

**University Centre for Earth & Space Sciences
University of Hyderabad**

**Ph D in Earth & Space Sciences
Course Work Structure – Subjects Offered**

Course No.	Course	Lecture (hrs)	Credits
ES 801	Earth System Sciences	40	4
ES 805	Research Methodology	30	3
ES 806	Mathematics for Earth Sciences	40	4
ES 807	Interdisciplinary Course	30	3
AP 811 - 830	Special Paper on a Specified Research Topic	25	2
TOTAL		165	16

PhD Course Syllabus

UNIVERSITY CORE COURSE FOR RESEARCH SCHOLARS

ES 801 - Earth System Sciences (40 hours-4 credits)

Unit 1

Geology

Major minerals and rock types, rock-forming processes, and time scales; Crustal processes and planetary evolution, geodynamics & global plate tectonics, Geomorphic processes and hypothesis, Landscape evolution in response to climatic and tectonic forcing, geographic information systems (GIS) and remote sensing analysis, Dynamics of crust and mantle, chemical composition of igneous rocks; modern sedimentary environments, sedimentary basins, Evolution of sedimentary processes through geologic time, mechanics of rock deformation, structural geology and tectonics.

Unit 2

Geophysics

Solar system, meteorites, Nature of the magnetic and gravity fields of the Earth. Density, porosity, magnetic susceptibility. Gravity meters and magnetometers. Theory and applications of gravity and magnetic methods of geophysical exploration, Isostasy, origin of the Earth's magnetic field, magnetic reversals, Geomagnetism, principles of paleomagnetism, Electromagnetic, resistivity, induced polarization, and self-potential methods applied to problems in the search for metallic mineral deposits. Elasticity, Seismic waves, refraction and reflection seismology, seismic processes; Earthquakes: cause, mechanism; heat flow, Thermal energy at plate boundaries and hot-spots, Mantle convection; Theory and systematics of radioactive decay; Occurrence, characteristics, movement, quality, development, and contamination of groundwater in the Earth's crust.

Unit 3

Atmospheric Sciences

Composition and structure of the atmosphere, solar and terrestrial radiation, atmospheric dynamics, weather systems, atmospheric boundary layer, and climate dynamics; clouds and aerosols, precipitation, global patterns of atmospheric winds; Linear theory of waves in rotating and stratified media. Geostrophic adjustment and model initialization.

Unit 4

Ocean Sciences

Ocean Circulation-Recent observations of mesoscale and large-scale ocean circulation. Inverse methods and their application to tracer distributions and deep ocean circulation. Review of modern theoretical developments such as geostrophic turbulence, homogenization of potential vorticity, ventilated thermoclines, wind and buoyancy driven ocean circulation models, and coupled ice-ocean circulation models; Oceanic Remote Sensing-Principles of radiative transfer applied to observing the oceans by satellite, radar, and other methods of remote sensing. Applications to cloud physics and climate research, tides and the rotation of the Earth.

ES 805 - Research Methodology (30 hours-3 credits)

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UNIT 1

Introduction to Research Methods

History, methodology and philosophy of Science; Evolutionary Epistemology, Scientific Methods, Hypotheses Generation and Evaluation, Code of Research Ethics, Definition and Objectives of Research, Various Steps in Scientific Research, Types of Research; Research Purposes - Research Design - Survey Research - Case Study Research.

UNIT 2

Data Collection and Sampling Design

Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire- Survey and Experiments – Design of Survey and Experiments - Sampling Merits and Demerits - Control Observations - Procedures - Sampling Errors.

UNIT 3

Basic Statistical Methods and Modeling

Basic statistical methods, Probability Distributions – Binomial, Poisson, Gaussian -, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Curve fitting, Regression analysis, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT 4

Computers and Computational methods

Concepts, scope of computers and computational techniques, simple programmes, languages, elementary numerical methods, fractals and their application, neural networks, fuzzy systems.

UNIT 5

Research Reports

Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report/ paper.

Text Books

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006.

Reference Books

1. Richard I Levin and David S. Rubin, Statistics for Management, 7/e. Pearson Education, 2005.

2. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.

3. U.K. Srivastava, G.V. Shenoy and S.C. Sharma – Quantitative Techniques for managerial decisions, New Age International, Mumbai, 2005.

4. William G. Zikmund, Business Research Methods, Thomson, 2006.

5. D.M. Pestonjee, (Ed.) Second Handbook of Psychological and Social Instruments, Concept Publishing, New Delhi, 2005.

ES 806 - Mathematics for Earth Sciences (40 hours - 4 credits)

Elements of Probability Theory: Basic axioms; random variable; moments; cumulants; Moment generating function; Characteristic function; Chebyshev inequality; law of large numbers; Central Limit theorem (CLT); illustration of CLT; basic idea of a stochastic process; Markov Chain: Basics; balance and detailed balance; convergence Markov chain to equilibrium ensemble; introduction to Markov Chain Monte Carlo methods; Matrices- rank of matrix, eigen vectors and eigen values of matrix, diagonalization of matrix; Bayesian statistics; stationary and nonstationarity.