GOA UNIVERSITY
Taleigao Plateau

SYLLABUS FOR GOA UNIVERSITY ADMISSIONS RANKING TEST (GU-ART) IN MARINE SCIENCE

(Students will be answering only one of the below mentioned sections depending on their subject discipline)

PHYSICS

Colligative properties of water - Lowering of vapour pressure and elevation of boiling point - freezing point depression - Specific heat of water – Solar radiations - Absolute temperature - Earth long wave radiation - Black body radiation – Conduction - convection and Radiation - Laws of thermodynamics - Newton's laws of motion and gravitation - Oceanic waves and tides – Viscosity - surface tension – Buoyancy - gravity – centrifugal and Centripetal forces - El Nino and La Nina- Indian monsoon. Motion along a rough inclined plane, momentum and energy conservation theorems. Modulii of elasticity, Relation between pressure, volume and temperature in adiabatic process. Multiplication and division of vectors by scalars, Addition and subtraction of vectors. Winds, pressure gradient force, Coriolis force, friction force, gradient winds, geostrophic winds, cyclostrophic winds, thermal winds, shallow water waves, deep water waves, intermediate water waves. Particle motion in shallow, intermediate and deep water waves, classification of sea surface waves based on period, causative forces and restoring forces, meteorological instruments, oceanographic sensors on satellite for estimation of wind, sea surface temperature, chlorophyll-*a* & sea surface height, parts of electromagnetic spectrum, properties of Electromagnetic radiations, absolute humidity, specific humidity, mixing ratio, relative humidity, shortwave radiation, long wave radiation, sensible heat flux and latent heat flux distribution over global oceans, states of water and energy associated with change of state, role of latent heat of condensation and melting in climate.

Reference Books:

1. Physics for degree students (2014) C.L. Arora and P.S. Hemne, S. Chand Publishing, New Delhi.
2. El Nino, La Nina and Southern Oscillation , Vol 46, first edition (1989) S. Philander, Academic press, USA.
3. Waves, Tides and shallow water processes (1989) Joan Brown and Jerry Bearman, Elseiver.
4. An Introduction to Mechanics (2014) D. Kleppner and R. Kolenkov, Cambridge University Press.
5. Classical Mechanics (2013) P. V. Panat, Narosa Publishing.
6. Thermal Physics (1993) S.C . Garg, R.M. Bansal and C. K. Ghosh, TMH.
7. Heat and Thermodynamics (1997) M. W. Zemansky and R.H. Ditman, McGraw Hill.
8. Mathematical methods for Physics and Engineering (20016) K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press.
9. Mechanics (2013) D.C.Tayal, Himalaya Publication.
10. Meteorology Today: An Introduction to weather, climate and the Environment (1985), 2nd edition, Ahrens, St. Paul, West Publ. House.
11. Introduction to Dynamical Oceanography (1983), 2nd edition, S. Pond and G. L. Pickard, Butterworth – Heinemann Ltd.

CHEMISTRY

Atmospheric Pollution: Composition of atmosphere. Ozone gas, Carbon dioxide, Green house gases, Global warming, acid rain, photochemical smog. Structure of the atom, Periodic Table, Atomic and molecular masses, mole concept and molar concentrations, Radioactivity and isotopes, Chemical bonding, Theory of dilute solutions, Ionic equilibria – solubility product, Acids and bases, Oxidation and reduction, Redox potentials, Transition elements, First and second law of thermodynamics, Chemical kinetics, Chemical equilibrium, Electrochemistry. Environmental chemistry: Environment and Environmental pollutants; water pollution and soil pollution. Chemical, bonding and molecular structure, classification of elements and their properties, Organic chemistry – some basic principles and Techniques. Aldehydes, ketones and carboxylic acids. States of matter: gaseous state, liquid state and solid state; Thermodynamic state: enthalpy change, entropy change and Gibbs energy change; Hydrogen: dihydrogen, hydrides, water, hydrogen peroxide and heavy water; s – Block elements; p – Block elements.

