THEORY PAPER – A3

Programme/Class: **B.Sc.**	Year: **Second**	Semester: **Third**
Subject: **EARTH SCIENCE**		
Course Code : **DSC : ERS-A3**	Course Title: **Title: Principles of Stratigraphy & Palaeontology**	
Credits : **4**		

Course outcomes:
After completing the course, the student will be able to

- Understand fossils, types, fossilization process and modes of preservation, economically important fossils, geotourism related fossils. .
- Understanding the origin and evolution of life on the earth.
- Learn rich mineral deposits like petroleum, coal, and other minerals associated with fossils.
- Understanding the paleoclimate and Paleoenvironment

Unit I	**Principles of Stratigraphy**: Concepts in stratigraphy: Basic principles and definitions, Concept of facies, Walther's Law of facies succession. Stratigraphic classification and code of Stratigraphic nomenclature, Stratigraphic correlation. Brief description of principal stratigraphic units: Lithostratigraphy, Biostratigraphy, Chronostratigraphy. Standard Geological time scale.
Unit 2	**Paleontology**: Introduction to palaeontology. Definition and classification of fossils. Types of fossils and fossilization- Modes of Preservation- Fossils of soft parts, fossils of hard parts (unaltered hard parts, altered hard parts (Molds & Casts, Petrifaction: Permineralization & Replacement, and Carbonisation) and indirect fossils (Imprints, Traces of Biological Activity: Tracks, Trails and Burrows -Ichnofossils:). Significance of fossils. General classification, morphological characters, distribution and geological history of Following Invertebrate Fossils: Coelenterata, Graptolites, Brachiopods, Lamellibranchia, Cephalopods, Echinodermata, Arthropoda. Classification of Microfossils, Morphology, classification and evolution of foraminifera. Brief study of vertebrate life through ages. Plant fossils through ages. Gondwana flora and their significance.
UNIT 3	**Geology of India** **Physiographic divisions of India**: Brief introduction to the physiographic and tectonic subdivisions of India **Archaean and Proterozoic** Formations of Peninsular India – distribution and classification with reference to Karnataka. Sargur Group, Dharwar Super Group, Peninsular Gneiss. **Proterozoic**: distribution, classification and economic importance of Cuddapah and Kaladgi, Vindhyan, Bhima and Kurnool Groups. **Paleozoic Group**: Paleozoic rocks of the Spiti.
UNIT 4	**Mesozoic:** (i)Triassic successions of Spiti, (ii). Jurassic of Kutch, (iii). Cretaceous successions of Cauvery basins

	Cenozoic stratigraphy of India: (i). Kutch basin, (ii). Siwalik successions, (iii). Assam, Andaman and Arakan basins. **Volcanic provinces of India :** Deccan traps: Distribution, lithology and biostratigraphy, classification, intertrappeans, intratrappeans, infratrappeans, Bhag beds and lamenta beds, age of Deccan traps, economic importance of Deccan traps. Rajmahal, Sylhet Trap Siwaliks – lithology, distributions, classification, life and age. **Stratigraphic boundaries:** Important Stratigraphic boundaries in India - a. Precambrian-Cambrian boundary, b. Permian-Triassic boundary, and c. Cretaceous-Tertiary boundary.

PRACTICALS: P3

Programme/Class: **B.Sc.,**	Year: **Second**	Semester: **Third**
Subject: **EARTH SCIENCE**		
Course Code: DSC -ERS –**P3**	Course Title: **P3 Practicals – Stratigraphy & Palaeontology**	
Credits: 2		Core: Compulsory
Max. Marks: 35+15 =50		Min. Passing Marks: as per rules
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:0-0-**2**		

