 | 24.46 | 488.81 | 78.61 | 2.52589 |
| 290 | 290.16 | 1.2311 | 206.91 | 676.1 | 1.66802 | 680 | 691.82 | 25.85 | 496.62 | 75.50 | 2.54175 |
| 295 | 295.17 | 1.3068 | 210.49 | 647.9 | 1.68515 | 690 | 702.52 | 27.29 | 504.45 | 72.56 | 2.55731 |
| 298 | 298.18 | 1.3543 | 212.64 | 631.9 | 1.69528 | 700 | 713.27 | 28.80 | 512.33 | 69.76 | 2.57277 |
| 300 | 300.19 | 1.3860 | 214.07 | 621.2 | 1.70203 | 710 | 724.04 | 30.38 | 520.23 | 67.07 | 2.58810 |
| 305 | 305.22 | 1.4686 | 217.67 | 596.0 | 1.71865 | 720 | 734.82 | 32.02 | 528.14 | 64.53 | 2.60319 |
| 310 | 310.24 | 1.5546 | 221.25 | 572.3 | 1.73498 | 730 | 745.62 | 33.72 | 536.07 | 62.13 | 2.61803 |
| 315 | 315.27 | 1.6442 | 224.85 | 549.8 | 1.75106 | 740 | 756.44 | 35.50 | 544.02 | 59.82 | 2.63280 |
| 320 | 320.29 | 1.7375 | 228.42 | 528.6 | 1.76690 | 750 | 767.29 | 37.35 | 551.99 | 57.63 | 2.64737 |
| 325 | 325.31 | 1.8345 | 232.02 | 508.4 | 1.78249 | 760 | 778.18 | 39.27 | 560.01 | 55.54 | 2.66176 |
| 330 | 330.34 | 1.9352 | 235.61 | 489.4 | 1.79783 | 780 | 800.03 | 43.35 | 576.12 | 51.64 | 2.69013 |
| 340 | 340.42 | 2.149 | 242.82 | 454.1 | 1.82790 | 800 | 821.95 | 47.75 | 592.30 | 48.08 | 2.71787 |
| 350 | 350.49 | 2.379 | 250.02 | 422.2 | 1.85708 | 820 | 843.98 | 52.59 | 608.59 | 44.84 | 2.74504 |
| 360 | 360.58 | 2.626 | 257.24 | 393.4 | 1.88543 | 840 | 866.08 | 57.60 | 624.95 | 41.85 | 2.77170 |
| 370 | 370.67 | 2.892 | 264.46 | 367.2 | 1.91313 | 860 | 888.27 | 63.09 | 641.40 | 39.12 | 2.79783 |
| 380 | 380.77 | 3.176 | 271.69 | 343.4 | 1.94001 | 880 | 910.56 | 68.98 | 657.95 | 36.61 | 2.82344 |
| 390 | 390.88 | 3.481 | 278.93 | 321.5 | 1.96633 | 900 | 932.93 | 75.29 | 674.58 | 34.31 | 2.84856 |
| 400 | 400.98 | 3.806 | 286.16 | 301.6 | 1.99194 | 920 | 955.38 | 82.05 | 691.28 | 32.18 | 2.87324 |
| 410 | 411.12 | 4.153 | 293.43 | 283.3 | 2.01699 | 940 | 977.92 | 89.28 | 708.08 | 30.22 | 2.89748 |
| 420 | 421.26 | 4.522 | 300.69 | 266.6 | 2.04142 | 960 | 1000.55 | 97.00 | 725.02 | 28.40 | 2.92128 |
| 430 | 431.43 | 4.915 | 307.99 | 251.1 | 2.06533 | 980 | 1023.25 | 105.2 | 741.98 | 26.73 | 2.94468 |
| 440 | 441.61 | 5.332 | 315.30 | 236.8 | 2.08870 | 1000 | 1046.04 | 114.0 | 758.94 | 25.17 | 2.96770 |
| 450 | 451.80 | 5.775 | 322.62 | 223.6 | 2.11161 | 1020 | 1068.89 | 123.4 | 776.10 | 23.72 | 2.99034 |
| 460 | 462.02 | 6.245 | 329.97 | 211.4 | 2.13407 | 1040 | 1091.85 | 133.3 | 793.36 | 23.29 | 3.01260 |
| 470 | 472.24 | 6.742 | 337.32 | 200.1 | 2.15604 | 1060 | 1114.86 | 143.9 | 810.62 | 21.14 | 3.03449 |
| 480 | 482.49 | 7.268 | 344.70 | 189.5 | 2.17760 | 1080 | 1137.89 | 155.2 | 827.88 | 19.98 | 3.05608 |
| 490 | 492.74 | 7.824 | 352.08 | 179.7 | 2.19876 | 1100 | 1161.07 | 167.1 | 845.33 | 18.896 | 3.07732 |
| 500 | 503.02 | 8.411 | 359.49 | 170.6 | 2.21952 | 1120 | 1184.28 | 179.7 | 862.79 | 17.886 | 3.09825 |
| 510 | 513.32 | 9.031 | 366.92 | 162.1 | 2.23993 | 1140 | 1207.57 | 193.1 | 880.35 | 16.946 | 3.11883 |
| 520 | 523.63 | 9.684 | 374.36 | 154.1 | 2.25997 | 1160 | 1230.92 | 207.2 | 897.91 | 16.064 | 3.13916 |
| 530 | 533.98 | 10.37 | 381.84 | 146.7 | 2.27967 | 1180 | 1254.34 | 222.2 | 915.57 | 15.241 | 3.15916 |
| 540 | 544.35 | 11.10 | 389.34 | 139.7 | 2.29906 | 1200 | 1277.79 | 238.0 | 933.33 | 14.470 | 3.17888 |
| 550 | 555.74 | 11.86 | 396.86 | 133.1 | 2.31809 | 1220 | 1301.31 | 254.7 | 951.09 | 13.747 | 3.19834 |
| 560 | 565.17 | 12.66 | 404.42 | 127.0 | 2.33685 | 1240 | 1324.93 | 272.3 | 968.95 | 13.069 | 3.21751 |
| 570 | 575.59 | 13.50 | 411.97 | 121.2 | 2.35531 | | | | | | |

