SYLLABUS FOR THE POST OF SURVEYOR OF SURVEY SETTLEMENT AND LAND RECORDS DEPARTMENT

PAPER-II: SPECIFIC PAPER - The content of this paper shall be determined by the Recruitment Committee, keeping in view the nature of the job for which the selection is being made and the qualifying examination in consultation with the appointing authority.

MATHEMATIS (40%)

ARITHEMATIC

NUMBER SYSTEM

1. SQUARES AND SQUARE ROOTS, CUBES AND CUBE ROOTS

a. Geometrical pattern of square numbers, squares of decimals and fractions square roots
b. Determination of square root of perfect square root
c. Estimation of sq. Root of a non perfect square
d. Cubes and cube roots
e. To find cube root by factor method
f. Identification of sq numbers
g. To find square root of perfect sq no's by factor method
h. To find sq. Of perfect sq. No., decimals and no's which are not perfect.
i. To find the smallest number that has to be added or subtracted from a given no. To make it a perfect sq. No.
j. Process of finding the square root by division method

2. SET THEORY

a. Representation of a set
b. Types of sets
c. Definition of union intersection, Compliment and difference of sets.
d. Venn .diagrams
e. Operation of sets
f. Union, intersection, Compliment and difference of sets. Representation using Venn diagrams
g. Properties of union and intersection of sets
h. De Morgan's laws of sets
i. Relation b/w no of elements of sets

3. SEQUENCE

a. Definition of sequence and series
b. Meaning and specified terms of ap, gp, and hp
c. Sum of terms in ap and gp
d. Relation b/w am, gm and hm

4. MATRICES

a. Definition, a. Route maps
b. Tabular information
c. Order of matrix
d. Types of matrices

e. Equality of matrices
f. Classification based on their elements and order
g. Matrices and transpose of a matrix.
h. Conditions necessary for addition, subtraction and multiplication of matrices.

5. PERMUTATIONS AND COMBINATIONS

Concept of permutations and combinations
a. Distinguish b/w permutations and combinations
b. Factorial notation
c. Meanings of ${}_nP^r$ and ${}_nC^r$.

6. STATISTICS

a. Frequency distribution table
b. Graphical representation table .tabular representation. Pie chart
c. Mean Measures of central tendency
d. Arithmetic of ungrouped data, median
e. Mean. Median and mode for grouped data
f. Range. Quartile. Deviation and mean deviation
g. Statistical measures
h. Histogram and frequency polygons
i. Collection of data
j. Calculation of mean, median and mode for ungrouped data
k. Preparation of Bar chart and Sector graph
l. Standard deviation
m. Standard deviation of ungrouped data
n. Standard deviation of grouped data
o. Coefficient of variations

7. H.C.F and L.C.M.

a. Application of H.C.F.
b. Application of H.C.F. in factorization.
c. Lowest common multiple.

ALGEBRA

1. BASICS OF ALGEBRA

a. Basic terms
b. Various algebraic terms
c. Operations with literal signed numbers
d. Use of symbols

2. MULTIPLICATION OF ALGEBRAIC EXPRESSIONS

a. Multiplication of binomials
b. Special products
c. Squaring of trinomial
d. Expressions $(a+b)^2$; $(a-b)^2$;$(a+b)(a-b)$; $(a+b+c)^2$

3. LINEAR EQUATIONS

a. Solving a linear equation
b. Balance scales

c. Applications of linear equations
d. Rectangular coordinate systems and graphs
e. Quadrants and convention of signs
f. Graph in linear equations

4. QUADRATIC EQUATIONS

a. Pure quadratic equation
b. Affected quadratic equation by factorization
c. Solving quadratic equation by formula method
d. Equation reducible to the form ax2+bx+c=O.
e. Problems based on quadratic equations.
f. Nature of roots ·of a quadratic equations.
g. Relationship b/w roots and coefficient to the terms of quadratic equations.
h. To form an equation for the given roots
i. Graphical method of solving a quadratic equation

5. FACTORJSATION OF ALGEBRAIC EXPRESSIONS:

a. Factorisation of trinomials.
b. Factorisation of trinomials using algebraic tiles.
c. Factorisation of quadratic trinomial of the $ax^2 + bx + c$
d. Factorise expressions of the form $a^2 + 2ab + b^2$, $a^2 - 2ab + b^2$ And $a^2 - b^2$ using identities.
e. Factorisation using standard identities.

6. HCF & LCM OF BINOMIALS AND TRINOMIALS.

a. Explain the meaning of HCF and LCM of algebraic expression.
b. Find the HCF and LCM of binomials and trinomials.

