Mansoura University Faculty of Engineering Dept. of Power Mech. Eng. Course Title: **Computer Application in MPE** Course Code: MPE4125		I st year Mech. Eng. June 2013 Exam Type: Final Time: 3 Hours Full Mark: 90

Answer all the following questions. Write the flow chart for all program

Question (1) (10 marks)

1-a)Write a computer program to get the area under the curve using trapezoidal rule $P=0.22\ V^2 - 0.4\ v^4+3$ From v=1 to v=2 with step equal 0.1 where

$$w = \int_1^2 p dv$$

[6mark]

1-b) write a computer program to solve the equation $aX^2+bX+C=0$

At a=4, b=5 , c=-4 **[4mark]**

Question (2) (20 marks)

2-a) write a computer program to calculate the root of the following non-linear equation using Newton – Raphson method **($X-0.2\sin X-0.5X^3=5$)** using the first gauss X=0.1 and the error equal 0.0001 **[10mark]**

2-b) write a computer program to calculate the root of the following non-linear equation using Bi-section method **($Xe^X-0.2\tan X-0.5X^3=15$)** using the first gauss X=0.1 and X=1.5 and the error equal 0.0001 **[10mark]**

Question (3) (10 marks)

Write a computer program to determine a function fitting to the following data points by the least square method.

i	X_i	Y_i
1	1.0	2.0
2	1.5	3.2
3	2.0	4.1
4	2.5	4.9
5	3.0	5.9

Use the relation $Y=A\ e^{bx}$

Question (4) (20 marks)

4-a) Write a computer program to get the solution of clamped at the natural frequencies of vibration of a uniform beam clamped at two ends satisfy;

$\tan(\beta L) = L \tanh((\beta L)$, $\beta>0$

where L is assumed to be 1m. By Newton's method based on a difference approximation to evaluate the derivative, determine the lowest three values of $\beta>0$

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Satisfying the equation above is used. Don't include β=0 as an answer. (hint: $\tanh(x)=\frac{e^{x}-e^{-x}}{e^{x}+e^{-x}}$) **[10mark]**

4-b) Write a computer program to Calculate the root of **tan(x)=3.5** in the interval [1,π] by the bisection method with a tolerance of 0.005. **[10mark]**

Question (5) (15 marks)

Write a computer program to get root of 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. Determine x where the thickness of airfoil is 0.1m by using the bisection method . Set tolerance to 0.00001.(There are two solutions).

Question (6) (15 marks)

Write a computer program to get the density of the air using Equation of state:

$$p = \rho \quad R \quad T$$

Where ρ, T and p are density in [kg/m^3], temperature in [K] and pressure in [kPa] respectively. The relation between T and P are shown in table 1

Please find the average temperature and pressure and also find the average density of the air

Where the value of the average temperature and pressure during empting process, according to the following relation:

$$T_{av}=\frac{1}{(t_{max}-t_{min.})}\int_{t_{min}}^{t_{max}} T.dt,\ P_{av}=\frac{1}{(t_{max}-t_{min})}\int_{t_{min}}^{t_{max}} P.dt$$

Table (1) relation between temperature and pressure at as a function of time

Time (t) [min.]	Temp. (T) [K]	Pressure (p) [bar]
0	300	4.9938
10	307.2432	4.796925
20	314.7764	4.58931
30	322.6333	4.370513
40	330.8541	4.140035
50	339.488	3.89731
60	348.5959	3.641702
70	358.2549	3.37246
80	368.565	3.088717
90	379.6595	2.789431
100	391.7231	2.473338
110	405.0231	2.138846
120	419.9734	1.783879
130	437.2755	1.405578
140	458.3037	0.9996519

Good Luck

Prof. M. G. Mousa