# 國立雲林科技大學
## 96學年度碩士班入學招生考試試題

系所：機械系
科目：熱力學

Saturated water—Temperature table

| Temp., $T$ °C | Sat. press., $P_{sat}$ kPa | Specific volume, m³/kg: Sat. liquid, $v_f$ | Specific volume, m³/kg: Sat. vapor, $v_g$ | Internal energy, kJ/kg: Sat. liquid, $u_f$ | Internal energy, kJ/kg: Evap., $u_{fg}$ | Internal energy, kJ/kg: Sat. vapor, $u_g$ | Enthalpy, kJ/kg: Sat. liquid, $h_f$ | Enthalpy, kJ/kg: Evap., $h_{fg}$ | Enthalpy, kJ/kg: Sat. vapor, $h_g$ | Entropy, kJ/kg · K: Sat. liquid, $s_f$ | Entropy, kJ/kg · K: Evap., $s_{fg}$ | Entropy, kJ/kg · K: Sat. vapor, $s_g$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.01 | 0.6117 | 0.001000 | 206.00 | 0.000 | 2374.9 | 2374.9 | 0.001 | 2500.9 | 2500.9 | 0.0000 | 9.1556 | 9.1556 |
| 5 | 0.8725 | 0.001000 | 147.03 | 21.019 | 2360.8 | 2381.8 | 21.020 | 2489.1 | 2510.1 | 0.0763 | 8.9487 | 9.0249 |
| 10 | 1.2281 | 0.001000 | 106.32 | 42.020 | 2346.6 | 2388.7 | 42.022 | 2477.2 | 2519.2 | 0.1511 | 8.7488 | 8.8999 |
| 15 | 1.7057 | 0.001001 | 77.885 | 62.980 | 2332.5 | 2395.5 | 62.982 | 2465.4 | 2528.3 | 0.2245 | 8.5559 | 8.7803 |
| 20 | 2.3392 | 0.001002 | 57.762 | 83.913 | 2318.4 | 2402.3 | 83.915 | 2453.5 | 2537.4 | 0.2965 | 8.3696 | 8.6661 |
| 25 | 3.1698 | 0.001003 | 43.340 | 104.83 | 2304.3 | 2409.1 | 104.83 | 2441.7 | 2546.5 | 0.3672 | 8.1895 | 8.5567 |
| 30 | 4.2469 | 0.001004 | 32.879 | 125.73 | 2290.2 | 2415.9 | 125.74 | 2429.8 | 2555.6 | 0.4368 | 8.0152 | 8.4520 |
| 35 | 5.6291 | 0.001006 | 25.205 | 146.63 | 2276.0 | 2422.7 | 146.64 | 2417.9 | 2564.6 | 0.5051 | 7.8466 | 8.3517 |
| 40 | 7.3851 | 0.001008 | 19.515 | 167.53 | 2261.9 | 2429.4 | 167.53 | 2406.0 | 2573.5 | 0.5724 | 7.6832 | 8.2556 |
| 45 | 9.5953 | 0.001010 | 15.251 | 188.43 | 2247.7 | 2436.1 | 188.44 | 2394.0 | 2582.4 | 0.6386 | 7.5247 | 8.1633 |