Topics		
1	Preparation and study of stratigraphic maps.	3 Practicals
2	Study of fossils showing various modes of preservation– Molds & Casts, Petrifaction: Permineralization & Replacement, and Carbonisation, Imprints.	1 Practical
3	Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils : Graptolites- Monograptus, Diplograptus	1 Practical
4	Brachiopoda- Terebratulata, Productus, Lingula, Orthis, Atria, Spirifer, Rhynchonella	2 Practical
5	Lamellibranchia- Lima, Trigonia, Pectin, Gryphaea, Trigonia, Venus, Exogyra, Alectryonia.	2 Practicals
6	Cephalopods- Ammonite, Orthoceras, Nautilus, Ceratite, Goniatite, Accanthoceras, Belemnites. Suture lines in Ammonites.	2 Practical
7	Echinodermata- Clypeaster, Clypeolampus, Breynia Cidaris, Micrastar, Hemiaster, Holaster, Stigmatopygus, Schizaster.	2 Practical
8	Trilobites -Calamine, Dalmanite, Paradoxide, Phacops	2 Practicals
9	Plant fossils- Lepidodendron, Calamites, Sigilaria, Glossopteris, Gangamopteris, Neuropteris, Ptilophyllum, Alethopteris, Pecopteris, Sphenopteris.	3 Practicals

Paper A4 : Theory Paper - Structural Geology and Hydrogeology

Programme/Class: **B.Sc.**	Year: **Second**	Semester:**Fourth**
Subject: **EARTH SCIENCE**		
Course Code : **DSC : ERS-A4**	Course Title: **Structural Geology and Hydrogeology**	
Credits : **4**		

Course outcome:
After completing the course, the student will be able to

- Students will understand the natural structures and rock mechanics.
- It helps to understand various primary and secondary structures occurring in rocks.
- Students will know about the water cycle, ground water related issues, water conservation, estimation of ground water and also quality.

Structural Geology

Unit – 1 :

Introduction. Structural Forms of Rocks: Primary Structural Forms & Secondary Structural Forms. Concept of brittle and ductile deformation. Forces – compression, tension, torsion and shear.

Primary structural forms – Sedimentary and Igneous Rocks. Lineation, Foliation and Unconformity. Description and origin of foliations: axial plane cleavage and its tectonic significance. Description and origin of lineation and relationship with the major structures. Unconformity types – para, dis, non, angular and regional unconformities.

Unit – 2 :

Secondary structural forms:

A. Cohesive Dislocations – Distortion, bending and Folds.

Folds: Definitions - parts of folds, axis, axial planes, limb, plunge. Crest and troughs. Mechanics of folding: Buckling, Bending, Flexural slip and flow folding. Types of folds- symmetrical and asymmetrical-anticline, syncline, anticlinorium, synclinorium, overturned fold, recumbent fold. isoclinal, chevron, fan folds, monocline and drag folds. Denudational structures - Outlier and inlier.

B. Disruptive Dislocations – Joints and Faults.

Joints: Definition, Dip, Strike. Joint plane, block Joint, Joint set, Joint system.

Classification – I. Geometrical: Dip, Strike, Oblique and bedding joints

II. Genetic – columnar, mural sheet joints, Master joints. Importance of joints.

Fractures and Faults: Definition - Elements of fault, Fault planes, Dip, Strike, Hade, Heave and Throw. Hanging and footwalls.

Unit – 3:

Classification –

I. Geometrical: a) Based on attitude of faults as compared to the adjacent beds. Dip, Strike, Diagonal and Bedding faults.

b) Based on Apparent movement; normal and reverse faults.

II. Genetic: Thrust faults, over thrust, and under thrust. Gravity faults - Step fault, Ridge fault. trough faults. Criteria for recognition of faults in the field.

References Books:

1. Basic Methods of Structural Geology (**Pearson Paper Back Edition) By Marshak Stephen and Mitra Gautum. (2017).**
2. Structural Geology, By Haakon Fassen, (2016).
3. Structural Geology – Mechanics of Deforming Metamorphic Rocks, By Hobbs. (2015).
4. Structural Geology of Rocks and Regions, By George H. Davis, Stephen J. Ronalds, Charles F. Kluth. (2022).