Reference Books:

1. Marine Pollution (1986) by R. B. Clark.
2. Environmental Chemistry (2006) by A.K. De.
3. Water Pollution (1994) by Sharma and Kaur.
4. Principles of Inorganic Chemistry (2017) by B. R. Puri, L. R. Sharma and K. C. Kalia
5. Principles of Physical Chemistry (2017) by B. R. Puri, L. R. Sharma and M. S. Pathania
6. Essentials of Physical Chemistry (2010) by A. Bahl, B. S. Bahl and J. D. Tuli
7. Chemistry Textbooks for Class XI (Part I & II) (2015) by NCERT, New Delhi

BIOLOGY

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; Reproduction in organisms, Life span, cell division, Types of Reproduction, Asexual and Sexual Reproduction, Events in Sexual Reproduction, Fertilization; Principles of inheritance and variation, Mendel's Laws of Inheritance, Law of Dominance, Segregation, Inheritance of Genes, Chromosomal Theory of Inheritance, Linkage and Recombination, Sex Determination, Mutation, Genetic Disorders, Mendelian Disorders, Cytoplasmic Inheritance; Molecular basis of inheritance**,** The DNA, Transforming Principle, RNA World, Replication, Transcription, Genetic Code, Translation, Regulation of Gene Expression, DNA Fingerprinting, Practical Applications; Strategies for enhancement in food production, Animal Husbandry, Management of Farm and Farm Animals, Bacterial and Viral Diseases, Animal Breeding, Methods of Animal Breeding, Controlled Breeding, Fisheries, types of Ponds, Sericulture; Biotechnology - principle and processes, Basic Steps in Gene Cloning, Tools of Recombinant DNA, Restriction Enzymes, Polymerase Enzymes, Ligases, Enzymes, Vectors, Host Organism, Cloning vectors, Processes of Recombinant DNA; Biotechnology and its application, Biotechnological Applications in Agriculture and medicine, Gene Subtraction, Biotechnological Applications in Medicine, Recombinant Insulin, Gene Therapy, Molecular Diagnosis, Transgenic Animals, Ethical issues, Controversies in India regarding Patent and Bio-piracy.

Reference Books:

1. Bioenergetics of Autotrophs and Heterotrophs - New Studies in Biology (1980) by John W. Anderson
2. Carbon Dioxide Utilisation: Closing the Carbon Cycle (2014) by Katy Armstrong, Elsje Alessandra Quadrelli, Peter Styring
3. Elements of ecology (1954) by Robert Smith
4. Ecology: Concepts and Applications (1998) by Manuel Molles
5. Biology Textbooks for Class XI (Part I & II) (2015) by NCERT, New Delhi
6. Biology Textbooks for Class XII (Part I & II) (2015) by NCERT, New Delhi

GEOLOGY

Rocks: Definition of rock, broad classification of rocks into igneous, sedimentary and metamorphic rocks;Igneous rocks, magma and lava; classification of igneous rocks - plutonic, hypabyssal and volcanic rocks; textures of igneous rocks-granularity, crystallinity, glassy and frothy textures; classification of igneous rocks based on composition- felsic, intermediate, mafic and ultramafic; common igneous rocks - granite, rhyolite, pegmatite, diorite, andesite, gabbro, dolerite, basalt and dunite; Sedimentary rocks, formation - weathering, erosion, denudation, transportation, deposition, compaction; Lithification and diagenisis; classification of sedimentary rocks - clastic, chemically and organically formed sedimentary rocks; sedimentary textures - Wentworth's grain size parameters, boulder, cobble, pebble, gravel, sand, silt and clay and structures - stratification, lamination, graded bedding, current bedding, ripple marks and mud cracks; common types of sedimentary rocks - shale, sandstone, conglomerate; lime stone, chalk and laterite; Metamorphic rocks, agents and types of metamorphism; metamorphic structures- gneissose, schistose, slaty and granulose; common metamorphic rocks- gneiss, schist, slate, marble, quartzite and charnockite; Rock cycle. Economic mineral deposits: Definitions of ore, gangue and grade of an ore. Common metals and their ores; Formation of mineral deposits- magmatic, hydrothermal, sedimentary, residual, placer, metamorphic and contact metasomatic deposits with examples; Study of important metallic minerals-