7. CO-ORDINATES-PLANE GEOMETRY

a. Plotting of graph- simple equations.
b. How to calculate values along an axis while the values along another axis is given

GEOMETRY

1. AXIOMS AND POSTULATES

Axioms-1,2,3,4,5 & 6
Postulates-1,2,3,4,5 & 6

a. Definition's
b. Enunciations (statements)
c. Definition and properties of point, ray and lines
d. Linear pair
e. Properties of vertically opposite angles
f. Parallel lines, transversals
g. Properties of corresponding angles formed when transversal intersects 2 parallel straight lines.
h. Properties of lines which are parallel to the same line.

2. THEOREMS

a. Converse of a theorem
b. Theorems on parallel -pairs of alternate angles
-pairs of interior angles

3. POLYGONS

a. Definition, diagonals and interior regions of polygons
b. Identification of polygons, Inscribing regular polygons
c. Differentiation b/w regular and irregular polygons
d. Inscribe regular pentagon. Hexagon and octagon
e. Definition of well conditioned polygons
f. Properties of well conditioned polygons

4. TRIANGLES

1. Classification of triangles, exterior angles of triangle, sum of 3 angles Is 180'
2.
   a. Proving theorems logically with reference to angles
   b. Developing deductive reasoning ability
   c. Riders based on theorems
3.
   a. Construction of triangles
   b. Steps of constructions
   c. Construction of equilateral triangle
   d. Right angled triangle

5. CONGRUENCE OF TRIANGLES

a. Meaning of congruence
b. Congruency of triangles
c. Postulates related to congruency of triangles
d. S.A.S Postulates
e. S.S.S Postulate
f. A.S.A Postulates
g. Right hypotenuse, side postulate

6. CONCURRENT LINES OF A TRIANGLE

a. Altitude of a triangle
b. Construction of altitude of triangle
c. Steps of construction
d. Medians of triangle-steps of construction
   - Properties of centroid
   - Drawing perpendicular bisectors to the sides of triangle
   - Position of circum circle
   - To draw angular bisectors
   - In centre, in circle
   - Steps of construction

7. QUADRILATERALS

1. Definition, identification.
   Writing ten elements of a given quadrilateral properties
   Construction of quadrilateral to given measurements
   Calculation of area of a quadrilateral using the formula

8. TYPES OF QUADRILLATERALS

a. Identification of different types, consecutive angles

b. Properties of each type of quadrilateral
c. Construction of parallelograms, Rhombus us, trapezia to given measurements
d. Calculation of area of parallelograms, rhombus and trapezium using formula

9. THEOREMS ON PARALLELOGRAMS

a. Properties of parallelograms
b. Meaning of corollary
c. Corollaries of theorems

10. MID POINT THEORM

a. Definition
b. Prove mid-point theorem logically
c. Converse of mid-point theorem
d. Solving problems and riders based on mid-point theorem.

11. AREAS

a. Identification and stating the properties of parallelograms
b. Standing on same base and b/w same parallels
c. Theorems on areas of parallelograms logically
d. Solving problems and riders based on the theorems.

12. CYCLIC QUADRILATERALS

a. Definition
b. Properties
c. Theorems
d. Construction
e. Problems and riders based on theorems on cyclic quadrilaterals.

13. SURFACE, AREAS AND VOLUMES OF SOLIDS

a. Definition of prism and pyramid
b. Properties of prism and pyramid
c. Difference b/w prism and pyramid
d. Surface area of prisms and pyramids
e. Volume of prisms and pyramids

14. CIRCLES

a. Definition of circle, radius, circumference, diameter, chord, arc and segment.
b. Chord property of circle
c. Central angle and inscribed angle
d. Theorem on angle property of the circle
e. Problems and riders based on properties of circle
f. To draw a chord of given length in a circle
g. To find distance b/w the centre and chord of a circle
h. To show that equal chords of a circle are equidistant from the centre.
i. Construction of a segment of a circle
j. Concentric circles
k. Congruent circles
l. Secant and tangents
m. To draw a tangent at a point on a circle

n. Relation b/w radius, point of contact and tangent of a circle
o. To draw a tangent to a circle from an external point
p. Properties of tangents
q. To draw a direct tangent to 2 circles of different radii
r. To construct transverse common tangents to 2 circles

15. THEOREMS ON TRIANGLES AND CIRCLES

a. Concept of similarity
b. Similarity of triangles
c. Basic proportionally theorem
d. Corollary of basic proportionality theorem
e. Theorems on similar triangles
f. Areas of similar triangles

16. RIGHT ANGLES TRIANGLE

a. Pythagoras theorem
b. Touching circles
c. Distance b/w the centre of touching circles.
d. Properties of tangents drawn to a circle from an external point.