Hydrogeology

Unit 1:

Introduction and basic concepts. Scope of hydrogeology and its societal relevance Hydrologic cycle. Precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water. Rock properties affecting groundwater, Vertical distribution of subsurface types of aquifer, aquifer parameters, anisotropy and heterogeneity of aquifers.

Groundwater flow Darcy's law and its validity intrinsic permeability and hydraulic conductivity, Groundwater flow rates and flow direction, Laminar and turbulent groundwater flow.

Unit 2:

Well hydraulics and Groundwater exploration, Basic Concepts (Drawdown, specific capacity) Elementary concepts related to equilibrium and Non-equilibrium conditions for water flow to a well in confined and unconfined aquifers. Surface-based groundwater exploration methods, Introduction to subsurface borehole logging methods.

Unit 3:

Groundwater chemistry: Physical and chemical properties of water and water quality, Introduction to methods of interpreting groundwater quality data using standard graphical plots, Sea water intrusion in coastal aquifers.

Groundwater management, Surface and subsurface water interaction, Groundwater level

fluctuations, Basic concepts of water balance studies, issues related to groundwater resources development and management, Rainwater harvesting and artificial recharge of groundwater.

Reference Books:

1. Todd, D. K. 2006. Groundwater Hydrology, 2nd Ed., John Wiley & Sons, N.Y.
2. Davis, S.N., and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
3. Karanth K.R., 1987, Groundwater: Assessment, Development and Management, Tata McGraw Hill Pub. Co. Ltd.

PRACTICALS: P4

Programme/Class: **B.Sc.,**	Year: **Second**	Semester: **Fourth**
Subject: **EARTH SCIENCE**		
Course Code: DSC -ERS –**P4**	Course Title: **P4 Practicals** – **Water Analysis, Surveying and Thin Section Making**	
Credits: 2		Core: Compulsory
Max. Marks: 35+15 =50		Min. Passing Marks: as per rules
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:0-0-**2**		
Topics		

Practicals :

Water Analysis

Collection and preservation of water samples from : open well, tap, bore well, river, water treatment plants, waste water treatment plants and proper labeling of samples.
Selection of parameters to be determined : *pH*, Electrical Conductivity, and Hardness of water.
Estimation of Ca, Mg, Carbonates & Bicarbonates, Chemical Oxygen Deman (COD), Biological Oxygen Demand (BOD).
Water quality analysis by Most Probable Number (MPN) test.
Identification of fresh water algae and protozoa using Microscopic methods.

Surveying

Introduction, Definitions, Categories of Survey: Plane survey, Geodetic survey
Types of Survey: Aerial survey, Boundary survey, Control survey, Engineering survey, Topographic survey, Hydrographic survey, Mine survey, construction survey, Route survey, Property survey
Phases of Surveyor: Decision making, field work and data collection, computing and data analysis, Mapping or data representation, stakeout
Methods of Surveying: Chain survey, Plane table survey, Compass survey, Dumpy level survey, Theodolite survey, GPS survey and Total station survey

Thin Section Making :

An introduction of the Precision thin section cutting and grinding machine. Cutting disc (diamond cut-off wheels), Grinding wheel (Dıamond cup grinding wheel), Standard slides plates and cover glass. Thin section polishing and lapping Machine. Silicon Carbide (Carborundum) powder, Epoxy glue or Canada balsam.
Selection of correct procedure for thin sections making depending upon the type of rocks.
Preparation of ore samples for microscopic studies.
Different types of microscopes used in studying thin sections.

Reference Books:

1. Standard Methods for Examination of water & waste wate APHA- AWWA- WPCE
2. Manual of water & waste water analysis, NEERI, Nagpur.
3. Text book of water and waste water engineering by H. K. Hussen.
4. Water supply & sanitary engineering by Birdie.
5. Practical Methods in Ecology & Environmental Science, By R.K. Trivedi, P.K. Goel,

C.L. Trisal
6. Petrography Laboratory Manual : Handspecimen and Think Section Petrography, By Loren A. Raymond, Publishers: GEOSI (2009).
7. Geology: A Practical Introduction for Surveyors, By Gareth W. Evans, (2004).
8. Engineering Geology Practicals, By M.T Maruthesha Reddy, (2018).
9. Elementary Surveying: An Introduction to Geomatics, By Paul R. Wolf and Charles D. Ghilani.

