UNIVERSITY OF SWAZILAND
FACULTY OF EDUCATION
SUPPLEMENTARY EXAMINATION PAPER 2006

TITLE OF PAPER : CURRICULUM IN MATHEMATICS

COURSE CODE : EDC 381

STUDENTS : B.ED III AND PGCE

TIME ALLOWED : THREE (3) HOURS

INSTRUCTIONS : ATTEMPT FOUR QUESTIONS
EACH QUESTION IS WORTH 20 MKS

ADDITIONAL MATERIALS : APPENDIX 1

THIS PAPER CONTAINS **SIX** PAGES. DO NOT OPEN UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

Answer four questions

Question 1

a) Name **five** types of objective test items. [5]
b) State **five** considerations to be made when constructing items for **two** of the types of items in (a). [10]
c) Write, stating the type, **one** example of an objective test item. [3]
d) What is meant by facility/difficulty index for a test item? [2]

Question 2

a) Name **six** measuring instruments for general assessment excluding objective tests. [6]
b) State advantages and/or disadvantages of four of the above instruments. [14]

Question 3

Appendix one is a copy of the IGCSE syllabus.

a) Given that your school does not write the national Junior Certificate examinations, use the syllabus to prepare a teaching syllabus for each of the junior secondary forms in your school such that there are no gaps in the teaching/learning. [15]
b) Write an introduction stating clearly how you would accommodate the core and extended nature of IGCSE in your teaching syllabus. [5]

Question 4

a) State **five** points that best describe the nature of traditional mathematics. [5]
b) State **five** difficulties encountered in the introduction of modern mathematics. [5]
c) State the aims of the OEEC which led to the introduction of modern mathematics. [10]

Question 5

a) Name the **three** leadership styles you studied this year. [3]
b) State **four** traits that best describe each type of leadership in a). [12]
c) Which type of leadership would you prefer to be dominant in your head of department? Give reasons for your answer. [5]

CURRICULUM CONTENT

Students may follow either the Core curriculum only or the Extended curriculum which involves both the Core and Supplement. Students aiming for grades A* to C should follow the Extended curriculum.

As well as demonstrating skill in the following techniques, candidates will be expected to apply them in the solution of problems.

THEME OR TOPIC	CORE	SUPPLEMENT
	All students should be able to:	Extended curriculum students, who are aiming for Grades A* to C, should, in addition be able to:
1. Number, set notation and language	- identify and use natural numbers, integers (positive, negative and zero), prime numbers, square numbers, common factors and common multiples, rational and irrational numbers (e.g. π, $\sqrt{2}$), real numbers; continue a given number sequence; recognise patterns in sequences and relationships between different sequences, generalise to simple algebraic statements (including expressions for the nth term) relating to such sequences	- use language, notation and Venn diagrams to describe sets and represent relationships between sets as follows: Definition of sets, e.g. $A=\{x: x$ is a natural number$\}$ $B=\{(x,y): y=mx+c\}$ $C=\{x: a \leqslant x \leqslant b\}$ $D=\{a,b,c\ldots\}$ Notation Number of elements in set A — $n(A)$ "...is an element of ..." — $\in$ "...is not an element of..." — $\notin$ Complement of set A — A' The empty set — $\varnothing$ Universal set — $\mathscr{E}$ A is a subset of B — $A \subseteq B$ A is a proper subset of B — $A \subset B$ A is not a subset of B — $A \not\subseteq B$ A is not a proper subset of B — $A \not\subset B$ Union of A and B — $A \cup B$ Intersection of A and B — $A \cap B$
2. Squares, square roots and cubes	- calculate squares, square roots, cubes and cube roots of numbers	
3. Directed numbers	- use directed numbers in practical situations (e.g. temperature change, flood levels)	
4. Vulgar and decimal fractions and percentages	- use the language and notation of simple vulgar and decimal fractions and percentages in appropriate contexts; recognise equivalence and convert between these forms	
5. Ordering	- order quantities by magnitude and demonstrate familiarity with the symbols $=, \neq, >, <, \geqslant, \leqslant$	
6. Standard form	- use the standard form $A \times 10^n$ where n is a positive or negative integer, and $1 \leqslant A < 10$	
7. The four rules	- use the four rules for calculations with whole numbers, decimal fractions and vulgar (and mixed) fractions, including correct ordering of operations and use of brackets	
8. Estimation	- make estimates of numbers, quantities and lengths, give approximations to specified numbers of significant figures and decimal places and round off answers to reasonable accuracy in the context of a given problem	
9. Limits of accuracy	- give appropriate upper and lower bounds for data given to a specified accuracy (e.g. measured lengths)	- obtain appropriate upper and lower bounds to solutions of simple problems (e.g. the calculation of the perimeter or the area of a rectangle) given data to a specified accuracy

