



# MURANG'A UNIVERSITY OF TECHNOLOGY

## SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

**THIRD YEAR SECOND SEMESTER EXAMINATION FOR, DIPLOMA IN  
AUTOMOTIVE/PLANT ENGINEERING**

PAS 1302 - ENGINEERING MATHEMATICS VI

DURATION: 2 HOURS

DATE: 11/12/2018

TIME: 9 – 11 A.M.

**Instructions to candidates:**

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

**SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION**

**QUESTION ONE (30 MARKS)**

a. Solve the following Homogenous Equations;

i.  $\frac{dy}{dx} = \frac{x+5y}{4x}$  (6 Marks)

ii.  $\frac{dy}{dx} = \frac{x^2+y^2}{xy}$  (8 Marks)

b. Solve using integrating factor (4 Marks)

i.  $\frac{dy}{dx} - 10y = e^{4x}$

c. Solve the following second order differential equations

i.  $\frac{d^2y}{dx^2} + 6 \frac{dy}{dx} + 9y = 0$  (3 Marks)

ii.  $\frac{d^2y}{dx^2} + 10 \frac{dy}{dx} + 25y = 0$  (3 Marks)

iii. Find;  $\int -1 \left\{ \frac{5s+1}{s^2-s-20} \right\}$  (6 Marks)

**SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION**

**QUESTION TWO (20 MARKS)**

a. Solve  $\frac{dx}{dt} - 2x = 4$  given that  $t = 0$  and  $x = 1$  (5 Marks)

b. Determine the Laplace transform of the following functions

i.  $\sin 4t$

ii.  $e^{7t}$  (2 Marks)

c.  $\int^{-1} \left[ \frac{9s-16}{s^2-2s} \right]$  (5 Marks)

d. Solve the Laplace Equation

$$2\dot{y} - 6y + 3x = 0$$

$$3\dot{x} - 3x - 2y = 0$$

Given that  $t = 0$ ,  $x = 1$  and  $y = 3$  (8 Marks)

**QUESTION THREE (20 MARKS)**

a. Find the general solution given;

i.  $\frac{d^2y}{dx^2} - \frac{5dy}{dx} + 6y = 48$  (6 Marks)

ii.  $\frac{d^2y}{dx^2} + \frac{6dy}{dx} + 9y = 4e^{5x}$  (9 Marks)

iii. Integrate by parts given,  $x^2 e^{5x} \cdot dx$  (5 Marks)

**QUESTION FOUR (20 MARKS)**

a. Obtain the Fourier Series for the periodic function (10 Marks)

$$f(x) = \begin{cases} -k & \text{when } -\pi < x < 0 \\ +k & \text{when } 0 < x < \pi \end{cases}$$

b. Find the Fourier Series for the function defined by; (10 Marks)

$$f(x) = -1 \quad -\pi < x < 0$$

$$f(x) = 0 \quad 0 < x < \pi$$

$$f(x) = f(x+2\pi)$$