Saturated water—Pressure table

| Press., $P$ kPa | Sat. temp., $T_{sat}$ °C | Specific volume, m³/kg: Sat. liquid, $v_f$ | Specific volume, m³/kg: Sat. vapor, $v_g$ | Internal energy, kJ/kg: Sat. liquid, $u_f$ | Internal energy, kJ/kg: Evap., $u_{fg}$ | Internal energy, kJ/kg: Sat. vapor, $u_g$ | Enthalpy, kJ/kg: Sat. liquid, $h_f$ | Enthalpy, kJ/kg: Evap., $h_{fg}$ | Enthalpy, kJ/kg: Sat. vapor, $h_g$ | Entropy, kJ/kg · K: Sat. liquid, $s_f$ | Entropy, kJ/kg · K: Evap., $s_{fg}$ | Entropy, kJ/kg · K: Sat. vapor, $s_g$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 6.97 | 0.001000 | 129.19 | 29.302 | 2355.2 | 2384.5 | 29.303 | 2484.4 | 2513.7 | 0.1059 | 8.8690 | 8.9749 |
| 1.5 | 13.02 | 0.001001 | 87.964 | 54.686 | 2338.1 | 2392.8 | 54.688 | 2470.1 | 2524.7 | 0.1956 | 8.6314 | 8.8270 |
| 2.0 | 17.50 | 0.001001 | 66.990 | 73.431 | 2325.5 | 2398.9 | 73.433 | 2459.5 | 2532.9 | 0.2606 | 8.4621 | 8.7227 |
| 2.5 | 21.08 | 0.001002 | 54.242 | 88.422 | 2315.4 | 2403.8 | 88.424 | 2451.0 | 2539.4 | 0.3118 | 8.3302 | 8.6421 |
| 3.0 | 24.08 | 0.001003 | 45.654 | 100.98 | 2306.9 | 2407.9 | 100.98 | 2443.9 | 2544.8 | 0.3543 | 8.2222 | 8.5765 |
| 4.0 | 28.96 | 0.001004 | 34.791 | 121.39 | 2293.1 | 2414.5 | 121.39 | 2432.3 | 2553.7 | 0.4224 | 8.0510 | 8.4734 |
| 5.0 | 32.87 | 0.001005 | 28.185 | 137.75 | 2282.1 | 2419.8 | 137.75 | 2423.0 | 2560.7 | 0.4762 | 7.9176 | 8.3938 |
| 7.5 | 40.29 | 0.001008 | 19.233 | 168.74 | 2261.1 | 2429.8 | 168.75 | 2405.3 | 2574.0 | 0.5763 | 7.6738 | 8.2501 |
| 10 | 45.81 | 0.001010 | 14.670 | 191.79 | 2245.4 | 2437.2 | 191.81 | 2392.1 | 2583.9 | 0.6492 | 7.4996 | 8.1488 |
| 15 | 53.97 | 0.001014 | 10.020 | 225.93 | 2222.1 | 2448.0 | 225.94 | 2372.3 | 2598.3 | 0.7549 | 7.2522 | 8.0071 |
| 20 | 60.06 | 0.001017 | 7.6481 | 251.40 | 2204.6 | 2456.0 | 251.42 | 2357.5 | 2608.9 | 0.8320 | 7.0752 | 7.9073 |
| 25 | 64.96 | 0.001020 | 6.2034 | 271.93 | 2190.4 | 2462.4 | 271.96 | 2345.5 | 2617.5 | 0.8932 | 6.9370 | 7.8302 |
| 30 | 69.09 | 0.001022 | 5.2287 | 289.24 | 2178.5 | 2467.7 | 289.27 | 2335.3 | 2624.6 | 0.9441 | 6.8234 | 7.7675 |
| 40 | 75.86 | 0.001026 | 3.9933 | 317.58 | 2158.8 | 2476.3 | 317.62 | 2318.4 | 2636.1 | 1.0261 | 6.6430 | 7.6691 |
| 50 | 81.32 | 0.001030 | 3.2403 | 340.49 | 2142.7 | 2483.2 | 340.54 | 2304.7 | 2645.2 | 1.0912 | 6.5019 | 7.5931 |
| 75 | 91.76 | 0.001037 | 2.2172 | 384.36 | 2111.8 | 2496.1 | 384.44 | 2278.0 | 2662.4 | 1.2132 | 6.2426 | 7.4558 |