THEME OR TOPIC	CORE	SUPPLEMENT
10. Ratio, proportion, rate	- demonstrate an understanding of the elementary ideas and notation of ratio, direct and inverse proportion and common measures of rate; divide a quantity in a given ratio; use scales in practical situations; calculate average speed	- express direct and inverse variation in algebraic terms and use this form of expression to find unknown quantities; increase and decrease a quantity by a given ratio
11. Percentages	- calculate a given percentage of a quantity; express one quantity as a percentage of another; calculate percentage increase or decrease	- carry out calculations involving reverse percentages, e.g. finding the cost price given the selling price and the percentage profit
12. Use of an electronic calculator	- use an electronic calculator efficiently; apply appropriate checks of accuracy	
13. Measures	- use current units of mass, length, area, volume and capacity in practical situations and express quantities in terms of larger or smaller units	
14. Time	- calculate times in terms of the 24-hour and 12-hour clock; read clocks, dials and timetables	
15. Money	- calculate using money and convert from one currency to another	
16. Personal and household finance	- use given data to solve problems on personal and household finance involving earnings, simple interest and compound interest (knowledge of compound interest formula is not required), discount, profit and loss; extract data from tables and charts	
17. Graphs in practical situations	- demonstrate familiarity with cartesian co-ordinates in two dimensions, interpret and use graphs in practical situations including travel graphs and conversion graphs, draw graphs from given data	- apply the idea of rate of change to easy kinematics involving distance-time and speed-time graphs, acceleration and deceleration; calculate distance travelled as area under a linear speed-time graph
18. Graphs of functions	- construct tables of values for functions of the form $ax + b$, $\pm x^2 + ax + b$, a/x $(x \neq 0)$ where a and b are integral constants; draw and interpret such graphs; find the gradient of a straight line graph; solve linear and quadratic equations approximately by graphical methods	- construct tables of values and draw graphs for functions of the form ax^n where a is a rational constant and $n = -2, -1, 0, 1, 2, 3$ and simple sums of not more than three of these and for functions of the form a^x where a is a positive integer; estimate gradients of curves by drawing tangents; solve associated equations approximately by graphical methods
19. Straight line graphs	- interpret and obtain the equation of a straight line graph in the form $y = mx + c$; determine the equation of a straight line parallel to a given line	- calculate the gradient of a straight line from the co-ordinates of two points on it; calculate the length and the co-ordinates of the midpoint of a straight line segment from the co-ordinates of its end points
20. Algebraic representation and formulae	- use letters to express generalised numbers and express basic arithmetic processes algebraically, substitute numbers for words and letters in formulae; transform simple formulae; construct simple expressions and set up simple equations	- construct and transform more complicated formulae and equations
21. Algebraic manipulation	- manipulate directed numbers; use brackets and extract common factors	- expand products of algebraic expressions; factorise where possible expressions of the form $ax + bx + kay + kby$, $a^2x^2 - b^2y^2$; $a^2 + 2ab + b^2$; $ax^2 + bx + c$; manipulate algebraic fractions, e.g. $\frac{x}{3} + \frac{x-4}{2}$, $\frac{2x}{3} - \frac{3(x-5)}{2}$, $\frac{3a}{4} \times \frac{5ab}{3}$, $\frac{3a}{4} - \frac{9a}{10}$, $\frac{1}{x-2} - \frac{2}{x-3}$ factorise and simplify expressions such as $\frac{x^2 - 2x}{x^2 - 5x + 6}$

THEME OR TOPIC	CORE	SUPPLEMENT
22. Functions		- use function notation, e.g. $f(x) = 3x - 5$, $f: x \mapsto 3x - 5$ to describe simple functions, and the notation $f^{-1}(x)$ to describe their inverses; form composite functions as defined by $gf(x) = g(f(x))$
23. Indices	- use and interpret positive, negative and zero indices	- use and interpret fractional indices, e.g. solve $32^x = 2$
24. Solutions of equations and inequalities	- solve simple linear equations in one unknown; solve simultaneous linear equations in two unknowns	- solve quadratic equations by factorisation and *either* by use of the formula *or* by completing the square; solve simple linear inequalities
25. Linear programming		- represent inequalities graphically and use this representation in the solution of simple linear programming problems (the conventions of using broken lines for strict inequalities and shading unwanted regions will be expected)
26. Geometrical terms and relationships	- use and interpret the geometrical terms: point, line, parallel, bearing, right angle, acute, obtuse and reflex angles, perpendicular, similarity, congruence; use and interpret vocabulary of triangles, quadrilaterals, circles, polygons and simple solid figures including nets	- use the relationships between areas of similar triangles, with corresponding results for similar figures and extension to volumes and surface areas of similar solids
27. Geometrical constructions	- measure lines and angles; construct a triangle given the three sides using ruler and compasses only; construct other simple geometrical figures from given data using protractors and set squares as necessary; construct angle bisectors and perpendicular bisectors using straight edges and compasses only; read and make scale drawings	
28. Symmetry	- recognise rotational and line symmetry (including order of rotational symmetry) in two dimensions and properties of triangles, quadrilaterals and circles directly related to their symmetries	- recognise symmetry properties of the prism (including cylinder) and the pyramid (including cone); use the following symmetry properties of circles: (a) equal chords are equidistant from the centre (b) the perpendicular bisector of a chord passes through the centre (c) tangents from an external point are equal in length
29. Angle properties	- calculate unknown angles using the following geometrical properties: (a) angles at a point (b) angles on a straight line and intersecting straight lines (c) angles formed within parallel lines (d) angle properties of triangles and quadrilaterals (e) angle properties of regular polygons (f) angle in a semi-circle (g) angle between tangent and radius of a circle	- use in addition the following geometrical properties: (a) angle properties of irregular polygons (b) angle at the centre of a circle is twice the angle at the circumference (c) angles in the same segment are equal (d) angles in opposite segments are supplementary; cyclic quadrilaterals
30. Locus	- use the following loci and the method of intersecting loci for sets of points in two dimensions: (a) which are at a given distance from a given point (b) which are at a given distance from a given straight line (c) which are equidistant from two given points (d) which are equidistant from two given intersecting straight lines	
31. Mensuration	- carry out calculations involving the perimeter and area of a rectangle and triangle, the circumference and area of a circle, the area of a parallelogram and a trapezium, the volume of a cuboid, prism and cylinder and the surface area of a cuboid and a cylinder	- solve problems involving the arc length and sector area as fractions of the circumference and area of a circle, the surface area and volume of a sphere, pyramid and cone (given formulae for the sphere, pyramid and cone)