PHYSICS (10%)

1. MAGNETISM

1.1) Natural Magnets.
1.2) Artificial Magnets,
1.3) Properties of Magnets
(a) Magnetic field -Detection of the presence eta Magnetic field.

1.4) Magnetic substances.
(a) Non magnetic substances.
(b) Diamagnetic Magnetic materials
(c) Paramagnetic materials
(d) Ferromagnetic materials
1.5) Preparing magnets.
(a) Mechanical method
(b) Electrical method
1.6) Uses of magnets
(a) Protection of magnetism-Earth's magnetism
1.7) Magnetic lines of force around a bar magnet
1.8) Electro magnetism
1.9) Instruments using magnetic effect of electric current

2. ELECTRICITY

2.1) Units of Electricity
(a) Electric Power- Units of Electric power
2.2) Practical Unit of electricity
2.3) Effects of electric current
(a) Magnetic effect of electric current
(b) Chemical effect Of electric current
(c) Heating effect of electric Current
2.4) Electric fuse

(a) Electric bulb

2.5) Sources of electricity
   (a) Electric cell
   (b) Dry cell

2.6) Electro motive force

3. ELECTROMAGNETIC RADIATION

3.1) Introduction
3.2) Electromagnetic Radiation
3.3) Properties of electromagnetic waves
3.4) Electromagnetic spectrum
3.5) Uses of electromagnetic Radiation
   (a) Light
   (b) Infrared radiations
      • Applications of infrared rays
   (c) Ultraviolet radiations
      • Applications of ultraviolet rays
   (d) X-rays
   (e) Gamma rays
   (f) Micro waves
   (g) Radio waves
3.6) Laser
   • Characteristics of laser radiation

4. ELECTRONICS.

4.1) Radio
   • Introduction
   • Radio communication
   • Radio transmitter
   • Radio receiver
4.2) Television

5. DYNAMICS

a. Motion.
b. What is motion.
c. Distance travelled, displacement
d. Speed Velocity
e. Acceleration
f. Graphic representation of motion
g. Equation of motion
h. Periodic motion
i. Simple pendulum - an application of oscillatory motion
   I. Law of simple pendulum
   II. Law of the pendulum
   III. Law
      • Uses of simple pendulum

j. Periodic motion – Waves
k. Wave motion.
l. Energy - motion - mechanical work
m. Energy – forms, sources
n. Newton's Laws of motion

I. Law
II. Law
III. Law

o. Acceleration due to Gravity
p. Equations of motion of bodies moving under the Influence of gravitational force

6. HEAT

6.1) Nature of heat
6.2) Heat & Temperature
6.3) Temperature scales
6.4) Relationship between Fahrenheit & Celsius scales of Temperature
6.5) Relationship between Celsius & Kelvin scales of Temperature
6.6) Measurement of temperature
(a) Mercury thermometer
(b) Clinical thermometer
(c) Maximum - minimum thermometer
6.7) Units of Heat
6.8) Changes of state of substances due to heat
6.9) Effects of heat
(a) Thermal expansion of bodies due to heat
(b) Linear expansion in solids

7. LIGHT

7.1) Importance of light
7.2) Refraction of light
7.3) Laws of refraction of light
7.4) Refractive index
7.5) Effects of refraction of light
7.6) Total Internal reflection
7.7) Applications of total internal reflection
(a) In optical instruments
(b)Optic fiber cables
(c) Sparkling of diamond
(d) Bicycle reflector
7.8) Mirage -Total internal reflection in nature
7.9) Refraction in a prism - Dispersion
7.10) Dispersion of light in nature
7.11) Lenses
7.12) Refraction of light through lenses.
7.13) Thin lens as an array of prisms.
7.14) Some parameters pertaining to lenses
7.15) Rules of signs in obtaining images by lenses.
7.16) Formation of images in lenses.
7.17) Formation of images by convex lens.
7.18) Formation of images by concave lens.
7.19) Uses of lenses – short sightedness or Myopia.
Long sightedness or Hypermetropia.
7.20) Optical instruments
7.21) Simple microscope

7.22) Camera
7.23) Compound microscope
7.24) Telescope
7.25) Binoculars
7.26) Dispersion & Spectrum
- Cause of dispersion
- Pure spectrum
- Visible spectrum
- Spectroscope
- Uses of spectroscope

7.27) Raman effect
- Introduction
- Discovery

8. SOUND

8:1) Introduction
8 .2) Ultrasonic sound
8.3) Uses of Ultrasonic waves
8.4) Sonar & Ultrasonic scanner
(a) Sonar
- How does sonar work

(b) Ultrasound scanner
8.5) Doppler effect in Sound & light
(a) Doppler effect in Sound
(b) Doppler effect in Light
8.6) Applications of Doppler effect