| 100 | 99.61 | 0.001043 | 1.6941 | 417.40 | 2088.2 | 2505.6 | 417.51 | 2257.5 | 2675.0 | 1.3028 | 6.0562 | 7.3589 |
| 101.325 | 99.97 | 0.001043 | 1.6734 | 418.95 | 2087.0 | 2506.0 | 419.06 | 2256.5 | 2675.6 | 1.3069 | 6.0476 | 7.3545 |
| 125 | 105.97 | 0.001048 | 1.3750 | 444.23 | 2068.8 | 2513.0 | 444.36 | 2240.6 | 2684.9 | 1.3741 | 5.9100 | 7.2841 |
| 150 | 111.35 | 0.001053 | 1.1594 | 466.97 | 2052.3 | 2519.2 | 467.13 | 2226.0 | 2693.1 | 1.4337 | 5.7894 | 7.2231 |
| 175 | 116.04 | 0.001057 | 1.0037 | 486.82 | 2037.7 | 2524.5 | 487.01 | 2213.1 | 2700.2 | 1.4850 | 5.6865 | 7.1716 |
| 200 | 120.21 | 0.001061 | 0.88578 | 504.50 | 2024.6 | 2529.1 | 504.71 | 2201.6 | 2706.3 | 1.5302 | 5.5968 | 7.1270 |
| 225 | 123.97 | 0.001064 | 0.79329 | 520.47 | 2012.7 | 2533.2 | 520.71 | 2191.0 | 2711.7 | 1.5706 | 5.5171 | 7.0877 |
| 250 | 127.41 | 0.001067 | 0.71873 | 535.08 | 2001.8 | 2536.8 | 535.35 | 2181.2 | 2716.5 | 1.6072 | 5.4453 | 7.0525 |
| 275 | 130.58 | 0.001070 | 0.65732 | 548.57 | 1991.6 | 2540.1 | 548.86 | 2172.0 | 2720.9 | 1.6408 | 5.3800 | 7.0207 |
| 300 | 133.52 | 0.001073 | 0.60582 | 561.11 | 1982.1 | 2543.2 | 561.43 | 2163.5 | 2724.9 | 1.6717 | 5.3200 | 6.9917 |
| 325 | 136.27 | 0.001076 | 0.56199 | 572.84 | 1973.1 | 2545.9 | 573.19 | 2155.4 | 2728.6 | 1.7005 | 5.2645 | 6.9650 |
| 350 | 138.86 | 0.001079 | 0.52422 | 583.89 | 1964.6 | 2548.5 | 584.26 | 2147.7 | 2732.0 | 1.7274 | 5.2128 | 6.9402 |
| 375 | 141.30 | 0.001081 | 0.49133 | 594.32 | 1956.6 | 2550.9 | 594.73 | 2140.4 | 2735.1 | 1.7526 | 5.1645 | 6.9171 |
| 400 | 143.61 | 0.001084 | 0.46242 | 604.22 | 1948.9 | 2553.1 | 604.66 | 2133.4 | 2738.1 | 1.7765 | 5.1191 | 6.8955 |
| 450 | 147.90 | 0.001088 | 0.41392 | 622.65 | 1934.5 | 2557.1 | 623.14 | 2120.3 | 2743.4 | 1.8205 | 5.0356 | 6.8561 |
| 500 | 151.83 | 0.001093 | 0.37483 | 639.54 | 1921.2 | 2560.7 | 640.09 | 2108.0 | 2748.1 | 1.8604 | 4.9603 | 6.8207 |
| 550 | 155.46 | 0.001097 | 0.34261 | 655.16 | 1908.8 | 2563.9 | 655.77 | 2096.6 | 2752.4 | 1.8970 | 4.8916 | 6.7886 |
| 600 | 158.83 | 0.001101 | 0.31560 | 669.72 | 1897.1 | 2566.8 | 670.38 | 2085.8 | 2756.2 | 1.9308 | 4.8285 | 6.7593 |
| 650 | 161.98 | 0.001104 | 0.29200 | 683.37 | 1886.1 | 2569.4 | 684.08 | 2075.5 | 2759.6 | 1.9623 | 4.7699 | 6.7322 |
| 700 | 164.95 | 0.001108 | 0.27278 | 696.23 | 1875.6 | 2571.8 | 697.00 | 2065.8 | 2762.8 | 1.9918 | 4.7153 | 6.7071 |
| 750 | 167.75 | 0.001111 | 0.25552 | 708.40 | 1865.6 | 2574.0 | 709.24 | 2056.4 | 2765.7 | 2.0195 | 4.6642 | 6.6837 |

