

**DIRECTORATE OF SCHOOL EDUCATION
NAGALAND, KOHIMA**

**PATTERN OF EXAMINATION FOR GT (MATHEMATICS & SCIENCE)
RECRUITMENT EXAMINATION.**

1. The written examination will consist of 2 (two) papers of 300 marks -viz;

i.	Mathematics:	(Total- 300 Marks)
	Paper - I (Descriptive):	150 Marks.
	Paper- II (Descriptive):	150 Marks.
ii.	Science:	(Total- 300 Marks)
	Paper- I (Descriptive):	150 Marks.
	Paper- II (Descriptive):	150 Marks.

The written examination will be held on 25-09-2017 from 10:00 to 12:00 Hrs (Paper-I) and from 1:00 to 3:00 Hrs (Paper-II).

**DIRECTORATE OF SCHOOL EDUCATION
NAGALAND, KOHIMA.**

**SYLLABUS FOR RECRUITMENT OF GRADUATE TEACHER (MATHEMATICS
& SCIENCE) UNDER SCHOOL EDUCATION DEPARTMENT.**

MATHEMATICS:

Total-300 MARKS

PAPER- I:

150 Marks

- I. Number Systems**
- II. Algebra**
- III. Coordinate Geometry**
- IV. Geometry**

PAPER-II:

150 Marks

- I. Trigonometry**
- II. Mensuration**
- III. Statistics & Probability**

PAPER- I:

150 Marks

I. NUMBER SYSTEMS.

a. Real Numbers

Euclid's division lemma, Fundamental Theorem of Arithmetic- statements after reviewing work done earlier and after illustrating and motivating through examples. Proofs of results- irrationality of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, decimal expansions rational numbers in terms of terminating/non-terminating recurring decimals.

II. ALGEBRA.

a. Polynomials.

Zeros of polynomial, relationship between zeros and coefficients of quadratic polynomials. Statement and simple problems on division algorithm for polynomials with real coefficients.

b. Pairs of linear equations in two variables.

Pair of linear equations in two variables and graphical solutions. Geometric representations of different possibilities of solutions/ inconsistency.

Algebraic conditions for number of solutions. Solution of a pair of linear equations in two variables algebraically- by Substitution, by Elimination and by

cross Multiplication method. Simple situational problems must be included. Simple problems on equations reducible to linear equations may be included.

c. Quadratic Equations.

Standard form of quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$. Solution of the quadratic equations (only real roots) by factorization, by completing the square by using quadratic formula. Relationship between discriminant and nature of roots.

Problems related to day-to-day activities to be incorporated.

d. Arithmetic progression.

Motivation for studying A.P derivation of standard results of finding the n^{th} term and sum of first n terms and their applications in solving in daily life problems.

III. COORDINATE GEOMETRY.

a. Lines (in two dimensions)

Concepts of coordinate geometry including graphs of linear equations. Awareness of quadratic polynomials. Distance between two points and sections formula (internal). Area of triangle.

IV. GEOMETRY.

a. Triangles.

Definitions, examples, counter examples of similar triangles.

1. (Prove) if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two side are divided into two same ratio.
2. (Motivate) if a line divide two sides of a triangle in the same ratio, the line is parallel to the third side.
3. (Motivate) if in two triangles, the corresponding angles are equal their corresponding sides are proportional and the triangles are similar.
4. (Motivate) if the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
5. (Motivate) if one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the triangles are similar.
6. (motivate) if perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse the triangles on each side of the perpendicular are similar to the whole triangle and to each other.
7. (Prove) the ratio of the areas of two similar triangles is equal to the ratio of the squares on their corresponding sides.
8. (Prove) in a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.
9. (Prove) in a triangle, if the square on one side is equal to the sum of squares on the other two sides, the angles opposite to the first side is a right triangle.

b. Circles.

Tangents to a circle motivated by a chord drawn from points coming closer and closer to the points.

1. (Prove) the tangent at any point of a circle is perpendicular to the radius through the point of contact.
 2. (Prove) the lengths of tangents drawn from an external point to a circle are equal.
- c. Constructions.**
1. Division of a line segment in a given ratio (internally).
 2. Tangent to a circle from a point outside it.
 3. Construction of a triangle similar to a given triangle.

PAPER-II:

150 Marks

I. TRIGONOMETRY.

a. Introduction to Trigonometry

Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence; motivate the ratios; whichever are defined at 0° & 90° , Values (with proofs) of the trigonometric ratios of 30° , 45° & 60° . Relationships between the ratios.

b. Trigonometric Identities

Proof and applications of the identity $\sin^2 A + \cos^2 A = 1$. Only simple identities to be given. Trigonometric ratios of complementary angles.

c. Heights and Distances

Simple and believable problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation/depression should be only 30° , 45° , 60° .

II. MENSURATION

a. Areas related to Circles

Motivate the area of a circle; area of sectors and segments of a circle. Problems based on areas and perimeter/circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60° , 90° & 120° only. Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

b. Surface Areas and Volumes

1. Problems on finding surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones. Frustrum of a cone.
2. Problems involving converting one type of metallic solid into another and other mixed problems. (Problems with combination of not more than two different solids be taken.)

III. STATISTICS & PROBABILITY

a. Statistics

Mean, median and mode of grouped data (bimodal situation to be avoided). Cumulative frequency graph. Drawing of pie-charts (fractional angles to be avoided).

b. Probability

Classical definition of probability. Connection with probability. Simple problems on single events, not using set notation.

