PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm Examination: Semester I

Academic Year: 2004

Date: August 2, 2004

Time: 13:30-16:30

Subject: 230-601 Advanced Engineering
Mathematics for Chemical Engineers

Room: Chemical
engineering's Meeting
Room

อนุญาตให้นำเอกสารและเครื่องคำนวณทุกชนิดเข้าห้องสอบได้

ทุจริตในการสอบโทษขั้นต่ำคือปรับตกในรายวิชาที่ทุจริตและพักการศึกษา 1 ภาคการศึกษา

Please do all 5 questions. Show all your work to receive full or partial credit.
Final score is only 120.

Question #	Total Score	Score
1	30	
2	30	
3	30	
4	20	
5	10	
Total	120	

สุกฤทธิรา (บุญเรือง) รัตนวิไล

1. Solve the differential equation (10 scores for each problem)

1.1 $y'' - 4y = 25x^2 \sin x$

1.2 $y'' - 4y' + 3y = 10e^{-2x}$ $y(0) = 1,\ y'(0) = -3$

1.3 $y' + \dfrac{4}{x}y = -6x^4 y^{\frac{3}{2}}$

2. Find the general solution of the following equation by using POWER SERIES method (15 scores for each problem)

    2.1 $y'' + y = 0$

    2.2 $x^2 y'' + xy' - x^2 y = 0$

3. A straight rectangular fin with uniform cross section is used to cooling a hot surface of wall. A fin is attached to a wall which temperature known to be Tw. The ambient air flowing around the fin has a temperature of Ta. The fin conductivity takes a value of k. The heat transfer coefficient around the surface is constant h. (30 scores)
   - Show the steady state differential equation for the case when fin temperature changes mainly in the x direction.
   - Solve that equation with the followings boundary conditions
         At   x = 0   T = Tw

       At   x = L $\dfrac{dT}{dx} = 0$
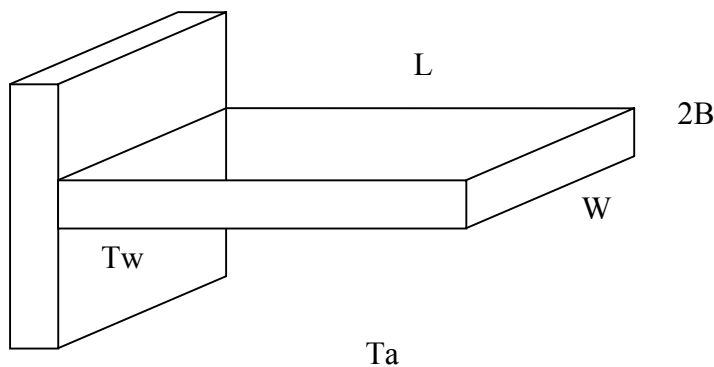
4. A tank contains 3 m^3 of fresh water. A stream of salt water containing 20 kg/m^3 of salt is fed into the tank at a rate of 0.05 m^3/s. Liquid flows from the tank at a rate of 0.01 m^3/s. Assume that the tank is well agitated. Assuming that the concentration of the outlet stream increases linearly with time, what is the salt concentration in the tank when the tank contains 7 m^3 of liquid? (20 scores)

5. **Draw a diagram** or map to show all methods that you have learn from class in order to **solve ordinary differential equation** for both first and second order ODE (10 scores)