9. GRAVITATION

9.1) Introduction
9.2) Universal law of Gravitation
9.3) Gravity near the Earth's surface
- Weight
- Weightlessness
- Variation of g:

9.4) Importance of the law of Gravitation

GEOGRAPHY(10%)

1. THE EARTH

- The Universe - Shape of the Earth
- The Axis of the Earth
- Rotation – Revolution
- Important lines of latitudes and Zones - Latitudes and Longitudes & Longitudes and time
- Zonal time
- International dateline

2. **THE LITHOSPHERE**
   - Layers of the Earth
   - Rocks and Weathering of Rocks
   - Earth Quakes & Volcanoes

     (a) Primary Waves
     (b) Secondary Waves
     (c) Long Waves

3. **MAPS**
   - Characteristics of maps
   - Types of maps - Large scale/small scale
   - Thematic maps - Globes

4. **PHYSICAL FEATURES OF INDIA**
   - Location and Extent
   - Northern Mountains
   - North Indian Plateau
   - The Peninsular Plato
   - Coastal Plains and Islands
   - Rivers and Lakes of India

Modern methods of surveying (20%)

Photogrammetry And Aerial Survey: Introduction, definition, basic principles, methods, importance of scale, height, applications. Satellite Imagery – types of satellites (optical, multispectral, hyper spectral, SAR), satellite image acquisition, resolution (spatial, spectral, temporal, radiometric), satellite imagery processing – rectification, orthorectification, mosaicking, classification and information extraction; softwares used (Earth Engine, GIS Image Analyst). Drone (UAV) Imagery – types of drones, drone survey planning, Ground Control Points (GCPs), drone image acquisition; drone imagery processing – Structure from Motion (SfM), point cloud generation, Digital Elevation Model (DEM) / Digital Surface Model (DSM) generation, Orthomosaic / Ortho-Rectified Image (ORI) generation; softwares used.

Remote Sensing: Introduction, principle of remote sensing, EMR types, Resolutions, types of satellites, types of sensors, LIDAR, visual and digital image processing and its application.

Global Positioning Systems (GPS): Definition, principles of GPS and its applications.

Geographical Information System (GIS): Introduction and principle of GIS, components of GIS and its applications.

Advanced Positioning and Satellite Communication Technology in Surveying: GPS (Global Positioning System): NAVSTAR GPS architecture, signal structure, trilateration principle, types of errors and corrections. DGPS (Differential GPS): concept, base station and rover

configuration, real-time and post-processed differential correction, accuracy levels. GNSS Rovers: RTK (Real Time Kinematic) surveying, CORS (Continuously Operating Reference Station) network – Karnataka State CORS Network, NTRIP protocol, field data collection with GNSS Rovers, precision in cadastral surveys. Satellite Communication Technology: GNSS satellite constellations (GPS, GLONASS, Galileo, NavIC/IRNSS), signal frequencies, satellite geometry and DOP values. Related Softwares: GNSS data processing software), post-processing and network adjustment tools, integration with GIS.

Computer Applications (20%)

i) **MS Office- MS Word, MS Excel, MS Powerpoint:** AutoCAD: Introduction to AutoCAD software, all commands in AutoCAD, drawing simple figures, triangles, rectangles, Text writing, hatching, development of 2D and 3D elements, extrusion, mirror option, etc., Operations using AutoCAD. Working with DXF files – import, export and editing of cadastral DXF data in AutoCAD.

ii) **GIS Softwares and their Applications:** Introduction to GIS software environment. (GIS) – open-source desktop GIS: installation, interface, loading vector and raster data, layer management, attribute table operations, spatial queries, digitizing and editing vector layers, styling and symbology, map layout and printing, plugins and extensions, coordinate reference system (CRS) management; use in cadastral mapping,. Geo Server / Map Server – open-source GIS servers for publishing OGC web services (WMS, WFS, WCS). Post GIS – spatial extension to PostgreSQL for storing and querying geographic data.

iii) **Basics of Software Solutions and Land Records Information Technology:** Software development lifecycle (SDLC) – how software applications are designed, developed, tested and deployed. Web application development concepts, web portals and citizen service portals. Mobile application development for field. offline-first design, geo-tagging, digital signature (eSign /DSC), sync with central server. Basics of how spatial and textual data is procured, stored and retrieved: State Data Centre (SDC) / architecture, database storage concepts, data access and retrieval methods. Application Programming Interface (API) – concept of REST(Representational State Transfer) and SOAP(Simple Object Access Protocol) APIs, API Gateway, integration of mobile apps with backend databases and web portals. Web portal design and user experience (UX)(User Experience) fundamentals. Java, Json, XML, HTML, HTTPS.

Commissioner,
Survey Settlement and
Land Records, Bangalore.