physical properties and chemical composition of hematite, magnetite, chalcopyrite, bauxite, galena and pyrolusite; Physical properties and industrial uses of some non-metallic minerals- mica, gypsum, asbestos, magnesite, barite, graphite and clay. Fossil fuels**:** Coal- origin and types of coal; Petroleum and natural gas- origin and migration of oil, formation of oil pools, oil traps. Major oil and gas fields of India. Oil shale and tar sand; Impacts of fossil fuels on mankind. Geological structures**:** Geometrical elements in rock structures - linear and planar structures, attitude of rock units - strike and dip of rock beds; Rock deformation - stress and strain, types of stress, stages of deformation; Primary structural features in rocks- bedding or stratification; Folds- parts of a fold; basic types of fold - anticline and syncline; symmetrical, asymmetrical and overturned folds; recumbent and isoclinal folds; Faults - parts of a fault; types of fault- normal, reverse, thrust, and strike-slip faults; horst and graben; Joints and their types -columnar and sheet joints; Unconformities and their types- angular unconformity, parallel unconformity (disconformity) and non-conformity. History of the earth: Stratigraphy and Palaeontology; stratigraphic correlation; Fossils, conditions for preservation of fossils, modes of fossilization and significance of fossils in geology; Dating of geologic events- relative and absolute dating; Fundamental principles of historical geology - uniformity, superposition, original horizontality, cross cutting relationship and faunal succession. Earthquakes: Causes of earthquakes- faulting, tectonic and non-tectonic causes; Earthquakes and plate boundaries; seismic belts of the world; Seismic waves - body waves and surface waves; Seismograph and seismogram; Earthquake magnitude and intensity - Richter and Mercalli scales; Effects of earthquakes. Geological hazards and disaster management: Basic concepts in disaster management- hazards and disasters, risk, vulnerability, and capacity; Phases of disaster management cycle - preparedness, response, recovery and mitigation; prediction and warning; Mitigation and management of earthquake damages and tsunami hazards; Types and effects of volcanoes; mitigation of volcanic disasters; Causes and mitigation of flood hazards; engineering and regulatory approaches of flood mitigation. Geology and environment: Significance of environmental geology; interaction among the Earth's sub-systems; Impacts of mining and quarrying on lithosphere, hydrosphere, atmosphere and biosphere; Environmental problems associated with sand mining; Sources and dangers of groundwater pollution; Saline water intrusion in coastal areas; Greenhouse effect and global warming; Sustainable development and conservation of natural resources; Causes and mitigation of landslides; Causes and mitigation of coastal erosion hard and soft engineering schemes.

Reference Books:

1. Petrology: Igneous, Sedimentary, and Metamorphic (2006) Harvey Blatt, Robert Tracy, Brent Owens: W. H. Freeman Publications.
2. Igneous and Metamorphic Petrology (2013) Myron G. Best John Wiley & Sons
3. Principles of igneous and metamorphic petrology (2009) Anthony R, Philpotts, Jay Ague: Cambridge University
4. Principles of Petrology (1973) Tyrrell, G. W.: Bi Publications Pvt. Ltd.
5. Genesis and the origin of coal and oil (1996) Trevor Major: Appologetics
6. Economic Geology-Principles and Practice (2011) Walter L Pohl: Wiley
7. Introduction to ore forming processes (2013) Laurence Robb John: Wiley and sons
8. India's Mineral Resources (1979) Krishnaswamy: Oxford and IBH Publishing Co.
9. Structural Geology (1977) Marland P Billings: Prentice Hall
10. A manual of problems in Structural Geology (2009) Gokhale N. W.: CBS.
11. Fundamentals of Structural Geology (2005) David D Pollard, Raymond C Fletcher: Cambridge University Press
12. Planet Earth, Cosmology, Geology and Evolution of Life and Environment (1992) Emiliani C.: Cambridge University Press
13. Principles of Geology (1978) Arthur Holmes: ELBS.
14. Principles of Stratigraphy (1990) Lemon R Y: Merrill Publishing Co.
15. Principles of Paleontology (2008) Michael Fote: Arnold I Miller-W H Freeman
16. Invertebrate Palaeontology (2004) Henry Wood: CBS Publishers and Distributors Pvt. Ltd.
17. Earthquakes (2006) Bruce. A: Bolt Mac Millan Edn. - Centinnial Update
18. Environmental Geology (2010) Edward A Keller: Prentice Hall 9th Edition
19. Environmental Geology an Earth Systems approach (2006) Dorothy Merritts: Fraklin and Marshall Mac Millan Edn 2nd Edition