20192 CIVIL ENGINEERING FACULTY - CIVIL ENGINEERING DEPARTMENT

INS-2942 NUMERICAL ANALYSIS MIDTERM EXAM *12.05.2020*

Number	Name Surname	Sign	Group	1	2	3	4	T.(100)

QUESTIONS

Duration : 90 minutes. Good Luck

Notice: 1. Each question sholud be answered its own page.
2. Solutions must be readable and understandable.
3. You must read and sign the following commitment.
If you not signed the commitment, you have been thought as cheat in the exam!!

COMMITMENT:

I, in this exam, promised that I am not going to cheat from and / or to nobody.

Name – Surname

Sign

1. **(25p)** Find a root of the function $8xe^{x} = \cos(2x)$ by Fixed Point Iteration Method, starting with $x_0 = 0.5$. Absolute error is $\Delta x \leq 10^{-4}$ and the following table should be filled.

n	$x_{n+1} = g(x_n) = \dfrac{\cos 2x}{8e^{x}}$	$\Delta x \leq 10^{-4}$
0	0.5000000	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

2. **(25p)** Find a root of the function $x^3 - e^x + \sin(x) = 0$ by Newton Method, starting with $x_0 = 1$. Absolute error is $\Delta x \le 10^{-4}$ and the following table should be filled.

n	x_n	$\Delta x \le 10^{-4}$
0	**1.0000000**	
1		
2		
3		
4		
5		
6		
7		
8		

$$\boxed{x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}}$$

3. **(25p)** Calculate x_1, x_2, x_3, by Gauss-Seidell Method. Absolute error is $\Delta x \le 10^{-4}$ and the following table should be filled.

$$\begin{aligned} -x_1 + 2x_2 + 5x_3 &= -4 \\ 3x_1 + x_2 + x_3 &= 6 \\ x_1 + 5x_2 - 2x_3 &= -3 \end{aligned} \quad , \quad \begin{Bmatrix} x_1^0 \\ x_2^0 \\ x_3^0 \end{Bmatrix} = \begin{Bmatrix} 2 \\ -1 \\ 0 \end{Bmatrix}$$

$$x_{ii}^{(k+1)} = \frac{1}{a_{ii}}\left[b_i - a_{i1}x_1^{(k+1)} + a_{i2}x_2^{(k+1)} + \cdots\cdots\cdots + a_{ii-1}x_{i-1}^{(k+1)} + a_{ii+1}x_{i+1}^{(k)} + \cdots\cdots\cdots + a_{in}x_n^{(k)}\right]$$

i	0	1	2	3	4	5	6	7
x_1	2							
x_2	-1							
x_3	0							
Δx_1	-							
Δx_2	-							
Δx_3	-							

4. **(25p)** Using data in the following table, obtain a polinomial in 3rd order and calculate P(0.75)=? , P(1.25)=? , P(1.5)=? By Lagrange Method.

i	0	1	2	3
x_i	0.5	1	1.5	2
f(x_i)	3.375	2	0.125	-3

P(x)= ?

$$P(x) = L_0(x)\,f_0 + L_1(x)\,f_1 + L_2(x)\,f_2 + L_3(x)\,f_3 + \dots\dots\dots$$

$$L_i = \frac{(x - x_0)(x - x_1)\dots\dots\dots(x - x_{i-1})(x - x_{i+1})\dots\dots\dots\dots(x - x_n)}{(x_i - x_0)(x_i - x_1)\dots\dots\dots(x_i - x_{i-1})(x_i - x_{i+1})\dots\dots\dots\dots(x_i - x_n)}$$