# 國立雲林科技大學
## 96學年度碩士班入學招生考試試題

系所：機械系
科目：熱力學

Superheated water

| 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 = 0.01 MPa (45.81°C)* | | | | P = 0.05 MPa (81.32°C) | | | | P = 0.10 MPa (99.61°C) | | | |
| Sat.† | 14.670 | 2437.2 | 2583.9 | 8.1488 | 3.2403 | 2483.2 | 2645.2 | 7.5931 | 1.6941 | 2505.6 | 2675.0 | 7.3589 |
| 50 | 14.867 | 2443.3 | 2592.0 | 8.1741 | | | | | | | | |
| 100 | 17.196 | 2515.5 | 2687.5 | 8.4489 | 3.4187 | 2511.5 | 2682.4 | 7.6953 | 1.6959 | 2506.2 | 2675.8 | 7.3611 |
| 150 | 19.513 | 2587.9 | 2783.0 | 8.6893 | 3.8897 | 2585.7 | 2780.2 | 7.9413 | 1.9367 | 2582.9 | 2776.6 | 7.6148 |
| 200 | 21.826 | 2661.4 | 2879.6 | 8.9049 | 4.3562 | 2660.0 | 2877.8 | 8.1592 | 2.1724 | 2658.2 | 2876.5 | 7.8356 |
| 250 | 24.136 | 2736.1 | 2977.5 | 9.1015 | 4.8206 | 2735.1 | 2976.2 | 8.3568 | 2.4062 | 2733.9 | 2974.5 | 8.0346 |
| 300 | 26.446 | 2812.3 | 3076.7 | 9.2827 | 5.2841 | 2811.6 | 3075.8 | 8.5387 | 2.6389 | 2810.7 | 3074.5 | 8.2172 |
| 400 | 31.063 | 2969.3 | 3280.0 | 9.6094 | 6.2094 | 2968.9 | 3279.3 | 8.8659 | 3.1027 | 2968.3 | 3278.6 | 8.5452 |
| 500 | 35.680 | 3132.9 | 3489.7 | 9.8998 | 7.1338 | 3132.6 | 3489.3 | 9.1566 | 3.5655 | 3132.2 | 3488.7 | 8.8362 |
| 600 | 40.296 | 3303.3 | 3706.3 | 10.1631 | 8.0577 | 3303.1 | 3706.0 | 9.4201 | 4.0279 | 3302.8 | 3705.6 | 9.0999 |
| 700 | 44.911 | 3480.8 | 3929.9 | 10.4056 | 8.9813 | 3480.6 | 3929.7 | 9.6626 | 4.4900 | 3480.4 | 3929.4 | 9.3424 |
| 800 | 49.527 | 3665.4 | 4160.6 | 10.6312 | 9.9047 | 3665.2 | 4160.4 | 9.8883 | 4.9519 | 3665.0 | 4160.2 | 9.5682 |
| 900 | 54.143 | 3856.9 | 4398.3 | 10.8429 | 10.8280 | 3856.8 | 4398.2 | 10.1000 | 5.4137 | 3856.7 | 4398.0 | 9.7800 |
| 1000 | 58.758 | 4055.3 | 4642.8 | 11.0429 | 11.7513 | 4055.2 | 4642.7 | 10.3000 | 5.8755 | 4055.0 | 4642.6 | 9.9800 |
| 1100 | 63.373 | 4260.0 | 4893.8 | 11.2326 | 12.6745 | 4259.9 | 4893.7 | 10.4897 | 6.3372 | 4259.8 | 4893.6 | 10.1698 |
| 1200 | 67.989 | 4470.9 | 5150.8 | 11.4132 | 13.5977 | 4470.8 | 5150.7 | 10.6704 | 6.7988 | 4470.7 | 5150.6 | 10.3504 |
| 1300 | 72.604 | 4687.4 | 5413.4 | 11.5857 | 14.5209 | 4687.3 | 5413.3 | 10.8429 | 7.2605 | 4687.2 | 5413.3 | 10.5229 |
| | P = 0.20 MPa (120.21°C) | | | | P = 0.30 MPa (133.52°C) | | | | P = 0.40 MPa (143.61°C) | | | |
| Sat. | 0.88578 | 2529.1 | 2706.3 | 7.1270 | 0.60582 | 2543.2 | 2724.9 | 6.9917 | 0.46242 | 2553.1 | 2738.1 | 6.8956 |
| 150 | 0.95986 | 2577.1 | 2769.1 | 7.2810 | 0.63402 | 2571.0 | 2761.2 | 7.0792 | 0.47088 | 2564.4 | 2752.8 | 6.9306 |
| 200 | 1.08049 | 2654.6 | 2870.7 | 7.5081 | 0.71643 | 2651.0 | 2865.9 | 7.3132 | 0.53434 | 2647.2 | 2860.9 | 7.1723 |
| 250 | 1.19890 | 2731.4 | 2971.2 | 7.7100 | 0.79645 | 2728.9 | 2967.9 | 7.5180 | 0.59520 | 2726.4 | 2964.5 | 7.3804 |
| 300 | 1.31623 | 2808.8 | 3072.1 | 7.8941 | 0.87535 | 2807.0 | 3069.6 | 7.7037 | 0.65489 | 2805.1 | 3067.1 | 7.5677 |
| 400 | 1.54934 | 2967.2 | 3277.0 | 8.2236 | 1.03155 | 2966.0 | 3275.5 | 8.0347 | 0.77265 | 2964.9 | 3273.9 | 7.9003 |
| 500 | 1.78142 | 3131.4 | 3487.7 | 8.5153 | 1.18672 | 3130.6 | 3486.6 | 8.3271 | 0.88936 | 3129.8 | 3485.5 | 8.1933 |
| 600 | 2.01302 | 3302.2 | 3704.8 | 8.7793 | 1.34139 | 3301.6 | 3704.0 | 8.5915 | 1.00658 | 3301.0 | 3703.3 | 8.4580 |
| 700 | 2.24434 | 3479.9 | 3928.8 | 9.0221 | 1.49580 | 3479.5 | 3928.2 | 8.8345 | 1.12152 | 3479.0 | 3927.6 | 8.7012 |
| 800 | 2.47550 | 3664.7 | 4159.8 | 9.2479 | 1.65004 | 3664.3 | 4159.3 | 9.0605 | 1.23730 | 3663.9 | 4158.9 | 8.9274 |
| 900 | 2.70656 | 3856.3 | 4397.7 | 9.4598 | 1.80417 | 3856.0 | 4397.3 | 9.2725 | 1.35298 | 3855.7 | 4396.9 | 9.1394 |
| 1000 | 2.93755 | 4054.8 | 4642.3 | 9.6599 | 1.95824 | 4054.5 | 4642.0 | 9.4726 | 1.46859 | 4054.3 | 4641.7 | 9.3396 |
| 1100 | 3.16848 | 4259.6 | 4893.3 | 9.8497 | 2.11226 | 4259.4 | 4893.1 | 9.6624 | 1.58414 | 4259.2 | 4892.9 | 9.5295 |
| 1200 | 3.39938 | 4470.5 | 5150.4 | 10.0304 | 2.26624 | 4470.3 | 5150.2 | 9.8431 | 1.69966 | 4470.2 | 5150.0 | 9.7102 |
| 1300 | 3.63026 | 4687.1 | 5413.1 | 10.2029 | 2.42019 | 4686.9 | 5413.0 | 10.0157 | 1.81516 | 4686.7 | 5412.8 | 9.8828 |

Superheated water (*Continued*)

