COURSE TITLE: GENERAL MATHEMATICS I
2018/2019 ACADEMIC SESSION
DURATION: 2 Hours   **HOD's SIGNATURE**

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INSTRUCTIONS:
1. YOU ARE TO ANSWER ANY **FOUR** QUESTIONS OUT OF **FIVE** QUESTIONS ON THE EXAMINATION PAPER.
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING THE EXAM
3. YOU ARE NOT ALLOWED TO BORROW CALCULATORS AND WRITING MATERIALS.

1(a) Define the following:
(i) Composite function (ii) Periodic function (iii) Even and Odd functions   **(3Marks)**

(b) (i) Evaluate $\lim_{x\to 5} \frac{x^2-25}{x-5}$ **(3 Marks)**

(ii) When is a function said to be continuous?   **(3 Marks)**
Hence investigate the continuity of this function

$$f(x) = \frac{x^3-8}{x^2-4} \quad ; x \neq 2, f(2) = 3; x = 2$$ **(3Marks)**

(c) Determine the number C which satisfy the conclusion of the mean value theorem for the function $x^3 + 2x^2 - x$ on $[-1, 2]$

   (3Marks)

2 (a) Expand the function $f(x) = \cos x$ about $x = \frac{\pi}{3}$ using Taylors expansion.   **(6Marks)**

(b) Differentiate $y = x^{11}e^{2x}$ **(5Marks)**

(c) If $x^4y + 3 + 2y = e^4 - 4x^2$ find y' **(4Marks)**

3(a) Evaluate $\int \frac{x^2+2}{x(x^2-9)} dx$ **(6Marks)**

(b) Differentiate with respect to x, $y = tanx$ **(4Marks)**

(c) Evaluate $\int_{1}^{2} (x^2 + 2x + 1)dx$ **(5Marks)**

4(a) Expand the function $x^3 - 2x^2 + 4x - 6$ about the point $x = 2$.   **(4Marks)**

(b) Evaluate $\int \frac{dx}{(3-2x)^2}$ **(4Marks)**

(c) Differentiate $y = \tan(3x + 2)$ **(4Marks)**

(d) find $\frac{dy}{dx}$ in term of a if $x = at^2$ and $y = 2at$ **(3Marks)**

5a) Show that $(3x^2y - 1)dx + (x^3 + 6y - y^2)dy = 0$ is exact, hence find the $function\ \emptyset(x, y)$ which is the exact form of the equation.   **(7Marks)**

b) Find the directional derivative of $U = x^2z + 2xy^2 + yz^2$ at $P(1, 2, -1)$ in the direction towards $Q\,(3, 5, -3)$. **(5Marks)**

c.) In what direction is Directional derivative a maximum and what is the value of the maximum. **(3Marks)**

6a.) Determine the critical points and locate any relative minima, maxima and saddle point of function f defined by

$$f(x, y) = x^3 + y^3 - 3x - 12y + 20 \qquad \text{(7Marks)}$$

b) If $f(x, y) = x^5 - 2xy + 3y^3$. Find $\dfrac{\partial f}{\partial x}$ and $\dfrac{\partial f}{\partial y}$ **(2Marks)**

c) If $f(x, y) = x^3y + e^{xy^2}$. Find f_x, f_y, f_{xx}, f_{yy}, and

Show that $f_{xy} = f_{yx}$ **(6Marks)**