FACULTY OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING
SECOND SEMESTER EXAMINATION
(JULY 2019)
2018/2019 ACADEMIC SESSION

Course Title: Engineering Mathematics 2

Course Code: GNE 212

HOD'S SIGNATURE

Instructions:

1) **Attempt Question One and any three**

2) **Time Allowed: 3 hours**

3) **SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAMINATION**

TIME ALLOWED: 3 HOURS

INSTRUCTION: ANSWER QUESTIONS 1 AND ANY OTHER THREE

QUESTION 1 (30 marks)

Answer the following questions as the case may be

A.   Express the following functions as partial fractions

i. $\dfrac{2x}{(25-x^2)(x-3)}$ (2 marks)

ii. $\dfrac{2x+3}{(x^2+3)(2-x)}$ (2 marks)

iii. $\dfrac{5x+4}{(x+2)^2(x-1)}$ (2 marks)

iv. $\dfrac{2x^2+1}{(x+2)(x-1)}$ (3 marks)

B.   Determine general solutions to the following ordinary differential equations

i. $\dfrac{dy(y+1)}{dx(x+3)}=1$ (3 marks)

ii. $\dfrac{dy}{dx}+2y=3$ (3 marks)

iii. $\dfrac{dy}{dx}+4x=-5y$ (3 marks)

iv. $\dfrac{dy}{dx}-5x=-3xy$ (3 marks)

v. $\dfrac{d^2y}{dx^2}+5\dfrac{dy}{dx}+6y=0$ (4 marks)

vi. $\dfrac{d^2y}{dx^2}+5\dfrac{dy}{dx}+6y=x^2+4$ (5 marks)

C.   The rate of change in the area of a curve can be presented as $\dfrac{dA}{dx}=x^2+4$

Determine the area bounded between 1 and 2 using trapezoidal method with 0.1 step.

QUESTION 2 (10 marks):

a. Express the partial fraction of $\dfrac{3x^2 + 3}{(x+4)(x-5)}$ (2 marks)

b. Find the general solution to this first order differential equation $\dfrac{dy(y+1)}{dx(x+3)} = 1$ (3 marks)

c. Determine the particular solution to $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} - 3y = 0$, when y(1) = 8 (5 marks)

QUESTION 3 (10 marks):

a. Express the partial fraction of $\dfrac{3x}{(x+2)^2(x-3)}$ (2 marks)

b. Find the general solution to this first order differential equation $\dfrac{dy}{dx} = 5 - 4y$ (3 marks)

c. Determine the particular solution to $\dfrac{dy}{dx} + 11y = 5 - 6y$, when y (0) = 6 (5 marks)

QUESTION 4 (10 marks):

a. If an expression $y = x^3 - 4x^2 - x - 12$ has root between 4 and 5 determine the root using Newton's method (2 marks)

b. Find the general solution to this second order differential equation
$\dfrac{d^2y}{dx^2} - \dfrac{dy}{dx} - 2y = 0$ (3 marks)

c. Determine the particular solution to $-\dfrac{dy}{dx} - 4y = -8x$, when y (2) = 8 (5 marks)

QUESTION 5 (10 marks):

a. Find the general solution to $\dfrac{dy}{dx} - 10x = -6y$ (2 marks)

b. Determine the particular solution to this second order differential equation
$\dfrac{d^2y}{dx^2} - \dfrac{dy}{dx} - 2y = x^2 + 4$, when y(0) = 2 and $\dfrac{dy}{dx}(0) = 1$ (4 marks)

c. Find the general solution to this second order differential equation $\dfrac{d^2y}{dx^2} + 4 = 0$

Express your answer in Euler format (4 marks)

QUESTION 6 (10 marks):

a. Find the general solution to this second order differential equation

$$\frac{d^2 y}{dx^2} - 5\frac{dy}{dx} - 2y = 0 \qquad \text{(4 marks)}$$

b. Determine the particular solution to this second order differential equation

$$\frac{d^2 y}{dx^2} + 5\frac{dy}{dx} + 6y = 0 \text{ , when } y(0) = 3 \text{ and } \frac{dy}{dx}(0) = 2 \qquad \text{(6 marks)}$$