

University of Technology-Electromechanical Engineering Dept.  
Final Exam - 2013-2014

Class: 2<sup>th</sup> Year – Electromechanical Sys.Eng.  
Subject: **Advanced Mathematics**  
Examiner: Dr.Suad A.& Dr.Hussain A.



Time: 3 hr.  
Date: 18/5/2014  
Note: Answer 5 questions only

Name:

ID No.

Signature

**Q1.A.** Solve by Laplace transform the following equation  $y'' - 2y' + y = e^t$   
Given at  $t = 0$  ,  $y_0 = 2$  ,  $y'_0 = 1$  .

**B.** Find Taylor series for  $f(x) = \ln X$  about  $X=2$  .

**Q2.A.** Show that the function  $z = (x - 2)^2 + (y - 3)^2$   
Has one stationary point and determines its nature.

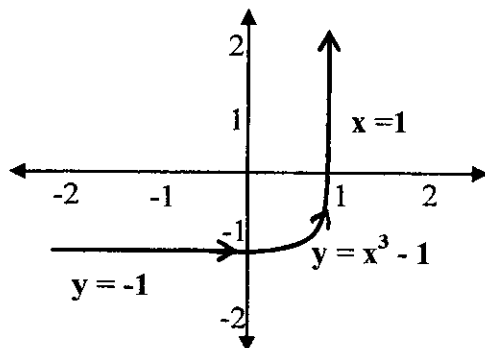
**B.** The factor  $Q$  in a resonant electrical circuit is given by  $Q = \frac{1}{R} \sqrt{\frac{L}{C}}$  , Find  
the percentage change in  $Q$  when  $L$  increases by 4%,  $R$  decreases by 3%  
and  $C$  decreases by 2% .

**Q3.A.** Express  $\frac{\partial w}{\partial t}$  in terms of  $t$ , then evaluate the derivative at given  $t$  :

$$w = \frac{x}{z} + \frac{y}{z} \quad x = \cos t \quad , \quad y = \sin t \quad , \quad z = \frac{1}{t} \quad .$$

**B.** Evaluate:  $z = \int_0^\infty \sqrt{u} e^{-u^3} du$  .

**Q4.A.** Evaluate  $\int_C 4x^3 ds$  Where  $C$  is the curve shown



**B.** Solve by inverse Laplace transforms to find  $g(t)$  :

$$g(s) = \frac{e^{-5s}}{(s-5)^4}$$

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**Q5.A.** Determine the half range Fourier **sin series** only for

$$f(x) = \begin{cases} \frac{2k}{l} x & 0 \leq x \leq \frac{l}{2} \\ \frac{2k}{l} (l - x) & \frac{l}{2} \leq x \leq l \end{cases}$$

$$f(x) = f(x + l).$$

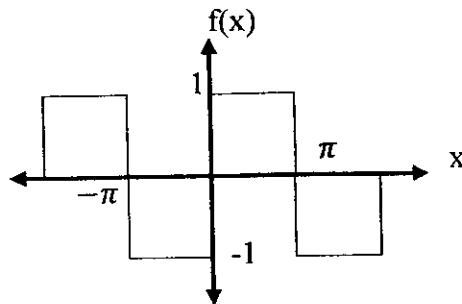
**B.** Determine if  $f(x)$  convergent or divergent for:

$$f(x) = \sum_{n=0}^{\infty} \frac{(3)^n}{9^{n+1} (n+1)} .$$

**Q6. A.** Evaluate:

$$\int_0^3 \int_0^{\sqrt{9-x^2}} \int_0^{\sqrt{9-x^2}} dz \, dy \, dx .$$

**B.** Find the Fourier series for the following periodic function.



**GOOD LUCK**