AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ENG. PHYSICS & MATH. DEPARTMENT
Electronics and Communications Engineering Program
Junior Students.

Mid Term Examination

Spring 2022 ***Exam Time: 60 minutes.***

PHM212s: Complex, Special Functions and Numerical Analysis

The Exam Consists of THREE Questions in THREE Pages. Answer All Questions ***Total Marks: 20 Marks***

General Instructions:

- ***Please read the examination paper carefully.***
- ***Be sure to solve each question in its paper (you can use the back).***
- ***Programmable & Graphical Calculators are NOT Allowed.***

Question no. 1 (6 marks)

a) Use the Gamma function to evaluate the following integral:

$$\int_0^1 x^{4/3} \ln^3 x \; dx$$

[3 Marks]

b) Evaluate $\int_{-\infty}^{\infty} \frac{x^4}{1+x^6} dx$ **using the Gamma function.**

[3 Marks]

Question no. 2 (7 marks)

a) Find and classify the singularities of the following differential equation:

$$(x-x^2)^2 y'' + 3\ x\, y' + (1-x^2)y = 0$$

[3 Marks]

B) Solve in terms of Bessel functions the following differential equation:

$$x^2 y'' + \ x\, y' + (x^3 - 4)y = 0$$

[4 Marks]

Question no. 3 (7 marks)

Find two linearly independent solutions in powers of " x " for the following differential equations:

$$(3 - x^2)\, y'' - x\, y' + 9\, y = 0$$

Best Wishes,
Dr. Makram Roshdy, Dr. Betty Nagy.