| 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 = 4.0 MPa (250.35°C) | | | | P = 4.5 MPa (257.44°C) | | | | P = 5.0 MPa (263.94°C) | | | |
| Sat. | 0.04978 | 2601.7 | 2800.8 | 6.0696 | 0.04406 | 2599.7 | 2798.0 | 6.0198 | 0.03945 | 2597.0 | 2794.2 | 5.9737 |
| 275 | 0.05461 | 2668.9 | 2887.3 | 6.2312 | 0.04733 | 2651.4 | 2864.4 | 6.1429 | 0.04144 | 2632.3 | 2839.5 | 6.0571 |
| 300 | 0.05887 | 2726.2 | 2961.7 | 6.3639 | 0.05138 | 2713.0 | 2944.2 | 6.2854 | 0.04535 | 2699.0 | 2925.7 | 6.2111 |
| 350 | 0.06647 | 2827.4 | 3093.3 | 6.5843 | 0.05842 | 2818.6 | 3081.5 | 6.5153 | 0.05197 | 2809.5 | 3069.3 | 6.4516 |
| 400 | 0.07343 | 2920.8 | 3214.5 | 6.7714 | 0.06477 | 2914.2 | 3205.7 | 6.7071 | 0.05784 | 2907.5 | 3196.7 | 6.6483 |
| 450 | 0.08004 | 3011.0 | 3331.2 | 6.9386 | 0.07076 | 3005.8 | 3324.2 | 6.8770 | 0.06332 | 3000.6 | 3317.2 | 6.8210 |
| 500 | 0.08644 | 3100.3 | 3446.0 | 7.0922 | 0.07652 | 3096.0 | 3440.4 | 7.0323 | 0.06858 | 3091.8 | 3434.7 | 6.9781 |
| 600 | 0.09886 | 3279.4 | 3674.9 | 7.3706 | 0.08766 | 3276.4 | 3670.9 | 7.3127 | 0.07870 | 3273.3 | 3666.9 | 7.2605 |
| 700 | 0.11098 | 3462.4 | 3906.3 | 7.6214 | 0.09850 | 3460.0 | 3903.3 | 7.5647 | 0.08852 | 3457.7 | 3900.3 | 7.5136 |
| 800 | 0.12292 | 3650.6 | 4142.3 | 7.8523 | 0.10916 | 3648.8 | 4140.0 | 7.7962 | 0.09816 | 3646.9 | 4137.7 | 7.7458 |
| 900 | 0.13475 | 3844.8 | 4383.9 | 8.0675 | 0.11972 | 3843.3 | 4382.1 | 8.0118 | 0.10769 | 3841.8 | 4380.2 | 7.9619 |
| 1000 | 0.14653 | 4045.1 | 4631.2 | 8.2698 | 0.13020 | 4043.9 | 4629.8 | 8.2144 | 0.11715 | 4042.6 | 4628.3 | 8.1648 |
| 1100 | 0.15824 | 4251.4 | 4884.4 | 8.4612 | 0.14064 | 4250.4 | 4883.2 | 8.4060 | 0.12655 | 4249.3 | 4882.1 | 8.3566 |
| 1200 | 0.16992 | 4463.5 | 5143.2 | 8.6430 | 0.15103 | 4462.6 | 5142.2 | 8.5880 | 0.13592 | 4461.6 | 5141.3 | 8.5388 |
| 1300 | 0.18157 | 4680.9 | 5407.2 | 8.8164 | 0.16140 | 4680.1 | 5406.5 | 8.7616 | 0.14527 | 4679.3 | 5405.7 | 8.7124 |
| | P = 6.0 MPa (275.59°C) | | | | P = 7.0 MPa (285.83°C) | | | | P = 8.0 MPa (295.01°C) | | | |
| Sat. | 0.03245 | 2589.9 | 2784.6 | 5.8902 | 0.027378 | 2581.0 | 2772.6 | 5.8148 | 0.023525 | 2570.5 | 2758.7 | 5.7450 |
| 300 | 0.03619 | 2668.4 | 2885.6 | 6.0703 | 0.029492 | 2633.5 | 2839.9 | 5.9337 | 0.024279 | 2592.3 | 2786.5 | 5.7937 |
| 350 | 0.04225 | 2790.4 | 3043.9 | 6.3357 | 0.035262 | 2770.1 | 3016.9 | 6.2305 | 0.029975 | 2748.3 | 2988.1 | 6.1321 |
| 400 | 0.04742 | 2893.7 | 3178.3 | 6.5432 | 0.039958 | 2879.5 | 3159.2 | 6.4502 | 0.034344 | 2864.6 | 3139.4 | 6.3658 |
| 450 | 0.05217 | 2989.9 | 3302.9 | 6.7219 | 0.044187 | 2979.0 | 3288.3 | 6.6353 | 0.038194 | 2967.8 | 3273.3 | 6.5579 |
| 500 | 0.05667 | 3083.1 | 3423.1 | 6.8826 | 0.048157 | 3074.3 | 3411.4 | 6.8000 | 0.041767 | 3065.4 | 3399.5 | 6.7266 |
| 550 | 0.06102 | 3175.2 | 3541.3 | 7.0308 | 0.051966 | 3167.9 | 3531.6 | 6.9507 | 0.045172 | 3160.5 | 3521.8 | 6.8800 |
| 600 | 0.06527 | 3267.2 | 3658.8 | 7.1693 | 0.055665 | 3261.0 | 3650.6 | 7.0910 | 0.048463 | 3254.7 | 3642.4 | 7.0221 |
| 700 | 0.07355 | 3453.0 | 3894.3 | 7.4247 | 0.062850 | 3448.3 | 3888.3 | 7.3487 | 0.054829 | 3443.6 | 3882.2 | 7.2822 |
| 800 | 0.08165 | 3643.2 | 4133.1 | 7.6582 | 0.069856 | 3639.5 | 4128.5 | 7.6836 | 0.061011 | 3635.7 | 4123.8 | 7.5185 |
| 900 | 0.08964 | 3838.8 | 4376.6 | 7.8751 | 0.076750 | 3836.7 | 4373.0 | 7.8014 | 0.067082 | 3832.7 | 4369.3 | 7.7372 |
| 1000 | 0.09756 | 4040.1 | 4625.4 | 8.0786 | 0.083571 | 4037.5 | 4622.6 | 8.0058 | 0.073079 | 4035.0 | 4619.6 | 7.9419 |
| 1100 | 0.10543 | 4247.1 | 4879.7 | 8.2709 | 0.090341 | 4245.0 | 4877.4 | 8.1982 | 0.079025 | 4242.8 | 4875.0 | 8.1350 |
| 1200 | 0.11326 | 4459.8 | 5139.4 | 8.4534 | 0.097075 | 4457.9 | 5137.4 | 8.3810 | 0.084934 | 4456.1 | 5135.5 | 8.3181 |
| 1300 | 0.12107 | 4677.7 | 5404.1 | 8.6273 | 0.103781 | 4676.1 | 5402.6 | 8.5551 | 0.090817 | 4674.5 | 5401.0 | 8.4925 |

