575ADDITIONALMATHEMATICS

INTRODUCTION

This syllabus is intended essentially for mathematical knowledge, ability and skill for further studies in Mathematics, SocialSciencesand Engineering.Knowledge of 570 Mathematics syllabus will be assumed and questions will be set on any section ofitscontents. The syllabus is designed to broaden the Mathematics experiences of candidates whose aptitude, ability and inclinations are such that they experience a high attaining level.Such candidates may continue their study of Mathematics to the Advanced Level.

Candidates will be required to use nonprogrammable electronic calculators.

AIMS

The syllabus aims to enhance numeracy and literacy in Mathematics. The 575 syllabus should alsoenable candidates to:

1. provide an advanced insight for progression into Advanced Level Mathematics 765 and 770.
2. apply Mathematical knowledge in other subject areas, particularly in the Sciences, Social Sciences andTechnology.
3. develop the ability to reason logically, classify, generalise, prove, solvea wider selection of problems, present the solutions clearly and interpretthe results.
4. appreciate patterns and relationships in areas of Mathematics, produce and bring out imaginative and creative work arising from additional areas, especially those around the learner's environment.

GENERAL OBJECTIVES

The objectives of the examination are as follows:

1. To demonstrate confident knowledge of the techniques of Pure Mathematics specified in the syllabus.
2. To apply the knowledge of mathematics to solve problems in Mechanics or Statistics and Probability.
3. To apply the knowledge of Mathematics to solve problems for which an immediatemethod of solution is not available and may involve knowledge of more thanone topic in the syllabus.
4. To write clear and accurate solutions to mathematical problems.

ASSESSMENT OBJECTIVES

The scheme of assessment will require the candidates to:

1. demonstrate knowledge and understanding of Mathematics terminologies and principles in a variety of context (AO1).
2. set out mathematical work, including the solutions to problems, in a logical and clear manner using appropriate symbols and terminology (AO2).
3. make logical deductions for given mathematical data and interpret Mathematics in terms of daily life and in diagram form, interpret, transform and make use of mathematical statements expressed in words or in symbols.(AO3).
4. organise, interpret and apply mathematical knowledge in a variety of context, presentinformation in written, tabularand graphicalformsandestimate work to degrees of accuracy appropriate tothecontext; i.e. analyse a problem, select a suitable strategy and apply an appropriate technique to obtain its solution.(AO4).

WEIGHTING OF THE ASSESSMENT OBJECTIVES

Assessment Objective	Weighting
Knowledge (AO1)	30 %
Understanding (AO2)	40 %
Application of knowledge (AO3)	20 %
Higher level abilities (synthesis, analysis and evaluation) (AO4)	5%

The assessment objectives are weighted to give an indication of the relative importance. The percentages are not intended to show the precise number of marks allocated to particular assessment objectives.

THE SCHEME OF ASSESSMENT

The examination willconsist of two papers.

Paper 1 will examine topics in Pure Mathematics only and will consists of about 50compulsory

multiplechoice questions to be answered in 1hour 30 minutes.This shall be 40 % of the total subject marks

Paper 2. This will be a paper of2hours 30 minutes and cover 60 % of the total marks.It will examine topics in Pure Mathematics with Mechanics or PureMathematics withStatistics and Probability, and will consist of three sections:**A**, **B** and **C**.

Section A will consist of a number of questions in Pure Mathematics and thecandidates will be expected to attempt **all**.

Section B will consist of three questions in Mechanics for which the candidateswillbeexpected to attempt **two questions**.

Section C will consist of three questions in Statistics and Probability for which thecandidates will be expected to attempt **two questions**

NOTE

Candidates are expected to answer a combination of Section A and Section B OR Section A and Section C, but NOT a combination of all the three sections.
Nonprogrammable electronic calculators and formulae booklets may be used.

SYLLABUSCONTENT

SECTION A: PURE MATHEMATICS(Compulsory for all candidates)

TOPIC		SUB TOPIC	NOTES
1.	**CIRCULAR MEASURE AND TRIGONOMENTRY**	1. Radian measure: Arc length, area of sector and area of segment. 2. The three basic trigonometric ratios of angles up to 360° (2π). 3. Special angles: Trigonometric ratios for the angles 0, 30°, 45°, 60°, 90° and their associates. 4. Angles measured in the clockwise direction and negative angles from -360° (-2π) to 360° (2π). 5. Graphs of y = sin x, y = cos x, $y = tan\ x$ and their multiples and sum and the periodicity of these functions. 6. Graphs of composite of the trigonometric functions. 7. Relationship between trigonometric ratios e.g. the identities $\tan x = \frac{\sin x}{\cos x}$, $\cos 2x + \sin 2x = 1$ 8. Applications of trigonometric ratios to simple problems in two dimensions: Solution of triangles, the cosine and sine rules, area of triangles, hero's formula. 9. Solution of trigonometric equations of the form: $\sin(ax + b) = \gamma, -\pi < x < 2\pi$, etc.	The use of quadrants, complementary and supplementary angles is expected. General proofs of sine and cosine formulae will not be required.
2.	***PERMUTATIONS, COMBINATIONS AND THE BINOMIAL THEOREM**	1. Simple cases of permutations and combinations; simple problems involving arrangements and selections. 2. Binomial theorem for expansion of $(a + b)^n$, for positive integral indices n. a. Pascal's triangle for $n \leq 10$. b. Calculation of binomial coefficients,general term:^nC_ror $\binom{n}{r}$for	Only straightforward problems will be set. Proofs not required.

