Mansoura University	**Course: MTH201**	**Year: BME Level 2**
Faculty of Engineering	**The counted marks : 50**	**Date : Dec. 2014**
BME Program	**(50% of the total mark)**	**Time: 2 hours**
Final Examination		**Dr. Samir Shamseldeen**

All computations are executed to FOUR decimal places

Question (1) [20 marks]

Given the following four-point data

x	0.25	0.5	1.25	1.5
$f(x)$	-0.5	1.0	1.5	3.0

a) Estimate $f(0.45)$ by using a second degree Newton 's interpolating polynomial

b) Determine the two constants a and b such that the curve $f(x) = a\,x + b\,sin(2\pi x)$ fits the above data in the least-square sense.

c) Assume that $f''(x)$ can be approximated using the backward formula $(h > 0)$

$$f''(x) = \frac{1}{h^2}[c_1 f(x) + c_2 f(x-3h) + c_3 f(x-4h)] + O(h^n)$$

1) Determine the three constants c_1, c_2 , c_3 and the number n

2) Use this backward relation to find $f''(1.25)$, (you should use a suitable value for h)

3) Is it possible to find $f''(0.5)$ and $f''(1.5)$ by using this formula? Explain.

Question (2) [30 marks]

a) Given the equation

$$f(x) = x^2 - \sin(x) - 7 = 0$$

1) Prove that there are two roots for this equation, one is negative and the other is positive.

2) Find the positive root correct to three decimal places using Simple iteration method

3) Find the negative root correct to three decimal places using Newton Raphson method

b) Given the system

$$x + 4y + z = 1, \quad 2x + y + z = 5, \quad x + y + 4z = 4,$$

with the initial approximation $(x_0, y_0, z_0) = (2.0\,,\ 0\,,\ 0)$. Find the third approximation (x_3, y_3, z_3) using the two methods:

1) Jacobi iteration method **2)** Gauss-Seidel method

c) Given the initial value problem $yy' + sin(y) = x^2$, $y(0) = 1.0$. Find the approximate value of $y(0.2)$ by using

1) Taylor method of order two and $h = 0.1$ **2)** Runge-Kutta four method with $h = 0.2$

End of the exam **Dr. Samir Shamseldeen**