SCIENCE:**Total- 300 MARKS****PAPER- I****150 Marks**

- I. Materials**
- II. Energy**

PAPER-II**150 Marks**

- I. Living World**
- II. Natural Resources**
- III. Our Environment**

PAPER- I**150 Marks****I. MATERIALS-CHEMICAL SUBSTANCES- NATURE AND BEHAVIOUR.**

- a. Rate of chemical reaction and chemical equilibrium:** Elementary idea of rate of reactions, slow and fast reactions, reversible and irreversible reactions. Chemical equilibrium-dynamic nature (in brief); acids and bases (Lowry and Bronsted theory); pH scale; heat changes during chemical reactions.
- b. Some important chemical compounds:** Preparation/manufacture (in brief), properties and uses of- washing soda, baking soda, bleaching powder and Plaster of Paris. Manufacture and properties of some important building materials–lime, cement, glass and steel.
- c. Metals and non-metals:** Metals- Minerals and ores; metallurgy- enrichment of ores, extraction of metals from ores, their refinement and purification (with reference to iron and aluminium); activity series of metals, general properties and corrosion of metals. Alloys – components, properties and uses of steel, stainless steel, brass and magnelium, Alloying of gold. Non-metals – physical and chemicals properties of non-metals; preparation, properties and uses of hydrogen, ammonia, sulphur, sulphuric acid.
- d. Carbon compounds:** Carbon; carbon-tetravalency and catenation; Functional groups (oxygen containing only); Preparation, properties and uses of ethanol and formaldehyde; Carboxylic acids – preparation, properties and uses of acetic acid; some common synthetic polymers, soaps and detergents.

II. ENERGY-LIGHT, ELECTRICITY AND ENERGY.

- a. Light:** Nature of light – theories of light; reflection of light – laws of reflection, reflection from plane and curved surfaces; mirror – plane, concave and convex; sign conventions; derivation of mirror formula, magnification. Laws of refraction; refraction through a rectangular slab; image formation by concave and convex lenses; lens formula (with simple treatment); sign conventions; power of lens; some optical

phenomena in nature (twinkling of stars, mirage); defects of vision and their correction. Construction and working of a compound microscope and an astronomical telescope; Dispersion of white light by a glass prism; composition of white light, colour of objects and pigments, super imposition of light of primary colours.

- b. Electricity and its effects:** Potential and potential difference, electric current, Ohm's Law, combination of resistances in series and parallel; heating effects of electric current and its applications; Power, commercial unit of electrical energy. Electrolysis– Faraday's Laws (excluding equations), electroplating, electrochemical cells– dry cell; Magnetic field due to current carrying conductor–straight, coil, solenoid (qualitative idea only), electromagnetic induction, electric motor and generator (DC), direct and alternating current (qualitative idea), domestic electric circuits, safety measures in using electricity.
- c. Sources of energy:** Renewable and non-renewable sources. Renewable sources–solar energy- solar cooker, solar water heater, solar cell; wind energy–hydro energyhydroelectricity, geothermal, biogas, hydrogen; Non- renewable sources– fossil fuels-coaldestructive distillation of coal (in brief), petroleum and natural gas; conditions of combustion; choice of a good fuel; efficient use of fuels. Nuclear fusion, nuclear fission, chain reaction, nuclear reactors (basic principle and safety measures), advantages and hazards of using nuclear energy; judicious use of energy.

PAPER-II:

150 Marks

I. LIVING WORLD - LIFE PROCESSES

- a. Life processes I:** Nutrition– modes of nutrition–autotrophic, heterotrophic, saprophytic, holozoic and parasitic; nutrition in plants–photosynthesis (main steps), factors affecting photosynthesis; nutrition in animals (main steps) – in amoeba and grasshopper; Human digestive system. Respiration and breathing, types of respiration (aerobic and anaerobic), respiration in plants and animals, respiration through skin, gills, air tube, lungs (earthworm, fish, grasshopper and human); structure and functions of respiratory organs in humans (elementary idea). Transportation in plants and animals; transportation in plants (water and minerals, food), transportation in human– role and composition of blood, blood clotting, blood groups and blood transfusion; structure and function of heart and blood vessels (elementary idea), lymphatic system; Excretion in animals (amoeba and earthworm); excretion in humans; osmoregulation.
- b. Life processes II:** Control and coordination – coordination in plants and animals; nervous system, reflex action, hormones in human beings (in brief). Reproduction – types, significance; Reproduction in plants- asexual reproduction- vegetative propagation in plantscutting, grafting and layering; parthenogenesis; sexual reproduction- reproductive parts in plants; Pollination and fertilization. Reproduction in animals – fission, budding, regeneration; reproduction in humans; sexual cycle in

female (in brief); fertilization in humans; artificial insemination, cloning (elementary idea only).

- c. **Heredity and evolution:** Heredity and variation; physical basis of heredity—chromosomes, DNA (elementary idea only); genes; sex determination; organic evolution theories of evolution (elementary idea only).

II. NATURAL RESOURCES

- a. **Management of natural resources:** Conservation and judicious use of natural resources, Regional Environment: Adverse effects of hunting, logging, fishing with chemicals; Water harvesting, sustainability of natural resources.

III. OUR ENVIRONMENT

- a. **Environment and environmental problems:** Biodegradable and non-biodegradable materials; Solid waste management; Ecological balance – sustainable development, inter-relationship of population; Climate change; Global warming. Efforts for conservation and protection of the environment, environmental laws.