TOPIC		SUB TOPIC	NOTES
		n $> 0, r >$ 0 $and\ r \leq$ n. 3. Binomial theorem for negative indices.	
3.	**SEQUENCES**	1. Sequences as functions; Increasing and decreasing sequences. 2. Arithmetic and geometric sequences. 3. Linear function of sequences: $(u_n = au_{n-1} + b)$. 4. Use of the $\sum$ notation. 5. Sum of an arithmetic sequence. 6. Arithmetic mean. 7. Sum of a geometric sequence. 8. Geometric mean. 9. Sum to infinity of a geometric sequence. 10. Simple notion of the convergence of a sequence.	Graphical representation of a sequence. The $\sum$ notation may be employed wherever its use seems desirable.
4.	**CARTESIAN COORDINATE GEOMETRY**	1. Rectangular Cartesian coordinates distance between two points. 2. The straight line and its equation. 3. The coordination of the mid-point joining two points. 4. Condition for two lines to be parallel or to be perpendicular. 5. Intersection of two lines. 6. Angle between two lines. 7. Distance from a point to a straight line.	The y = mx + c and $y - y_1 = m(x - x_1)$ forms of the equation of a straight line are expected to be known.
5.	**VECTORS**	1. Scalar and vector quantities; equality of vectors. 2. Magnitude (modulus) of a vector. 3. The addition and subtraction of vectors and the multiplication of a vector by a scalar. 4. Angle between two vectors. 5. Use of vectors to establish simple properties of geometrical figures. 6. Components and resolved parts of a vector. 7. Position vectors. 8. The unit vectors **i** and **j**. 9. Equation of a line segment in the form $\boldsymbol{r} = \boldsymbol{a}t + (1 - t)\boldsymbol{b}$, where **a** and **b** are position vectors. 10. Median and centroid of a triangle.	Knowledge of the fact that if $a_1\mathbf{i} + b_2\mathbf{j} = a_2\mathbf{i} + b_2\mathbf{j}$, then $a_1 = a_2$ and $b_1 = b_2$ is expected. The 'simple properties' will in general involve collinearity and concurrency.

TOPIC		SUB TOPIC	NOTES
6.	**LINEAR PROGRAMMING**	1. Graphical representation and solutions of linear simultaneous equations. 2. Graphical representation and solutions of linear inequalities in two variables. 3. Objective functions. 4. Extreme values of a solution of a system of linear inequalities. 5. Maximum and minimum values of a function defined over a solution set. 6. Problems requiring the maximization of objective functions.	The solution of simultaneous linear inequalities is required. Use of graphical inequalities in two dimensions to find an optimum solution is required.
7.	**APPLICATION AND TRANSFORMATION OF THE 2-D PLANE**	1. Application and interpretation of 2 x 2 matrices. 2. Transformation matrices. 3. Transformations in a plane associated with 2 x 2 matrices: translation, enlargements, reflections, rotations, stretch and shears. 4. Combination of transformations. 5. Invariant properties of simple rectilinear figures under transformations. 6. The invariant point or invariant line.	A translation **T** followed by a rotation **R** will written as **RT**.
8.	**ELEMENTARY GROUP THEORY**	1. Binary operations. a. Operations tables. b. Properties of binary operations: closure, identity element, inverse element, associative law, commutative law. 2. Definition of a group a. Order of a group; Subgroups. b. Abelian groups.	Questions algebraic structures will be set.
9.	**POLYNOMIALS**	1. Remainder theorems. 2. Factor theorems. 3. Polynomial equations of order 3.	

