



School of Advanced Sciences

Department of Mathematics

Fall Semester 2020-2021

**MAT-1011: Calculus for Engineers (MATLAB)**

Date: xx.01.2021

FINAL ASSESSMENT TEST

SLOT: LXX+LXX

1. Demonstrate Rolle's theorem for the function  $f(x) = x^5 - 5x^3 + 4x$  in the interval  $(-3, 3)$ . Plot the graph of the function  $f(x)$  and show the points inside the interval  $(-3, 3)$  which obey the Rolle's theorem. [20]
2. (a) Find the Laplace transform of the function  $f(t) = \begin{cases} \sin t & ; 0 \leq t \leq \pi \\ 0 & ; \pi \leq t \leq 2\pi \end{cases}$  [10]  
(b) Find the Inverse Laplace transformation of the function  $\frac{4s+5}{(s-1)^2(s+2)}$  [10]

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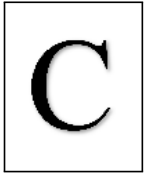
SLOT: LXX+LXX

1. (a) Find the critical values of the function  $f(x) = x^3 - 6x^2 + 9x + 2$ . [8]  
(b) Find the values of the second derivative of  $f(x)$  and check the sign of the  $f''(x)$  at the critical points and sketch the graph of the function  $f(x)$  with necessary formatting. [12]
2. Find the value of integral  $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dy dx$ . Using 'surf', visualize the surface [20]  
 $f(x, y) = \frac{x}{\sqrt{x^2+y^2}}$ .

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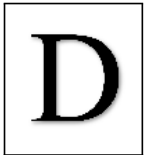
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1. Find the Taylor series expansion of the function  $f(x, y) = \tan^{-1}(y/x)$  upto the terms of 3rd degree at the point (1, 1). [20]  
Plot the graph of the function  $f(x, y)$  using *surf* in the neighbourhood of the given point. Include the necessary information such as title, axis etc. in the graph.
2. Find the work done by the force field  $\vec{f} = x\hat{i} + y\hat{j} + z\hat{k}$  in moving a particle along the curve  $C$  given in its parametric form as  $x = \cos \pi t$ ,  $y = t^2$  and  $z = \sin \pi t$  from  $t = 0$  to  $t = 1$ . [20]  
Check whether the force field is conservative.

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1. Evaluate the area bounded by the two curves  $y = x^2$  and  $y = 2x$  using MATLAB. [20]  
Sketch the curves which indicate the required area.
2. Find the gradient of the scalar function  $f(x, y) = \sqrt{x^2 + y^2}$ . [20]  
Plot the vector field of the gradient and also show the scalar function using contour curves.

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