

ANDHRA PRADESH
RECRUITMENT OF ASSISTANT PROFESSORS IN THE UNIVERSITY
SYLLABUS FOR THE SCREENING TEST

EARTH, ATMOSPHERE AND OCEAN SCIENCES
SUBJECT CODE – 45

1. The Earth and the Solar System:

Milky Way and the solar system. Modern theories on the origin of the Earth and other planetary bodies. Earth's orbital parameters, Kepler's laws of planetary motion, Geological Time Scale; Space and time scales of processes in the solid Earth, atmosphere and oceans. Radioactive isotopes and their applications. Meteorites Chemical composition and the Primary differentiation of the earth. Basic principles of stratigraphy. Theories about the origin of life and the nature of fossil record.

Earth's gravity and magnetic fields and its thermal structure: Concept of Geoid and, spheroid; Isostasy.

2. Earth Materials, Surface Features and Processes:

Gross composition and physical properties of important minerals and rocks; properties and processes responsible for mineral concentrations; nature and distribution of rocks and minerals in different units of the earth and different parts of India. Physiography of the Earth; weathering, erosion, transportation and deposition of Earth's material; formation of soil, sediments and sedimentary rocks; energy balance of the Earth's surface processes; physiographic features and river basins in India.

3. Interior of the Earth, Deformation and Tectonics

Basic concepts of seismology and internal structure of the Earth. Physico-chemical and seismic properties of Earth's interior. Concepts of stress and strain. Behaviour of rocks under stress; Folds, joints and faults. Earthquakes – their causes and measurement. Interplate and intraplate seismicity. Paleomagnetism, sea floor spreading and plate tectonics.

4. Oceans and Atmosphere

Hypsography of the continents and ocean floor –continental shelf, slope, rise and abyssal plains. Physical and chemical properties of sea water and their spatial variations. Residence

times of elements in sea water. Ocean currents, waves and tides, important current systems, thermohaline circulation and the oceanic conveyor belt. Major water masses of the world's oceans. Biological productivity in the oceans.

Motion of fluids, waves in atmospheric and oceanic systems. Atmospheric turbulence and boundary layer. Structure and chemical composition of the atmosphere, lapse rate and stability, scale height, geopotential, greenhouse gases and global warming. Cloud formation and precipitation processes, air-sea interactions on different space and time scales. Insolation and heat budget, radiation balance, general circulation of the atmosphere and ocean. Climatic and sea level changes on different time scales. Coupled ocean-atmosphere system, El Niño Southern Oscillation (ENSO). General weather systems of India, - Monsoon system, cyclone and jet stream, Western disturbances and severe local convective systems, distribution of precipitation over India. Marine and atmospheric pollution, ozone depletion.

5. Environmental Earth Sciences

Properties of water; hydrological cycle; water resources and management. Energy resources, uses, degradation, alternatives and management; Ecology and biodiversity. Impact of use of energy and land on the environment. Exploitation and conservation of mineral and other natural resources. Natural hazards. Elements of Remote Sensing.

6. Physical Oceanography:

T-S diagrams; mixing processes in the oceans; characteristics of important water masses.

Wind generated waves in the oceans; their characteristics; shallow and deep water waves. Propagation, refraction, and reflection of waves. Wave spectrum, principles of wave forecasting.

Tide-producing forces and their magnitudes; prediction of tides by the harmonic method; tides and tidal currents in shallow seas, estuaries and rivers. Factors influencing coastal processes; transformation of waves in shallow water; effects of stratification; effect of bottom friction, phenomena of wave reflection, refraction and diffraction; breakers and surf; littoral currents; wave action on sediments – movement to beach material; rip currents; beach stability, ocean beach nourishment; harbour resonance; seiches; tsunamis; interaction of waves and structure.

Estuaries: classification and nomenclature; tides in estuaries; estuarine circulation and mixing; depth – averaged and breadth – averaged models; sedimentation in estuaries; salinity intrusion in estuaries; effect of stratification; coastal pollution; mixing and dispersal of pollutants in estuaries and nearshore areas; coastal zone management.

The global wind system; action of wind on ocean surface; Ekman's theory; Sverdrup, Stommel and Munk's theories; upwelling and sinking with special reference to the Indian ocean. Inertial currents; divergences and convergences; geostrophic motion; barotropic and baroclinic conditions; oceanic eddies, relationship between density, pressure and dynamic topography; relative and slope currents. Wind driven coastal currents; typical scales of motion in the ocean. Characteristics of the global conveyor belt circulation and its causes.

Formation of subtropical gyres; western boundary currents; equatorial current systems; El Nino; monsoonal winds and currents over the North Indian Ocean; Somali current; southern ocean. Upwelling process in the Arabian Sea.

7. Chemical Oceanography:

Composition of seawater – Classification of elements based on their distribution; major and minor elements, their behavior and chemical exchanges across interfaces and residence times in seawater.

Element chemistry in atypical conditions-estuaries, hydrothermal vents, anoxic basins, HNLC waters, sediment pore fluid and anthropogenic inputs.

Chemical and biological interactions – Ionic interactions; biochemical cycling of nutrients, trace metals and organic matter. Air-sea exchange of important biogenic dissolved gases; carbon dioxide-carbonate system; alkalinity and control of pH; biological pump. Factors affecting sedimentary deposits-CaCO₃, Silicate, Manganese nodules, phosphorites and massive single deposits.

8. Geological Oceanography:

Morphologic and tectonic domains of the ocean floor. Structure, composition and mechanism of the formation of oceanic crust. hydrothermal vents-. Ocean margins and their significance. Ocean Circulation, Coriolis effect and Ekman spiral, convergence, divergence and upwelling, El Nino. Indian Ocean Dipole Thermohaline circulation and oceanic conveyor belt. Formation of Bottom waters; major water masses of the world's oceans. Oceanic sediments: Factors controlling the deposition and distribution of oceanic sediments; geochronology of oceanic sediments, diagenetic changes in oxic and anoxic environments. Tectonic evolution of the ocean basins. Mineral resources. Paleoceanography – Approaches to paleoceanographic reconstructions; various proxy indicators for paleoceanographic interpretation. Reconstruction of monsoon variability by using marine proxy records Opening and closing of ocean gateways

and their effect on circulation and climate during the Cenozoic. Sea level processes and Sea level changes. Methods of paleo Sea Surface temperature. Quantifications.

9. Biological Oceanography:

Classification of the marine environment and marine organisms.

Physio-chemical factors affecting marine life – light, temperature, salinity, pressure, nutrients, dissolved gases; adaptation and biological processes.

Primary and secondary production; factors controlling phytoplankton and zooplankton abundance and diversity; nekton and fisheries oceanography; benthic organisms; coastal marine communities and community ecology – estuaries, coral reefs and mangrove communities, deep-sea ecology including hydrothermal vent communities.

Energy flow and mineral cycling – energy transfer and transfer efficiencies through different trophic levels; food webs including the microbial loop.

Human impacts on marine communities; impacts of climate change on marine biodiversity.

Impact of pollution on marine environments including fisheries.