TOPIC		SUB TOPIC	NOTES
10.	**INDICES, LOGARITHMS AND SURDS**	1. Use and properties of indices. 2. Logarithm: including change of base. 3. The functions a^x and $\log_c x$, where c is a positive integer. 4. Logarithmic equations. 5. Definition of a surd. 6. Arithmetic operations on surds.	A knowledge of the shape of the graphs of a^x and $\log_c x$, is expected, but not a formal expression for the gradient.
11.	**ABSOLUTE VALUE FUNCTION**	The absolute value function $\|x\|$. a. Definition of the absolute value function $\|x\|$. b. Inequality involving absolute value.	
12.	**QUADRATIC FUNCTIONS AND SIMPLE EQUATIONS**	Quadratic Theory i. Elementary theory of quadratic functions. ii. Graphs of quadratic functions. Quadratic equations. iii. Symmetric roots of a quadratic equation.	Solution of the equation $f(x) = 0$ by factorisation, completing the square and use of the quadratic formula.
13.	**DIFFERENTIATION**	1. The derivative defined as a limit. a. Differentiation of algebraic functions from first principle. b. Differentiation of standard functions. c. Differentiation of sum, products, quotients and function of a function; the chain rule. d. Application to gradients, stationary points, tangents and normal. 2. Elementary curve sketching: behaviour at stationary point, maxima and minima and intercept with coordinate axes.	Knowledge of Relation between sign of f' is expected To include the derivatives of x^n, $\sin ax$, $\cos ax$, $\tan ax$. Differentiation may be used in any part of the syllabus where appropriate.
14.	**INTEGRATION**	1. Integration as the reverse of differentiation: a. Integration of powers of x except x^{-1}. b. Integration of $\sin ax$ and $\cos ax$. 2. The fundamental theorem of calculus: a. $\int \frac{d}{dx}(F(x))dx = F(x) + c$, where c is a constant. b. Indefinite and definite integrals. c. Application of integration: area under a curve, area between two curves.	

SECTION B: MECHANICS

TOPIC		SUB TOPIC	NOTES
15.	**APPLICATION OF CALCULUS**	1. Connected rates of change. 2. Solids of revolution. 3. Centre of mass of uniform laminae, distribution (or its equivalent) in two dimension.	
16.	**DYNAMICS**	1. Kinematics of a particle moving in a straight line. 2. Velocity and acceleration when position is a function of time or simple examples of the equations: $a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$, and their solutions. 3. Displacement, velocity and acceleration as vectors. 4. Relative velocity. 5. Newton's laws of motion: the setting up and solution of equations of motion in one dimension. 6. Momentum and impulse. a. Momentum as a vector. b. The impulse-momentum principle. c. Conservation of linear momentum.	Problems will include motion of connected particles over a smooth single pulley. Problems involving Newton's law or restitution will not be set.
17.	**FORCES**	1. Force as a vector. a. Coplanar forces; the resultant of two coplanar forces. b. Resolution of forces into components: i. Parallelogram law of forces, ii. riangle law of forces, iii. Lami's theorem. 2. Moment of a force: moment of a force in component form about the origin.	Questions may require the resolving of forces into two components or the use of force diagrams. Questions on ladders leaning against a smooth wall and in limiting equilibrium on rough horizontal ground may be

TOPIC		SUB TOPIC	NOTES
		a. Simple cases of equilibrium of particles and rigid bodies under coplanar forces. 3. Friction.	set. The simple cases of application of basic condition of equilibrium to uncomplicated systems only are required.
18.	**WORK, ENERGY AND POWER**	Work, energy and power. The work-energy principle.	

SECTION C: STATISTICS AND PROBABILITY

TOPIC		SUB TOPIC	NOTES
19.	**DESCRIPTIVE STATISTICS**	1. Collection, classification and tabulation of statistical data. 2. Discrete and continuous data. 3. Data representation: pie chart, pictogram, bar charts and line graph. 4. Frequency distribution. a. Grouped frequency and distribution. b. Cumulative frequency distribution. c. Cumulative frequency curves (Ogive). 5. Contrast between good and misleading representation.	Realistic data should be used. Candidates should participate in collecting data.
20.	**MEASURES OF CENTRAL TENDENCY**	1. Mean; median and mode for grouped data. 2. Arithmetic and weighted mean; medians.	Index numbers.
21.	**MEASURES OF DISPERSION**	1. Range. 2. Interquartile range. 3. Semi-Interquartile range. 4. Quartiles and percentiles. 5. Variance and standard deviation for	Lengthy calculations will not be required. $\bar{y} = a\bar{x} + b$ and $Var(ax + b) = a^2Var(x)$

TOPIC		SUB TOPIC	NOTES
		grouped and ungrouped data. 6. Change of variable of linear relationship: mean and variance.	
22.	**PROBABILITY**	1. Definition of probability. 2. Rules of probability: a. Mutual exclusive events and independent events (Sum and product rules) and their applications. b. Exhaustive and complementary events. c. Probability trees. d. Conditional probability.	By symmetry and 'equal likelihood' and the limit of relative frequency. the knowledge of Baye's theorem not expected.
23.	*** ELEMENTARY DISTRIBUTIONS**	Discrete random variables. 1. The binomial distribution. 2. Elementary notions of discrete probability distributions.	Including knowledge, but not proof of the mean, np, and the standard deviation √(npq) of the binomial distribution.

*** indicates new topics**

DIFFERENCES BETWEEN THE 2011 SYLLABUS AND THE OLD 575 SYLLABUS

This syllabus contain two new topics namely:

- Permutations and Combinations (topic 2)
- Elementary Distributions (topic 23)

TEXTBOOKS AND REFERENCES:

1. *Mastering Additional Mathematics* byTangangTamambang,(n.d).
2. *Additional Mathematics for West Africa*,by J. F. Talbert &A.Godman. (n.d.).