國立臺北科技大學 103 學年度碩士班招生考試

系所組別：1330 車輛工程系碩士班丙組

第二節　熱力學　試題

> **注意事項：**
> 1. 本試題共五題，配分共 100 分。
> 2. 請標明大題、子題編號作答，不必抄題。
> 3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、(20%) A piston cylinder contains air at 1200 kPa, 850 K with a volume of 0.06 m^3. The piston is pressed against the upper stops, and it will float at a pressure of 800 kPa. If the air is cooled to 500 K, what is the process work and heat transfer?(Air $C_v = 0.7176 kJ/kg-K$)

二、(20%) A wind turbine with rotor diameter of 25 m takes 35% of the kinetic energy out as the shaft work. If one day is with the atmospheric pressure 101.3 kPa, temperature 25^0C, and wind speed of 30km/h, what power is produced?(Air $R = 0.287 kJ/kg-K$)

三、(20%) A heat engine has a solar collector receiving 0.25 kW/m^2 inside which the transfer media is heated to 500 K. The solar energy powers the heat engine which rejects heat at 25^0C. If the heat engine should deliver 3 kW, what is the minimum area (m^2) for the solar collector?

四、(20%) Two 10 kg blocks of steel, one at 300^0C and the other at 30^0C, come in thermal contact. Find the change in entropy of the steel. (steel $C = 0.46 kJ/kg-K$)

五、(20%) Carbon dioxide at 350 K, 200kPa is brought through a steady device, where it is heated to 630 K by a 800 K reservoir in a constant pressure process. Find the specific entropy generation. (CO_2 $C_p = 0.973 kJ/kg-K$)

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1. Pleas solve the following first-order differential equations:

(a)(10%)　$y' + 8x^3y^3 + 2xy = 0$

(b)(10%)　$y = xy' - (y')^2/4$

(c)(10%)　$xy' + 2y = 5x^3, y(1) = 3$

2. Pleas solve the following differential equations:

(a)(10%)　$y^{(3)} + y^{(2)} - 2y' = 0, y(0) = 1, y'(0) = 2, y''(0) = 0$

(b)(10%)　$x^2y'' - 2xy' + 2y = 0, y(1) = 1, y'(1) = 3$

(c)(10%)　$(2x-3)^2y'' + (14x-21)y' + 4y = 0$

3.(20%)　Please solve the following problem by Power Series method.

　　$2xy'' + (x+1)y' + y = 0$

4. Please solve the following problems by Laplace Transform.

(a)　$y'' + 2ty' - 4y = 1, y(0) = y'(0) = 0$　　　　　　　　(10%)

(b)　$\begin{cases} y_1' - 2y_1 - y_2 = 2e^{5t} \\ y_2' - y_1 - 2y_2 = 3e^{2t} \end{cases}$　, $y_1(0) = y_2(0) = 0$　　　(10%)