Programme/Class: **B.Sc.**	Year: **Second**	Semester:**Third**
Subject: **EARTH SCIENCE**		
Course Code : **DSE : ERS- OE-3**	Course Title: **Dimensional Stone Technology**	
Course outcomes: After completing the course, the student will be able to understand the importance of Ornamental rocks and their reserves. Basics of Quarrying techniques, commercial values, cutting and polishing, and marketing of the ornamental stones. Also some knowledge on the environmental impacts of stone industry.		
Credits: **3** Model : **L + T + P**	Core Subject: **DSE**	

Unit - 1

Introduction: General, legal and Leasing Policy, Exploration of Resources, Estimation of Reserves, Classification of dimensional stone based on Grade, hardness and quality factors, Quarrying Techniques, Processing Units, commercial values, Marketing, etc.

Geology and Exploration: General, Dimensional Stone Reserves in India, Geology and Geographical distribution of Marble, Granite, Sandstone, Limestone, Slate Deposits, soapstone, dolerite, basalt, laterite with special reference to Karnataka. Prospecting and exploration of dimensional stone deposits, Reserve Estimation, Evaluation parameters. **Characterization of Dimensional Stone**: Introduction, Petrography Examination, chemical and mineralogical composition, Physico-mechanical Properties,

Unit – 2

Mining of Dimensional Stone: General, Stages-Overburden removal, primary cutting, manual operation, semi-mechanized operation-line drilling machines. Mechanized operations-Plane cutting, water jet cutting, splitting method, Hydraulic splitting, Conventional Mining of Limestone (Kotah stone), Sandstone, Granite and Marble. **Specification and tests**-Indian standard BIS and International Market ASTM .

Unit – 3

Processing: General, Flow chart of Processing; Dressing, Cutting/Sawing, Surface Grinding and Polishing/Flaming, Edging/Trimming/Grooving, Gang Saw, Circular Saw, Various types of Polishing Machines. **Abrasives:** Types, Use and Selection, Shaping. **Dimensional Stones**:

Uses, Marketing and Environmental impacts of Stone Industry.

Reference Books:

1. Dimensional stone technology by S.S Rathore , Bharadwaj G.S, Jain.S. C himanshu publ. New Delhi
2. Recent development in machinery and equipment for dimensional stone mining- S.S Rathore,Gupta.Y.C , Fermor R.L
3. Text book of Geology-P.K.Mukherjee
4. Indian Mineral Resources- Krishnaswamy
5. Geology of India- R.Vaidyanathan & M.Ramakrishnan

Open Electives Subject
THEORY PAPER – A3

Programme/Class:**B.Sc.**	Year: **Second**	Semester:**Third**
Subject: **EARTH SCIENCE**		
Course Code : **DSE: OE-3**	Course Title: **MARINE GEOLOGY**	
Credits : **3 L + T + P Model.**		

Course outcomes:
After completing the course, the student will be able to

- Marine resources – Oceans and Seas. Mineral deposits in the deep sea like metals, petroleum, coal, phosphorites, metallic nodules.
- Marine life and their economic importance.

Theory Paper OE-3: Marine Geology

Importance of the course: It is one of the branches of Earth Science. As the oceans cover about 71% of the Earth, study of this subject is important for the exploration of earth to a greater extent as the continental resources are depleting. Therefore, it is a good scope for multidisciplinary students for better understanding of the subject.

