



Prince of Songkla University
Faculty of Engineering

Final Test
27 April 2016
215-274 Numerical Methods for Mechanical Engineering

Semester 2/2015
09:00-12:00
Room: Robot Head

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|---|
| Name _____ ID _____ |
| Section <input type="checkbox"/> 01 Perapong <input type="checkbox"/> 02 Kittinan |

Direction:

1. All types of calculator and dictionary are permitted.
2. There are totally 4 problems.
3. One sheet of hand-written A4 paper is allowed. No photocopy!!

Perapong Tekasakul
Kittinan Maliwan

Instructors

| Problem No. | Full score | Your mark |
|----------------|------------|-----------|
| 1 | 15 | |
| 2 | 15 | |
| 3 | 15 | |
| 4 | 15 | |
| Total | 60 | |

1. Use the fourth-order RK method to solve

$$\frac{d^2y}{dx^2} - t + y = 0$$

where $y(0) = 2$ and $\frac{dy(0)}{dx} = 0$.

Solve from $x=0$ to 1 using $h=0.2$. (15 points)

2. Use the shooting method to solve

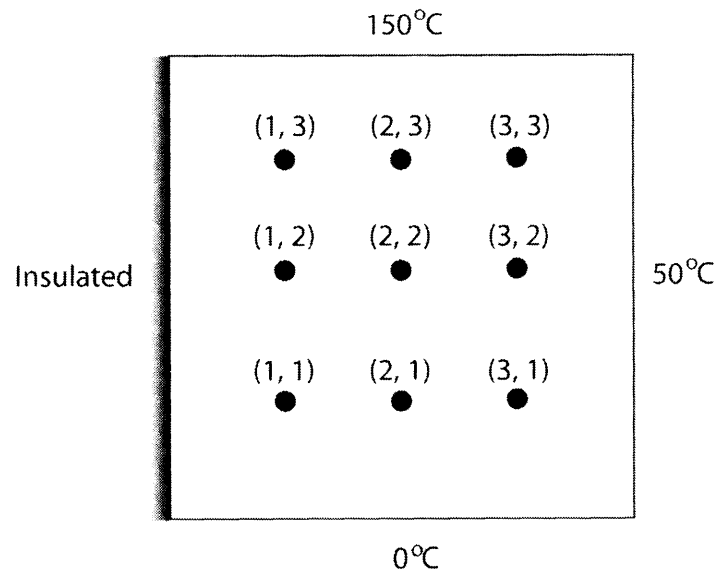
$$\frac{d^2T}{dx^2} - 1 \times 10^{-7}(T + 273)^4 + 4(150 - T) = 0$$

with the boundary conditions $T(0) = 200$ and $T(0.5) = 100$.

Employ the Heun's method with step size of 0.1.

The two guesses for initial condition of z are -860 and -840. (15 points)

3. Use Liebmann's method to solve for the temperature of the plate shown in the figure below. Use a relaxation factor of 1.1. Do only 1 iteration. (15 points)



4. Use the Crank-Nicholson method to solve for the temperature distribution of a long thin rod with a length of 10 cm and the following values: $k = 0.835 \text{ cm}^2/\text{s}$, $\lambda = 0.020875$, $\Delta x = 2 \text{ cm}$, and $\Delta t = 0.1 \text{ s}$.

Determine the temperature distribution at $t = 0.1 \text{ s}$. At $t = 0$, the temperature of the rod is zero and the boundary conditions are fixed for all times at $T(0) = 50^\circ \text{C}$ and $T(10) = 100^\circ \text{C}$.

Show all of the calculations in details including the solution to the system of equations.

(15 points)

