# MASENO UNIVERSITY

## UNIVERSITY EXAMINATIONS 2017/2018

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR
THE DEGREE OF BACHELOR OF SCIENCE AND
BACHELOR OF EDUCATION SCIENCE
WITH INFORMATION TECHNOLOGY

### MAIN CAMPUS

### MMA 405: PARTIAL DIFFERENTIAL EQUATIONS I

Date: 13th March, 2018                                   Time: 8.30 - 11.30am

## INSTRUCTIONS:

- Attempt Question ONE and any other TWO.
- Show all the necessary workings
- Observe further instructions on the answer booklet

# [Question One, 30mks]

(a) Solve the following equation

$$\frac{dx}{y - xz} = \frac{dy}{yz + x} = \frac{dz}{x^2 + y^2}$$

[4mks]

(b) Verify that the following equation is integrable and find its primitive

$$(z + z^2)\cos x\, dx - (z + z^2)dy + (1 - z^2)(y - \sin x)dz = 0$$

[5mks]

(c) Form the partial differential equation by eliminating the arbitrary function from

$$z = exp(2x + 3y)f(2x - 3y)$$

[4mks]

(d) Find the integral surface of the equation

$$(y - z)\left\{2xyp + (x^2 - y^2)q\right\} + z(x^2 - y^2) = 0$$

through the curve $x = t^2$, $y = 0$, $z = t^3$

[7mks]

(e) Show that the equation
$p^2 + q^2 = 1$ and $(p^2 + q^2)x = pz$ are compatible and hence find its solution.

10mks

# [Question TWO, 20mks]

(a) Form a partial differential equation by eliminating the arbitrary constants from the equation

$$z = (x + a)^2 e^{by}$$

[7mks]

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(b) Find the solution of

$$(x^2 - 1)p + xyq + y^2z = x^2 - 1$$

which is zero on the positive $y$- axis.                                  [13mks]

## [Question Three, 20mks]

(a) Find the characteristics of the equation

$$pq = z$$

and hence, determine the integral surface which passes through the parabola $x = 0$, $y^2 = z$.                                  [10mks]

(b) Using charpit's method, find the complete integral of

$$x^2p^2 + y^2q^2 - 4 = 0$$

                                  [10mks]

## [Question Four, 20mks]

Apply Jacobi method to find complete integral of the following equations

(i) $p_1p_2p_3 + p_4^3x_1x_2x_3x_4^3 = 0$                                  [10mks]

(ii) $p_1p_2p_3 = z^3x_1.x_2x_3$                                  [10mks]

## [Question Five, 20mks]

Find the integral surface of the equation

$$x(x + y)p - y(x + y)q - z(x - y) = 0$$

which passes through $x^2 + z^2 = 2x$  $y = 1$                                  [20mks]

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