# 國立雲林科技大學
## 96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. (1) 說明爲何在低溫下(或室溫)，晶粒細小的金屬比晶粒粗大的具有較大的強度？晶粒大小與其強度的關係爲何？ 10%

   (2) 爲何在高溫中具大晶粒尺寸材料的強度比細晶粒材料高？ 5%

2. 列舉說明可提升金屬材料疲勞強度的方法。 5%

3. 繪出典型之工程應力-工程應變之曲線，並於圖上標示出下列各值：
   (1) yield stress
   (2) ultimate stress
   (3) fracture stress
   (4) elastic limit
   (5) percent elongation
   10%

4. 說明下列加工法之中文名稱及簡述其製程： 20%
   (1) Casting
   (2) Anodizing
   (3) Sintering
   (4) Forging
   (5) Sputtering

國立雲林科技大學
96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

5. 一般製造橡膠零件之技術是隨熱塑性化合物的加工而變動的。試舉出四種最常用之橡膠化合物加工法，簡述原理並說明其優缺點 20%

6. 近代加工朝向微小化，電子束爲常用之能量加工方式之一。請說明電子束原理，並舉出四種利用電子束之加工方式，並比較彼此之差異性 15%

7. 在精密量測中，何謂阿貝原理(Abbe' Law)？試利用兩種量具解釋之並說明其補償對策。15%

國立雲林科技大學
96學年度碩士班入學招生考試試題

系所：機械系
科目：動力學

1. (a) Drive equations for velocity and acceleration in planar motion of particles (Fig. 1a), and express them with the polar coordinates **r and θ.** (10%)
(b) A crate slides down the section of the spiral ramp (Fig. 1b) such that $\mathbf{r = (0.5z)}$ ft and $\mathbf{z = (100\text{-}0.1t^2)}$ ft, where t is in seconds. If the rate of rotation about the z axis is $\mathbf{\theta = 0.04\pi t}$ rad/s, determine the magnitude of acceleration of the crate at the instant $\mathbf{z = 3}$ ft. (15%)

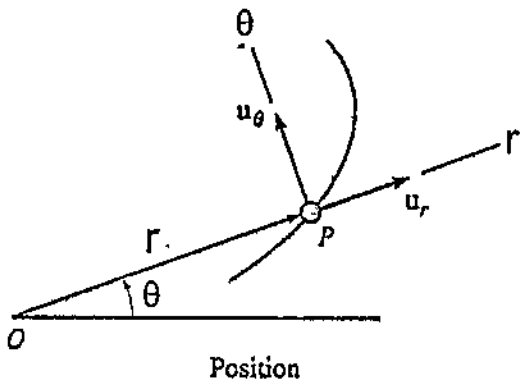



Fig. 1a

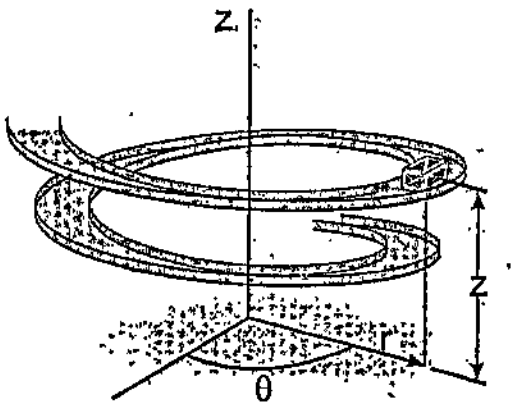



Fig. 1b

2. (a) Verify the principle of work and energy for particles $T_1 + \Sigma U_{1\text{-}2} = T_2$, where $T_1/T_2$ represents kinetics energy at position 1 and 2 of the motion path and $\Sigma U_{1\text{-}2}$ is the sum of the work done by all forces acting on a particle from position 1 to position 2. (10%)
(b) Packages with a weight of 50 lb are delivered to the chute at $\mathbf{V_A = 3}$ ft/s by a convey belt (Fig. 2). Determine their speeds when they reach points B, C and D. Neglect friction and the size of packages. (15%)