Unit 1: Oceanography - Physical properties of sea water, waves, tides and currents, Composition of seawater and processes controlling it. Food-web, primary, secondary and tertiary production. Classification of marine life, planktonic and benthic life in the ocean. **14 hrs.**

Unit 2: Geological oceanography: Morphology of Ocean floor, Origin and evolution of the ocean basins. Continental drift, Sea-floor spreading and plate tectonics. **14 hrs.**

Unit 3: Marine mineral resources: Distribution and classification of minerals of economic importance in different oceanographic settings: Seawater as sources of elements/minerals. Placer and heavy mineral deposits, petroleum and coal, phosphorites, gas hydrates, poly-metallic nodules, hydrothermal and metalliferous sediments. **12 hrs.**

List of Reference:

1. Alan Strahler (2016) Introducing Physical Geography, 6th Edition, Wiley.
2. Miller, C.B. (2004) Biological Oceanography. Blackwell Publishers. 416p.
3. Paul R. Pinet (1992) Oceanography: An introduction to the Planet Oceanus, West Publ., Co.571p.

4. Thruman, H. V. (1994) Introductory Oceanography. 7th Ed. McMillan Pub., Co.
5. George Karleskint, Richard Turner, James Small, (2012) Introduction to Marine Biology Publisher: Brooks Cole, 512p.
6. Fasham, Michael J.R. (2003) Ocean Biogeochemistry. The Role of the Ocean Carbon Cycle in Global Change Series.
7. Komar, P. D., (1976) Beach Processes and Sedimentation, Prentice-Hall. 429p.
8. Reddy M.P.M. (2001) Descriptive Physical Oceanography, AA Balkema Press. 440p.

Programme/Class: **B.Sc.**	Year: **Second**	Semester:**Third**
Subject: **EARTH SCIENCE**		
Course Code : **DSE : ERS- OE-3**	Course Title: **Climatology**	
Course outcomes: **Skills, employability and entrepreneurship:** The above subject is very relevant to the current processes operating on the Earth System that has implications on the society. In India, this subject is quite rarely studied at graduate level, quite often included in M.Sc./P.G. courses such as Meteorology, Agriculture, Geography, Oceanography, and at M.Tech. courses in Climatology/Meteorology and Atmospheric Science. Since weather is highly dynamic, it requires skill's to understand to a maximum extent from the multidisciplinary perspectives. The main purpose of this course is to create interest among young and talented students from multidiscipline. This study is also useful for predicting the extreme variability of weather including what has happened in the history of the Earth. Students pass out from this subject have opportunities for employment and also study advance courses offered in different CSIR, DST, R and D labs., and private organizations.		
Credits: **3** MODEL : **L + T + P**	Core Subject: **DSE**	

Theory Paper OE-3 : Climatology

Unit 1	**Meteorology** Elements of meteorology and their significance. Temperature, atmospheric pressure and air masses, wind, humidity, clouds precipitation (rainfall). Earth's radiation balance and human interference: Meteorological hazards: floods, drought, famine, cyclones, cloud burst, thunder storms, dust storms and hail stones. General weather system of India. Monsoons, their seasonality, onset and withdrawal, causative factors and trends. A brief introduction to Satellite Meteorology and its applications.	14 hrs
Unit 2	**Climatology** Principles of climatology and differences between meteorology and climatology. Climate of the globe and its classification. Climate Change: short-term and long-term climate cycles. Classification of continental and oceanic climates: Greeks, Koppen's and Thornthwaite's schemes of classification.	14 hrs
Unit 3	**Paleoclimatology:** Tracers or proxies for understanding the long-term paleoclimate. Archives of paleoclimate: ice cores, tree rings, lake and marine sediments, speleothem/cave deposits. Principles of General Circulation and Climate Modelling.	12 hrs

List of References

1) Ahrens, C.D. and Henson, R. (2017) Meteorology today: an introduction to weather, climate, and the environment. 12th Ed**.** www.cengage.com/highered, **www.cengagebrain.com**.
2) Bryant, E. (1997) Climate Processes and Change Cambridge Univ. Press. Cambridge.
3) Donn, W.L. (1975) Meteorology - - McGraw-Hill Book Co., New York.
4) Holton, J. R. (1992) An introduction to Dynamic Meteorology, III Ed, Academic Press, London.
5) Kelkar, R. R. (2017) Satellite Meteorology, Second Edition, CRC Press, Florida.
6) Lutgens, F., Tarbuck, E. and Herman, R. (2018) Atmosphere: An Introduction to Meteorology 14th Ed., Pearson 0135213134 / 9780135213131 Pearson.
7) Pick W.P. (2017) A Short Course in Elementary Meteorology. Andesite Press (22 August 2017).
8) Raymond S.B. Reconstructing Climates of the Quaternary. 3rd Edn, Academic Press, New York.

