Syllabus for the GU-ART (Goa University Admission Ranking Test) for
M.Sc. Remote Sensing and GIS
(Approved in BoS scheduled on 12.01.2022)

Earth's Atmosphere – Components of Earth's atmosphere, Vertical structure of the atmosphere, Temperature scales, Air pressure and density.

Earth's heat-budget and Gravity – Insolation, Earth's long-wave radiation, Atmospheric greenhouse effect, Earth's annual energy balance, Newton's laws of motion and gravitation, Atmospheric waves, Centrifugal and centripetal forces, Momentum and energy conservation theorems, Relation between pressure, volume and temperature in adiabatic processes.

Greenhouse gases - Koppen's and Thornthwaite's scheme of classification of climate, Climate change, aerosols.

Radiation - Basic laws, Rayleigh and Mie scattering, multiple scattering, Wien's displacement law, Stefan–Boltzmann law, Planck's law, Weather observations and transmission – Meteorological satellites – Polar orbiting and geostationary satellites.

Basic Mathematics – Algebra, Geometry, Trigonometry, Vectors, Calculus, Co-ordinate systems, Mathematical logic, Circles, Parabola, Relations and Functions, Inverse Trigonometric Functions, Matrices and Determinants, Continuity and Derivatives, Differential calculus, Applications of Derivatives, Integrals and applications, Differential Equations, Vector Algebra, Probability, Numerical Methods, Analytical Geometry, Permutations and Combinations, Sequences and Series, Ratio and proportions.

Basic Physics - Units, Motion and forces, Conservation of energy and momentum, Electricity and magnetism, Waves, Gravity. Colligative properties of water, Specific heat of water, Viscosity, Surface Tension, Buoyancy Current Electricity, Magnetic Effects of Current and Magnetism, Electro-magnetic induction and A.C.. Electro-magnetic spectrum – Properties of electro-magnetic radiations, Black-body radiation, Temperature and heat transfer, Latent Heat, Conduction, Convection, Radiation, Absorption, Emission, Laws of thermodynamics, Ray optics and wave optics, Dual nature of matter, Atoms and nuclei, Semi-conductors.

Basic Statistics: Mean, Median, Quantiles, Variance, Standard deviation, Correlation, Regression, Slope, Intercept, Data collection, Types, Classification, tabulation and graphical representation, Interpolation and extrapolation, Measures of central values, Measures of dispersion, Probability, Sampling, distributions, Tests of significance, Time-Series Analysis Accuracy, Precision, measures of skewness and kurtosis, scatterplots, sampling methods.

Computer Science: Concepts of hardware and software, Storage devices, Graphic User Interface, database concepts, Compilers and interpreters; Number systems: Binary, Decimal,

Common Application Softwares, Computer networks, Internet tools and browsers, data structures, logical reasoning, data sufficiency questions.

Basic concepts of Remote Sensing: Radiation principles, Basic concepts, Electromagnetic spectrum, Scattering, Spectral signature, Resolutions (Spectral. Spatial, Temporal and Radiometric), Platforms and Sensors, Remote Sensing Data Products - PAN, Multispectral, Microwave, Thermal, Hyperspectral, Visual and digital interpretation methods. Basic fundamentals on sensors, electronics related, circuits, electrical engineering, Common engineering to be added,

Maps and Cartography: Map types, design, symbolization, legend, scale, annotation and map layout, - Importance of maps, Map sheet numbering, Coordinate systems- Cartesian and geographical, map projections, map datum – MSL, Geoid, spheroid, WGS-84.

GPS and GNSS – GPS fundamentals, GPS satellite Constellation, Components of GNSS, Data collection methods, GPS types

GIS - Introduction, Data Sources, Data Input methods, Data Models and Data Structures, Spatial data (Point, Line and Area) representation, Non-spatial data; Vector and Raster Data representation, Advantages and disadvantages of Vector and raster data, Spatial analysis - Interpolation, Buffer, Overlay, Terrain Modeling and Network analysis.

Ecology and Environment: Principles of ecology, trophic level, niche and energy transfer and pyramid, food chain and food web, primary, secondary and tertiary producers, autotrophy, role of light and nutrients, enzymes, chemo-autotrophy and heterotrophy, role of microbes, decomposition and oxidation process, production of organic matter, carbon dioxide cycle, anthropogenic sources, land sea interaction, greenhouse gases, deforestation

Geology - Physiographic divisions of India; Basic concepts of geomorphology. Weathering and soil formations; Landforms, slopes and drainage. Physical and chemical characters of rock forming silicate mineral groups; Optical properties of common rock forming minerals; Common minerals of igneous and metamorphic rocks; textures and structures of igneous and metamorphic rocks. Indian mineral deposits - coal and petroleum.

