MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS STATISTICS AND ACTUARIAL SCIENCE

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

ECU 00101: ENGINEERING MATHS II

DATE: 2/5/2019 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Solve the equations i) $\frac{4}{x-2} = \frac{5}{3x+4}$ (3 marks)

ii) $2x^2 + x = 3$ (3 marks)

b) Factorise

$3x^2 + 10x + 3$

Hence solve the equation $3x^2 + 10x + 3 = 0$ (5 marks)

c) Solve for x in the equation

$3(1-x) - 5(2-3x) = 2(x-4)$ (5 marks

d) Find the values of x and y that satisfy the simultaneous equations

$2x + 3y = 7$
$3x + 2y = 8$ (5 marks)

e) The following formula applies to thin tubes under external pressure

$p = \frac{m^2}{m^2-1} 2E \left(\frac{t}{d}\right)^3$

express t in terms of the other quantities. (5 marks)

f) Simplify the expression

$$\frac{1}{x+5} = \frac{x-6}{2x^2+9x-5}$$ (4 marks)

QUESTION TWO (20 MARKS)

a) Use elimination method to solve the equations

$$5x - 3y - 2z = 31$$
$$2x + 6y + 3z = 4$$
$$4x + 2y - z = 30$$ (8 marks)

b) From the formula $I = \frac{E}{\sqrt{R^2+W^2L^2}}$ Obtain an expression for R

In terms of the other quantities (5 marks)

c) i) Solve

$$3x - 2y = 0$$
$$4x + y = -11$$ (4 marks)

ii) Expand $(2x - 3y)(x + 5y)$ (3 marks)

QUESTION THREE (20 MARKS)

a) Solve the following quadratic equations

i) by factorization $3x^2 - 11x - 4 = 0$ (5 marks)

ii) by completing of squares method

$$2x^2 + 5x - 4 = 0$$ (5 marks)

iii) by formula method

$$4x^2 + 7x + 2 = 0$$ (5 marks)

b) If f = crushing of the material l = length of the strut r = radius of gyration of the cross-sectional area of the strut p=bucking strength c = a constant depending upon the material and the nature of the ends of the strut then the Rankine-Gordon formula for the buckling load is given by

$$p = \frac{f}{1+c\left(\frac{l^2}{r^2}\right)}$$

Find r when $f = 28$ $l = 15$ $p = 15.7$ $c = \frac{1}{1500}$ (5 marks)

QUESTION FOUR (20 MARKS)

a) Given that $y = mx + c$ find the value of m and c if

$$x = 3 \ \ when \qquad y = 2\frac{1}{2} \quad and\ also\ x = 5\frac{1}{2} \ \ when\ y = 3\frac{3}{4}$$

(5 marks)

b) Solve the simultaneous equation

$$2x + 3y + 4z = 29$$
$$3x - 4y + 5z = 14$$
$$5x + 5y - 6z = 1$$

(8 marks)

c) Derive the quadratic formula hence solve

$$2x^2 - 7x + 4 = 0$$

(7 marks)

QUESTION FIVE (20 MARKS)

a) The equation $ax^2 + bx + c = 0$ has roots $x = \frac{2}{3}$ $and\ x = \frac{-3}{2}$ find the values of $a\ , b\ and\ c$

(6 marks)

b) Solve the simultaneous equations

$$3x + 2y = 12$$
$$4x - 3y = -1$$

(6 marks)

c) Use the method of substitution to solve the equations

$$x + y + z = 9$$
$$2x + y + z = 7$$
$$2x + 2z = 5$$

(8 marks)