Programme/Class: **B.Sc.**	Year: **Second**	Semester:**Third**
Subject: **EARTH SCIENCE**		
Course Code : **DSE : ERS- OE-3**	Course Title: **Watershed Management**	
Course outcomes: After completing the course, the student will be able to understand the importance of water resources both – surface and subsurface water, water harvesting, water conservation, watershed planning and management. It also helps to understand the role of remote sensing, water law and NGOs.		
Credits: **3**	Core Subject: **DSE**	

Unit-1:

Introduction, Watershed – definition, concept, objectives, Land capability classification, priority watersheds, land resource regions in India.

Watershed Planning – Principles, collection of data, present land use, Preparation of watershed development plan, Estimation of costs and benefits, Financial plan, selection of implementation agency, Monitoring and evaluation system.

Unit-II:

Watershed management: Participatory watershed Management, run off management, factors affecting runoff, Temporary & Permanent gully control measures, Water conservation practices in irrigated lands, Soil and moisture conservation practices in dry lands.

Water conservation practices: *In-situ & Ex-situ* moisture conservation principle and practices, Afforestation principle, Micro catchment water harvesting, Ground water recharge, percolation ponds, Water harvesting, Farm pond, Supplemental irrigation, Evaporation suppression, Seepage reduction.

Unit-II:

Watershed Development Programme: River Valley Project (RVP), Hill Area Development Programme (HADP). National Watershed Development Programme for Rainfed Agriculture (NWDPRA), Other similar projects operated in India. Govt. of India guidelines on watershed development programme, Watershed based rural development, Infrastructure development, Use of Aerial photography and Remote sensing in watershed management. Role of NGOs in watershed development.

Reference Books:

1. Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.

2. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.

3. Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.

4. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
5 Tripathi R.P. and H.P.Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi
6. Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
7. Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996

Programme/Class: **B.Sc.**	Year: **Second**	Semester: **FOURTH**
Subject: EARTH SCIENCE		
Course Code : **DSE : ERS- OE-4**	Course Title: **Geology and Society**	
Credits : 3. Model: L + T + P		

Course outcomes:

The challenges and opportunities posed by the climate change, resource demands and conflicts, and natural disasters (due to man-made structures as well as natural climate change) point to the importance of studying transdisciplinary nature of the earth processes and their implications to our society. This interdisciplinary nature of Earth Science draws a special attention from the students with other branches of science. From this interdisciplinary optional course on Earth and Social Science, students gain an understanding of natural processes and the impact the distribution and use of natural resources such as water, fossil fuels, and critical minerals for economic growth. It also facilitates the understanding natural hazards such as climate change, landslides, tsunami induced coastal erosions, thermal disturbances in sea water & sea food, and earthquakes.

Unit – 1 :

Geological History of mineral evolution; Critical minerals for economic growth; rare earth elements and their uses in modern technology for low carbon economic growth.

Water-Future: ground water exploration and exploitation, recycling water and pollution monitoring and water management. Desalination of coastal region water to improve the water quality. Understanding of hydrogeology and environmental conditions for water management.

Unit – 2 :

Engineering geology for construction of earthquake resilience infrastructure for public; micro-zonation studies of seismic hazards analyses of smart cities , dams and nuclear power stations.

Unit – 3 :

Understanding the basics of past climate change through field work near ancient stalagmites bearing caves to provide basic parameters for future earth. Thermodynamic modelling of carbon capture and sequestration using naturally occurring minerals. Modelling of probable risks of natural hazard and climate change with precise uncertainties.

