HO CHI MINH CITY INTERNATIONAL UNIVERSITY

FINAL EXAMINATION

Academic year 2020-2021, Semester 1; Duration: 120 minutes

SUBJECT: Differential Equations (FERM)	
Head of the Department of Mathematics	Lecturer:
Professor Pham Huu Anh Ngoc	Pham Huu Anh Ngoc
	Signature:

Instructions:

- *Each student is allowed a scientific calculator and a maximum of two double-sided sheets of reference material (size A4 or similar), stapled together and marked with their name and ID. All other documents and electronic devices are forbidden..*

Question 1. (20 marks) *Determine the form* of a particular solution of the following differential equation:

$$y^{(5)} - 4y^{(4)} + y''' - 4y'' = x^3 + 1 - (x^2+1)e^{4x} + 12x\sin x.$$

Question 2. (i) (10 marks) Find $\alpha \in \mathbb{R}$ such that $y(x) = x^\alpha$ is a solution of the following differential equation

$$x^2y''' + 10xy'' + 18y' = 0, \quad x \in (0, \infty).$$

(ii) (10 marks) Find the general solution of the following differential equation:

$$x^2y''' + 10xy'' + 18y' = x^4 + x^2, \quad x \in (0, \infty).$$

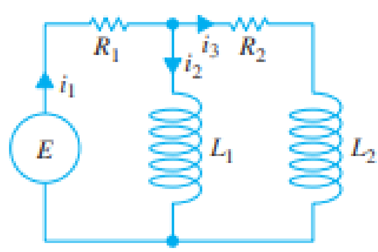
Question 3. (20 marks) Find the general solution of the linear system of differential equations

$$\frac{dx}{dt} = 4x + \frac{1}{3}y + e^t; \quad \frac{dy}{dt} = 9x + 6y - 2e^t.$$

Question 4. (20 marks) Find the general solution of the following differential equation

$$y^{(5)} - 3y^{(4)} + 2y''' = 2020 + 2021e^{2x}.$$

Question 5. (20 marks)



The system of differential equations for the currents $i_2(t)$ and $i_3(t)$ in the electrical network shown in the Figure is

$$\begin{cases} \dfrac{di_2}{dt} &= -\dfrac{R_1}{L_1}i_2 - \dfrac{R_1}{L_1}i_3 + \dfrac{E}{L_1} \\[2ex] \dfrac{di_3}{dt} &= -\dfrac{R_1}{L_2}i_2 - \dfrac{R_1+R_2}{L_2}i_3 + \dfrac{E}{L_2} \end{cases}$$

(a) Use the method of undetermined coefficients to solve the system if $R_1 = 2\ \Omega, R_2 = 3\ \Omega, L_1 = 1\ h, L_2 = 1\ h, E = 60\ V, i_2(0) = 0$, and $i_3(0) = 0$.

(b) Determine the current $i_1(t)$.

The end.