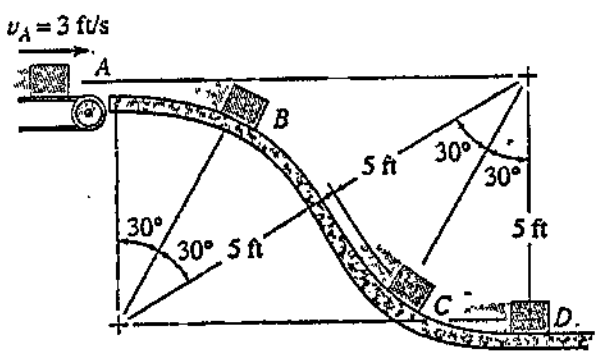



Fig. 2

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系所：機械系
科目：動力學

3. Disk D, of radius R, is pinned to end A of the arm OA of length L located in the plane of the disk as shown in Fig. 3. The arm rotates about a vertical axis through O at the constant rate $\omega_1$, and the disk rotates about A at the constant rate $\omega_2$. Determine
   (a) The velocity of point P located directly above A. ( 8% )
   (b) The acceleration of point P. ( 8% )
   (c) The angular velocity and angular acceleration of the disk. ( 9% )

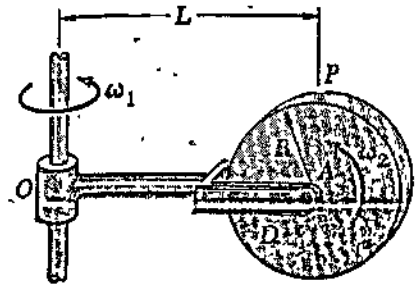


Fig. 3

4. A slender rod of length L and mass m is supported as shown in Fig. 4. After the cable is cut the rod swings freely. Determine followings as the rod first passes through a vertical position.
   (a) The angular velocity of the rod. ( 12% )
   (b) The corresponding reaction at the pin support. ( 13% )

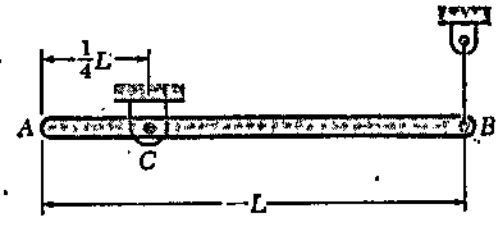


Fig. 4

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系所：機械系
科目：應用微積分

本試題共三大題，共計100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) Find $\lim_{h\to 0}\frac{(2+h)^3-8}{h}$. [7%]

   (b) Find $\lim_{t\to 0}\frac{e^{3t}-1}{t}$. [8%]

   (c) Find $\partial z/\partial y$ for $x^2+y^2+z^2=3xyz$. [10%]

2. (a) Find the Taylor series for $f(x)=e^x$ centered at $a=3$. [10%]

   (b) Find the absolute maximum and absolute minimum values of the function on the given interval. $f(x)=2x^3-3x^2-12x+1$ [-2,3] [15%]

國立雲林科技大學
96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

3. (a) $\int \frac{x}{\sqrt{x-1}} dx = ?$ (10%)

(b) $\int (3^x + \tan^2 x) dx = ?$ (10%)

(c) $\int (x+4)^{30} dx = ?$ (10%)

(d) $\int x^2 \sin 3x dx = ?$ (10%)

(e) $\int \frac{x^2+4}{x^3-3x+2x} dx = ?$ (10%)

國立雲林科技大學
96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 container half full with water is placed on a scale, and then a hollow aluminum ball connected to a rigid rod is held and forced into the water. Will the reading on the scale change as the ball enters the water halfway? Why? (10%) Does the scale reading depend on the depth to which the ball is immersed? If yes, how does it vary? (15%) (※ The hollow ball can be immersed completely without causing any water spill)

2. Considering a pipe system with circular cross section, please answer the following questions:
   a) How do you determine whether the flow field inside the pipe is laminar or turbulent?(5%)
   b) Draw the velocity profile u(r) ($-R \leq r \leq +R$) for both laminar and turbulent flow and state the main difference.(10%)
   c) When the pumping power consumption required delivering the fluid is in concern, then, it is better to keep the flow field under which condition, laminar or turbulent? Why? (10%)

國立雲林科技大學
96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 as two free jets from the tee attached to the pipe shown in Figure 1. The exit speed is 15 m/s. If viscous effects and gravity are negligible, determine the x and y components of the force that the pipe exerts on the tee. 25%

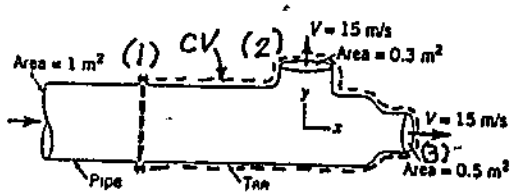


Fig. 1

4. Water flows through a two-dimensional diffuser having a $20^{o}$ expansion angle as shown in Figure 2. Assume that the flow in the diffuser can be treated as a radial flow emanating from a source at the origin O. (a) If the velocity at the entrance is 20 m/s, determine an expression for the pressure gradient along the diffuser walls. (b) What is the pressure rise between the entrance and exit? 25%

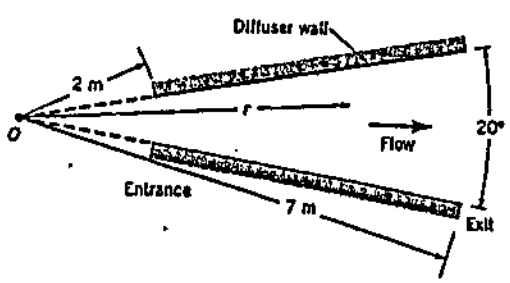


Fig. 2