THEME OR TOPIC	CORE	SUPPLEMENT
32. Trigonometry	- interpret and use three-figure bearings measured clockwise from the North (i.e. 000°-360°) - apply Pythagoras' theorem and the sine, cosine and tangent ratios for acute angles to the calculation of a side or of an angle of a right-angled triangle (angles will be quoted in, and answers required in, degrees and decimals to one decimal place)	- solve trigonometrical problems in two dimensions involving angles of elevation and depression, extend sine and cosine values to angles between 90° and 180°, solve problems using the sine and cosine rules for any triangle and the formula area of triangle = $\frac{1}{2}ab\sin C$, solve simple trigonometrical problems in three dimensions including angle between a line and a plane
33. Statistics	- collect, classify and tabulate statistical data; read, interpret and draw simple inferences from tables and statistical diagrams; construct and use bar charts, pie charts, pictograms, simple frequency distributions, histograms with equal intervals and scatter diagrams (including drawing a line of best fit by eye); understand what is meant by positive, negative and zero correlation; calculate the mean, median and mode for individual and discrete data and distinguish between the purposes for which they are used; calculate the range	- construct and read histograms with equal and unequal intervals (areas proportional to frequencies and vertical axis labelled 'frequency density'); construct and use cumulative frequency diagrams; estimate and interpret the median, percentiles, quartiles and inter-quartile range; calculate an estimate of the mean for grouped and continuous data; identify the modal class from a grouped frequency distribution
34. Probability	- calculate the probability of a single event as either a fraction or a decimal (not a ratio); understand and use the probability scale from 0 to 1; understand that: *the probability of an event occurring = 1 - the probability of the event not occurring*; understand probability in practice, e.g. relative frequency	- calculate the probability of simple combined events, using possibility diagrams and tree diagrams where appropriate (in possibility diagrams outcomes will be represented by points on a grid and in tree diagrams outcomes will be written at the end of branches and probabilities by the side of the branches)
35. Vectors in two dimensions	- describe a translation by using a vector represented by $\begin{pmatrix} x \\ y \end{pmatrix}$ $\overrightarrow{AB}$ or **a**; add and subtract vectors; multiply a vector by a scalar	- calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$. (Vectors will be printed as $\overrightarrow{AB}$ or **a** and their magnitudes denoted by modulus signs, e.g. $\lvert\overrightarrow{AB}\rvert$ or $\lvert\mathbf{a}\rvert$. In their answers to questions candidates are expected to indicate **a** in some definite way, e.g. by an arrow or by underlining, thus $\overrightarrow{AB}$ or $\underline{\mathbf{a}}$) - represent vectors by directed line segments; use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors; use position vectors
36. Matrices		- display information in the form of a matrix of any order; calculate the sum and product (where appropriate) of two matrices; calculate the product of a matrix and a scalar quantity; use the algebra of 2 x 2 matrices including the zero and identity 2 x 2 matrices; calculate the determinant and inverse $\mathbf{A}^{-1}$ of a non-singular matrix **A**
37. Transformations	- reflect simple plane figures in horizontal or vertical lines; rotate simple plane figures about the origin, vertices or mid points of edges of the figures, through multiples of 90°; construct given translations and enlargements of simple plane figures; recognise and describe reflections, rotations, translations and enlargements	- use the following transformations of the plane: reflection (M); rotation (R); translation (T); enlargement (E); shear (H); stretching (S) and their combinations (if M(a) = b and R(b) = c the notation RM(a) = c will be used; invariants under these transformations may be assumed.) - identify and give precise descriptions of transformations connecting given figures; describe transformations using co-ordinates and matrices (singular matrices are excluded)