Geography - Geographic principles; Concepts of geomorphic cycles Landforms and Land scape development; Erosion surfaces; Slope development; Geomorphology. Genesis of soils; Classification and distribution of soils; Soil profile; Soil erosion, Degradation and conservation; Problems of deforestation and conservation measures; Social forestry, agro-forestry; Wild life; Principle ecology; Human ecological adaptations; Influence of man on ecology and environment; Types and patterns of rural settlements; Environmental issues in rural settlements; Concept of a region; Types of regions and methods of regionalization; Growth centres and growth poles; Structure and relief; Drainage system and watersheds; Physiographic regions; Ecological issues: Environmental hazards: landslides, earthquakes, Tsunamis, floods

and droughts, epidemics; Issues related to environmental pollution; Changes in patterns of land use; Principles of environmental impact assessment and environmental management; Environmental degradation; Deforestation, desertification and soil erosion; Concept of sustainable growth and development; Environmental awareness; Linkage of rivers; Basic components of Maps and Type of Maps.

Reference Books:

1. Basic Statistics; 2006; B. L. Agarwal; New Age International Publishers

2. Fundamentals of Physics, Haliday, Resnik and Walker, John Wiley and Sons.

3. Physics for Degree Students B.Sc. First Year; 2010; C. L. Arora and P. S. Hemne; S. Chand Publishing

4. Physics for Degree Students B.Sc. Second Year; 2012; C. L. Arora and P. S. Hemne; S. Chand Publishing

5. Physics for Degree Students B.Sc. Third Year; 2014; C. L. Arora and P. S. Hemne; S. Chand Publishing

6. Mathematical methods for Physics and Engineering; 2006; K. F. Riley, M. P. Hobson and S. J. Bence; Cambridge University Press

7. Heat and Thermodynamics; 1997; M.W. Zemansky and R.H. Ditman; McGraw Hill.

8. Quantitative Aptitude for Common Admission Test; Arun Sharma, McGraw Hill (6th Edition).

9. Mathematics for Degree Students B.Sc. First Year; 2010; P. K. Mittal; S. Chand

10. Mathematics for Degree Students B.Sc. Second Year; 2010; P. K. Mittal; S. Chand

11. Mathematics for Degree Students B.Sc. Third Year; 2016; U. S. Rana; S. Chand

12. Essentials of Meteorology: An Invitation to the Atmosphere; Eighth Edition; 2018; C. Donald Ahrens and Robert Henson; Cengage Learning, 20, Channel Center Street, Boston, MA 02210, USA

13. CK-12 Basic Physics - Second Edition; James J Dann and James H Dann; https://www.ck12.org/book/peoples-physics-book-basic/, retrieved on 13 January 2022

14. Fundamentals of Mathematics; 2008; Denny Burzynski; https://cnx.org/contents/XeVIW7Iw@4.6:4lF8HG_a@2/Perimeter-and-Circumference-of-Geometric-Figures, retrieved on 13 January 2022

15. P. K. Mukherjee. Text Book of Geology, World Press, 1999
16. Frederick K. Lutgens; Edward J. Tarbuck; Dennis G. Tasa. Essentials of Geology, Pearson Education, 2017, 592p.
17. Charles Fletcher. Physical Geology, 3rd Edition-Wiley (2017)

18. L. S. Bhat. Geography in India Selected Themes, Pearson Publishers, 307p. 2009.
19. Joseph Holden. Physical Geography: The Basics, Routledge Publ. 245p. 2021
20. Majid Husain, Geography of India. McGraw Hill Education (India) Private Limited, 350p, 2020.
21. Ecology: Concepts and Applications (1998) by Manuel Molles
22. Biology Textbooks for Class XI (Part I & II) (2015) by NCERT, New Delhi
23. Biology Textbooks for Class XII (Part I & II) (2015) by NCERT, New Delhi
24. V. Rajaraman. Fundamental of Computers, PHI publishers, 642p. 2014 (VIth Edition).
25. Anil. K. Jain, Fundamentals of digital image processing, Pearson Education, India, 592p. 2015.
26. R. S. Aggarwal, A modern approach to logical reasoning, S. Chand publisher, 224p. 2024 (2nd edition).
27. Kang-Tsung Chang, Introduction to Geographic Information System, McGraw-Hill Education, New York, 461p. 2019.
28. A. N. Patel and Surendra Singh, Remote sensing: principles and applications, Scientific publishers, 190p. 2024.