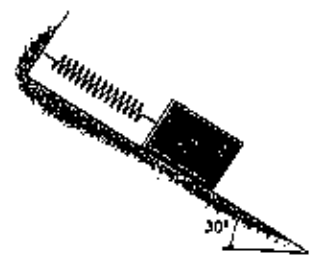


國立中央大學九十一年度碩士班研究生入學試題卷

所別： 機械工程學系 己組 科目： 基礎科目(一) 共 之 頁 第 1 頁

*注意！不限題數，任意作答，但請注意衡量時間。

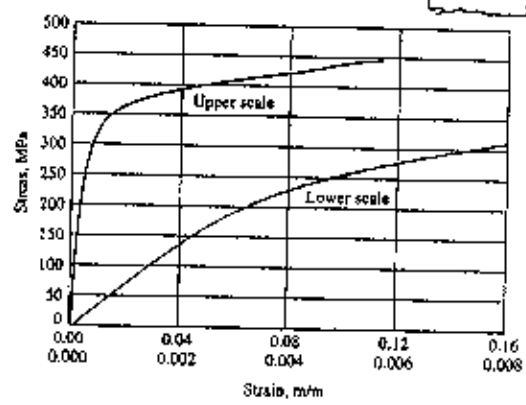
1. Motion of block A ($W=805$ lb) on the inclined surface is resisted by friction ($\mu=0.1$) and a linear spring ($k=25$ lb/ft). If the block is released at rest with the spring unstretched, determine the first phase of motion down the inclined surface.
 - (a) The maximum displacement of the block from its rest position. (6 分)
 - (b) The velocity of the block when it is 15 ft from its rest position. (7 分)
 - (c) The acceleration of the block as it begins to move up the inclined surface. (7 分)



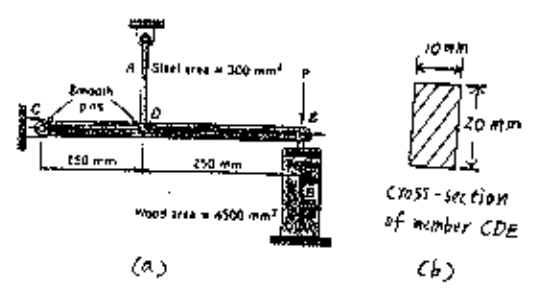
2. Two uniform slender rods AB and CD , each of mass m , are connected by two wires as shown. If the wire BD is cut, determine at that instant the acceleration (a) of point D , (b) of point B . (20 分)



3. A tensile test specimen was tested to fracture. Stress and strain values, which were calculated from load and deformation data obtained during the test, are shown in the figure. Note that the lower curve in the figure is a portion of the upper curve for strain less than 0.008. Determine
 - (a) The modulus of elasticity. (3 分)
 - (b) The proportional limit. (3 分)
 - (c) The ultimate strength. (3 分)
 - (d) The yield strength (0.2% offset). (3 分)
 - (e) The elongation. (3 分)



4. The axial stresses are 12 MPa (compression) in the wood post B and 150 MPa (tension) in the steel bar A of Fig. (a). Determine
 - (a) The load P . (5 分)
 - (b) The minimum diameter for pin C if it is in single shear and the shearing stress is limited to 70 MPa. (5 分)
 - (c) The maximum flexural stress in member CDE if it has a rectangular cross section 10 mm wide by 20 mm deep as shown in Fig. (b). (15 分)



5. 用 C/C++ (或 FORTRAN, MATLAB 均可) 語言寫一程式，此程式可印出下列結果(請註明所用語言；不可逐字輸入列印)。 (20 分)

```

1
1 4
1 4 7
1 4 7 10
... ..
... ..
1 4 7 10 13 16 19 22 25 28
    
```

6. C/C++ 中二維陣列變數 $a[2][3]$ 的元素儲存順序是 $a[0][0], a[0][1], a[0][2], a[1][0], a[1][1], a[1][2], a[2][0], a[2][1], a[2][2]$ ；已知變數佔記憶體空間：字元(character) 1 byte；整數(integer) 2 byte；浮點數(floating point) 4 byte。 (20 分)

