



**University of Technology**  
**Department of Applied Sciences**  
**Final Examination**  
**2016 -2015**



**Subject : Numerical Analysis**  
**Branch : Appl-Math**  
**Examiner: A.M Shukur**

**Class : second class**  
**Time : 3 hours**  
**Date : / 5 /2016**

**Note: Answer only five questions, ( 14 mark for each one )**

**Q1)** Use Gauss-Sidle method to calculate the approximation-solution( $X^3$ ) and the absolute Error, of the following system;( $x_1 + 6x_2 - 3x_3 = 4$ ); ( $5x_1 + 2x_2 - x_3 = 6$ ) ( $2x_1 + x_2 + 4x_3 = 7$ ) ? Start with  $X^0 = 0$ ; where, exact solution is  $X = (1, 1, 1)^T$ .

**Q2)** For the following data,  $x = \{0.1, 0.5, 0.9, 0.3, 1.7\}$ , and  $f(x) = \sin(x)$ ; use Newton's differences method to find the approximation values for  $\sin(1.5)$  and  $\sin(0.3)$ ? Calculate the absolute error for each one?

**Q3)** By using least square method find the best polynomial  $f(x) = a e^{bx}$  to fit the following data (1 , 2 ) ; ( 2 , 3 ) ; ( 3 , 4 ) ?

**Q4)** Use Taylor's series method ( $m = 4$ ) to solve IVP  $y' = y$  and  $y(0) = 1$ ? Write the error-term in this method?

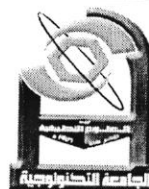
**Q5)** Use composition between (3/8 Simpson and Trapezoidal) rules, to calculate the area under the curve  $f(x) = e^{x^2}$ ; from  $x = 0$  to  $x = 1.2$  ; where  $h = 0.3$  ? write the traction errors term for both formulas?

**Q6)** Prove that one can Write the linear system ( $AX = b$ ) in the general form ( $\vec{X}^{k+1} = M^* \vec{X}^k + \vec{Y}_*$ ) by using iteration (Jacobi and SOR) methods? where the matrix  $M^*$  is  $M_{Jacobi}$  or  $M_{SOR}$  also the vector  $\vec{Y}_*$  is  $\vec{Y}_{Jacobi}$  or  $\vec{Y}_{SOR}$ .

**Good Luck**



University of Technology  
Department of Applied Sciences  
Final Examination 2015/2016



Subject : Ordinary D.E.  
Division : Applied Mathematics  
Examiner : Assist.Prof.Ikram A.Saed

year:2-nd year  
Time : 3 hours  
Date :

Answer five Questions only

Q1: Solve the following D.E. :

(a)  $[ x \sin(\frac{y}{x}) - y \cos(\frac{y}{x}) ] dx + x \cos(\frac{y}{x}) dy = 0$  ( 7 marks )

(b)  $e^{2y} dx + 2(xe^{2y} - y)dy = 0$  ( 7 marks )

Q2: (a) Find the orthogonal trajectories of the following family of curves :

$y = (x - c)^2$  . ( c is a parameter ) ( 7 marks )

(b) Prove that :

$x J'_p(x) = p J_p(x) - x J_{p+1}(x)$  (7 marks)

Q3: (a) Find the general solution of the following D. E. :

$y''' - y' = 4e^{-x} + 3e^{2x}$  . (9 marks)

(b) Given  $L\{f(x)\} = F(s)$  , show that  $L\{f'(x)\} = s F(s) - f(0)$  . ( 5 marks )

Q4:(a) Use the power - series method to find the general solution near  $x_0 = 2$  of the following D . E. :

$y'' - (x-2)y' + 2y = 0$  ( 9 marks )

(b) Show that  $y = x^2 J_2(x)$  is a solution of the D.E. :

$xy'' - 3y' + xy = 0$  . (5 marks)

Q5:(a) Solve the following D. E. by using Laplace transform .

$y'' - 3y' + 4y = 0$  ,  $y(0) = 1$  ,  $y'(0) = 5$  ( 7 marks )

(b) Expand  $f(x) = \cos x$  ,  $0 < x < \pi$  in a Fourier sine series . ( 7 marks )

Q6:(a) Find  $L^{-1}\left\{\frac{2s}{s^2 - 6s + 10}\right\}$  . ( 7 marks )

(b) Find  $L\{e^{-x} x \cosh 2x\}$  . ( 7 marks )