Programme/Class: **B.Sc.**	Year: **Second**	Semester: **FOURTH**
Subject: EARTH SCIENCE		
Course Code : **DSE : ERS- OE-4**	Course Title: **Geophysical Exploration**	
Credits : 3. Model: L + T + P		

Course outcomes:

- To study the physical properties of the Earth and application of physics in Geoscience.
- To understand subsurface features and structures for better understanding of subsurface of the Earth.
- To understand the various geophysical techniques and their field setup.
- To understand the geophysical data processing and interpretation

OE-4 Theory Paper : Geophysical Exploration

Unit-1: Introduction

Physical properties of the Earth, Scope of exploration geophysics, Geophysical survey methods, Uses of geophysical Surveys, Geophysical surveying applications

Unit-2: Electrical and Electromagnetic Methods

Electrical methods: Introduction, Electrical methods – Self-Potential, Induced Polarization, Electromagnetic and Resistivity methods, Methods of electrode arrangement, Field methods, Data Interpretation and Application, *Electromagnetic methods:* Principle, Field procedure, Magnetometers, Interpretation of magnetic data, Size and shape of bodies, Correction of magnetic data, Applications.

Unit-3: Gravity and Seismic Methods

Gravity Methods: Principle, Units of gravity, Measurement of gravity, Gravity anomalies, Field methods, Gravimeters, Corrections, Interpretation of gravity data, Determination of shape and depth of ore bodies, Corrections and applications. *Seismic Methods*: Seismic waves, Travel velocity in various geological formations, Principles offshore and onshore field operation, refraction and reflection survey, Correction of seismic data, Methods of interpretation, Types of seismic shooting and Application

Unit-4: Airborne and Subsurface Geophysical methods

Airborne Geophysical methods: Scope of Airborne Investigations, Airborne Geophysical Measures, *Subsurface Geophysical methods:* Introduction to drilling and logging, Principles of well logging, Formation evaluation, Resistivity logging, Self-potential logging, Sonic logging and Application.

Reference Books:

1. Dobrin, M.B. and C.H. Savit, Introduction to Geophysical Prospecting, 4th Edition, McGraw-Hill, 1988
2. Fowler, C.M.R., The Solid Earth, Cambridge University Press, 1990
3. G. R. Foulger and C. Peirce - Geophysical Methods in Geology
4. Keary, P., M. Brooks and I. Hill, An Introduction to Geophysical Exploration, 3rd edition Blackwell Science, 2002, ISBN0632049294

5. Martin Landrø and Lasse Amundsen - Introduction to Exploration Geophysics with Recent Advances Bivrost 2018. ISBN: 978-82-303-3763-9
6. P. Kearey, M. Brooks and I. An Introduction to Geophysical Exploration, Hill, 3rd edition Blackwell Science, 2002, ISBN0632049294,
7. Parasnis, D.S., Principles of applied geophysics, Chapman & Hall, 1996
8. Reynolds, J.M., An introduction to applied and environmental geophysics, Wiley & Sons Ltd., 1997.
9. Robert H. Griffin - Geophysical exploration for engineering and environmental investigations, Department of the ARMY U.S. Army Corps of Engineers Washington, DC 20314-1000.
10. Telford, W.M., L.P. Geldart, R.E. Sheriff and D.A. Keys, Applied Geophysics, 2nd Edition, Cambridge University Press, 1990

Programme/Class: **B.Sc.**	Year: **Second**	Semester: **FOURTH**
Subject: EARTH SCIENCE		
Course Code : **DSE : ERS- OE-4**	Course Title: **Geostatistics**	
Credits : 3. Model: L + T + P		
Course outcomes: Candidate will be exposed to the basics of geostatistics, which helps in the analysis of survey data, reserves data, and cluster analysis including factor analysis and contouring. Such statistical analysis can be used in mining industries and hydrogeology.		