- (a) 於程式變數宣告時，有一陣列變數 $b[4][N]$ ；若元素 $b[2][1]$ 在記憶體中位置為 1750，且 $b[3][2]$ 在記憶體中位置為 1774。請問 b 是那一種類型變數？ N 的僅為何？
- (b) 在下面程式變數宣告中，共佔了多少記憶體空間？

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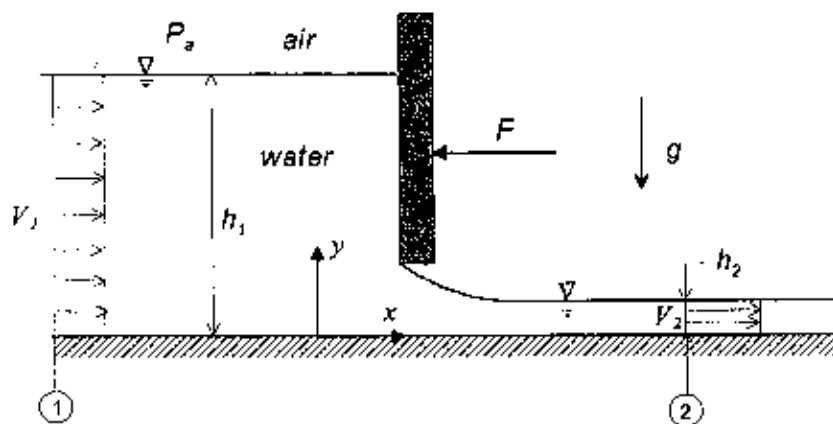
char    a[5][20], score[5];
int     m, n, phon_num[5];
float   subj_avg[5][8];
    
```

參考用

國立中央大學九十一年度碩士班研究生入學試題卷

所別： 機械工程學系 己組 科目： 基礎科目(一) 共 2 頁 第 2 頁

7. A sluice (水閘) gate is installed in a steady water stream of the density ρ , depth h_1 and speed V_1 (as assumed far upstream of the gate). Downstream of the gate, the stream has a depth h_2 less than h_1 . Assume that the flow is inviscid and incompressible, and both the stream velocities V_1 and V_2 are uniform.
- Given ρ , g , h_1 , V_1 and h_2 , find the horizontal force F , per unit width, required to hold the gate in place. (Hint: take a control volume and apply the conservation of mass and momentum). (10 分)
 - Consider a streamline connecting two points at position (1) and (2) respectively. Write down the Bernoulli equation. (10 分)
 - Obtain the stream velocities V_1 and V_2 in terms of h_1 , h_2 and g . (10 分)
 - Show that as h_2 approaches zero, V_2 approaches $\sqrt{2gh_1}$, and F approaches $\rho gh_1^2/2$. Explain. (10 分)



8. Explain the following terms: (12分)

- State postulate,
- Critical temperature,
- Dew-point temperature.

9. For the following processes, consider the total entropy generated in the control mass and in the surroundings. Describe the processes that change the entropy and the sign change of each process. Explain your answer. (8分)

- A cake of ice floating in water that is very near the freezing temperature slowly increases in mass until all the water is frozen. (Take the control mass as the ice plus the water.)
- One kilogram of putty is dropped onto a floor tile and sticks without bouncing.

For problems 10 and 11, please define the system or control volume clearly, and list all assumptions used.

10. Two blocks A and B are initially at 100 and 500 °C, respectively. They are brought together and isolated from the surroundings. Determine the final equilibrium temperature of the blocks. Block A is aluminum [$c_p = 0.900 \text{ kJ/kg}\cdot\text{K}$] with $m_A = 0.5 \text{ kg}$, and block B is copper [$c_p = 0.386 \text{ kJ/kg}\cdot\text{K}$] with $m_B = 1.0 \text{ kg}$. (10分)

11. Air exits an adiabatic turbine at a pressure of 1 atm. The inlet condition are $T_1 = 1100 \text{ °C}$ and $P_1 = 5 \text{ atm}$. The actual work output is 381.8 kJ/kg. Determine the isentropic efficiency of the turbine. (10分)