



Mansoura University	1 st Year of mechanical Eng.
Faculty of Engineering	Time Allowed : 3 Hr
Mechanical Power Eng. Dept.	Computer Application in MPE1
June 2010	

Notes : the exam in two page
Attempt solve all problems

Problem (1): [15 mark]

The surface configuration of the NACA 0012 airfoil of length 1m and maximum thickness of 0.2m is given by:

$$Y(x)=\pm[0.2969\sqrt{x}-0.126x-0.3516x^2+0.2843x^3-0.1015x^4]$$

Where plus and minus signs refer to upper and lower surface respectively where the thickness of airfoil is 0.1m by using the bisection method . Set the tolerance to 0.00001.(There are two solutions). Determine the following:-

- 1-The X at using thickness of airfoil is 0.1 m.
- 2- Write a computer program to solve this equation
- 3- Write a flow chart for this problem

Problem (2): [15 mark]

The results of a wind tunnel experiment on the flow of air on the wing tip of an airplane provide the following data

R/C	0.73	0.78	0.81	0.875	0.95	1.02	1.03	1.055	1.135
Vθ/V∞	0.0788	0.0788	0.064	0.0788	0.0681	0.0703	0.0703	0.0681	0.0681
R/C	1.14	1.245	1.32	1.385	1.43	1.445	1.535	1.57	1.63
Vθ/V∞	0.079	0.0575	0.0681	0.0575	0.0511	0.0575	0.049	0.0532	0.049

Where R is the distance from the vortex core, C is the aircraft wing chord, Vθ is the vortex tangential velocity, and V∞ is the aircraft free stream velocity. Let X= R/C and Y= Vθ/V∞ .

Determine the following:

- 1- Determine the constant for Y=a e^{bX} for the above data
- 2- Write a computer program to solve this equation
- 3- Write a flow chart for this problem

Problem (3): [15 mark]

The following values of a function are given

x	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
F(x)	1.543	1.668	1.811	1.971	2.151	2.352	2.577	2.828	3.107

Find $\int_{1.0}^{1.8} f(x) dx$, using trapezoidal rule with

- 1) Find the integral of a)h=0.1 b) h=0.2 c) h=0.4
- 2) Write a computer program to solve this equation
- 3) Write a flow chart for this problem

Problem (4): [15 mark]

- 1) Suppose you have \$1000 saved in the bank Interest is compounded at the rate of 9% per year

What will be your bank balance after three years? a) Find the Interest of many at 5year b) Write a computer program to solve this equation

c) Write a flow chart for this problem

2) Define 3 vectors A, B, C have the same size Then find: $A + B$, $C - A$, $C * B$, A / C

a) Write a computer program to solve this equation b) Write a flow chart for this problem assume the dimension of all vectors is 100×100

Problem (5): [15 mark]

the friction factor f for turbulent flow in a pipe is given by

$$\frac{1}{\sqrt{f}} = 1.14 - 2.0 \log_{10} \left(\frac{e}{D} + \frac{9.35}{Re \sqrt{f}} \right)$$

Where Re is the Reynolds number, e is the roughness of the pipe surface, and D is the pipe diameter. (a) Write a computer program to solve the above equation for f using the successive substitution method. (b) Evaluate f by running the program for the following cases: a) $Re = 3 \times 10^4$, $D = 0.1m$, $e = 0.0025$, ii) $Re = 5 \times 10^6$, $D = 0.1m$, $e = 0.0001$ (Hint: rewrite the equation to the following form first:

$$f = (1.14 - 2.0 \log_{10} \left[\frac{e}{D} + \frac{9.35}{Re \sqrt{f}} \right])^{-2}$$

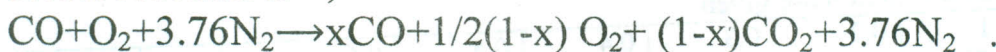
Introduce an initial guess to f on the right side. Reintroduce f calculated to the right side again, and repeat this iteration until f converges. The initial guess may be set zero. The results of these calculations can be checked with a Moody's chart found

in any standard fluid mechanics where $f1$ is defined $f1 = \frac{0.32}{Re^{0.25}}$ and

compare between the $f1$ and f

Problem (6): [15 mark]

consider the same chemical reaction as in the previous problem except that it occurs with the existence of N_2 at the atmospheric pressure. The actual reaction is ;



The equation of equilibrium is

$$3.06 = \frac{[(1-x)(1052+x)^{1/2}]}{[x(1+x)^{1/2}]}$$

1) Determine the value of x using Newton's method.

2) Write a computer program to solve this equation

3- Write a flow chart for this problem