Geostatistics

1. Mean, median and mode.
2. Quartiles, deciles and percentages.
3. Correlation co-efficient, regression analysis and skewness.
4. Measures of dispersion - Absolute Measures of Dispersion and Relative Measures of Dispersion
   (a) Range method ------R= H-L (H = highest value, L= lowest value)
   (b) Quartile method ---- $Qd = Q_3 - Q_1$
   (c) Semi Inter Quartile----$SIQ = \frac{Q_3 - Q_1}{2}$
   (d) Mean deviation or Average deviation
   (e) Standard deviation or Root mean deviation and Charlier's check
5. Cluster analysis, factor analysis and contouring.
6. Karl Pearson's co-efficient of skewness and kurtosis,
7. Students' T Test.
8. Discriminate and Cluster Analyses - Hierarchical cluster analysis (HCA).
9. Multivariate analysis - Multiple Linear Regression (MLR).
10. Dendrogram.

Reference Books:

1. An Introduction to Applied Geostatistics
   By : Edward H. Isaaks & R. Mohan Srivastava, Publishers: OUP, USA.
2. Geostatistics with Applications in Earth Science
   By D.D. Sarma, Springer Publications 2009.
3. Spatial Statistics and Geostatistics
   By Y. Chen & D.A. Griffith
4. Geostatistics for Beginners
   By Anil Kumar Mehrotra, Publishers: Zorba Books, 2020.
5. Introduction to Geostatistics : Applications in Hydrogeology

By P.K. Kitanidis, Publishers: Cambridge University Press, UK.
6. Introduction to Geostastics
By A. Bardossy

Programme/Class: **B.Sc.**	Year: **Second**	Semester: **FOURTH**
Subject: EARTH SCIENCE		
Course Code : **DSE : ERS- OE-4**	Course Title: **Geotourism**	
Credits : 3. Model: L + T + P		

Course outcomes:

- To understand the beauty and rarity of the geological features, landscapes, mountains, geysers, rock monuments, national parks, Fossils parks, etc.
- To understand the preservation of the geological features and monuments.
- Propagating the importance of these geological features to the common man.

Unit - 1:

Introduction- Geodiversity and rarity of geological features, Geo-conservation, Geo-site, Geo-heritage and Geo-park and their role in geo-tourism development. Concept of National Parks of geological origin. Natural and cultural landscapes**,** A geo-conservation plan for geosites and the development of UNESCO's Global Geopark. Geotourism- impacts and other types of tourism.

Unit - 2:

Geodiversity values and threats**,** Geo-tour guides and basic knowledge of geodiversity. Important Geo-sites of India and in particular Karnataka, Geotourism Development & Sustainable Management, Education on Geosites preservation.

Unit - 3:

Locations of important fossil parks in India - Marine Gondwana Fossil Park, Fossil Wood Parks, Siwalik Fossil Park, Stromatolite Parks, etc. Rock monuments of India - Peninsular Gneiss, Columnar Basalt, Pillow Lava, Pyroclastic Rocks, Nepheline Syenite, Barr Conglomerate, Welded Tuff, Charnockite. Geological Marvels - Lonar Lake, Eddy Current Markings, Natural Arch, Wind erosion structures, Sendra Granite, etc. Other monuments – stratigraphic and economic important locations/ mines. Natural caves and tunnels, Stalactites and Stalagmites.

Reference Books:

1. Gray, M., 2004. Geodiversity: Valuing and conserving abiotic nature. John Wiley & Sons Ltd.
434 p. (or later edition).

2. Dowling, R.K., and Newsome, D., 2006. Geotourism. Elsevier, 260p.

3.Gray, M. (2004) Geodiversity: valuing and conserving abiotic nature; John Wiley & Sons.

4.Henriques, M.H.; dos Reis, R.P.; Brilha, J.; Mota, T. Geo-conservation as an Emerging Geo-science. Geo-heritage 2011, 3, 117–128.

5.IUCN Geo-diversity, World Heritage and IUCN Available online: https://www.iucn.org/theme/world-heritage/our-work/global-world-heritage-projects/geodiversity-world-heritage-and-iucn.

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