



DAVANGERE


UNIVERSITY

**Curriculum Framework for Four-Year Undergraduate
Multidisciplinary Programme (Honours) & Master
Programme in Colleges and Universities of Karnataka State
Under NEP 2020.**

**3rd and 4th Semesters Model
Syllabus for BSc. In
Earth Science**

**Submitted to
Vice Chairman**

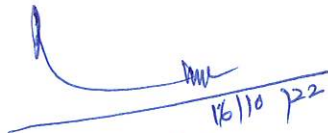
Karnataka State Higher Education Council
30, Prasanna Kumar Block, Bengaluru City University Campus, Bengaluru, Karnataka – 560009


DEAN


Registrar
Davangere University
Shivagangotri, Davangere

**Model Curriculum
of
BSc Honours
in
Earth Science
3rd & 4th Semesters**

Karnataka State Higher Education Council


16/10/22
DEAN

B.Sc., Earth Science (Basic/Hons.) Semester 3

THEORY PAPER – A3

Title of the course:

Course 1: DSC - Principles of Stratigraphy & Paleontology and geology of India

Course 2 : OE – Watershed Management

Course 1: DSC - Principles of Stratigraphy & Paleontology and geology of India		Course 2 : OE – Watershed Management	
Number of Theory Credits	Number of lecture hours / semester	Number of Theory Credits	Number of lecture hours / semester
4	56	3	42

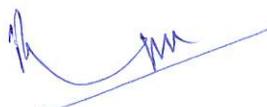
Unit I Principles of Stratigraphy: Concepts in stratigraphy: Basic principles and definitions, Concept of facies, Walther's Law of facies succession. Stratigraphic classification and code of Stratigraphic nomenclature, Stratigraphic correlation. Brief description of principal stratigraphic units: Lithostratigraphy, 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, Petrification: 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.

Mesozoic: (i) Triassic successions of Spiti, (ii). Jurassic of Kutch, (iii). Cretaceous successions of Cauvery basins

UNIT 4 Volcanic provinces of India : Deccan traps: Distribution, lithology and biostratigraphy, classification, intertrappeans, intratrappeans, infratrappeans, Bhag beds and lamanta 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

THIRD SEMESTER B.Sc / B.Sc., HONS. DEGREE PROGRAMME EARTH SCIENCE

DSC/P-3 : PRATICAL -3

LTP/Credits: 2

Teaching Hours / Week: 4

Exam Duration: 4 Hours

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|--|--------------|
| 1. Preparation and study of stratigraphic maps. | 1 Practical |
| 2. Study of fossils showing various modes of preservation–
Molds & Casts, Petrification: 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,
Atrina, Spirifer, Rhynchonella | 1 Practical |
| 5. Lamellibranchia- Lima, Trigonina, Pecten, Gryphaea,
Trigonia, Venus, Exogyra, Alectryonia. | 2 Practicals |
| 6. Cephalopods- Ammonite, Orthoceras, Nautilus, Ceratite,
Goniatite, Accanthoceras, Belemnites. Suture lines in
Ammonites. | 2 Practicals |
| 7. Echinodermata-Clypeaster, Clypeolampus, Breynia Cidaris,
Micraster, Hemiaster, Holaster, Stigmatopygus, Schizaster. | 2 Practicals |
| 8. Trilobites -Calamine, Dalmanite, Paradoxide, Phacops | 1 Practical |
| 9. Plant fossils- Lepidodendron, Calamites, Sigillaria,
Glossopteris, Gangamopteris, Neuropteris, Ptilophyllum,
Alethopteris, Pecopteris, Sphenopteris. | 1 Practical |
| 10. Field visit / Study tour | |

OE 3 - Watershed Management

OE – 3 (3 Credits)

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-III:

Watershed Development Programme: River Valley Project (RVP), Hill Area Development Programme (HADP). National Watershed Development Programme for Rainfed Agriculture (NWDPA), 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. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.
2. Gurmeh Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
3. Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
4. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
5. Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
6. 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi

B.Sc., Earth Science (Basic/Hons.) Semester 4

THEORY PAPER – A4

Title of the course:

Course 1: DSC - Structural Geology and Hydrogeology

Course 2 : OE – Watershed Management

Course 1: DSC Structural Geology and Hydrogeology		Course 2 : OE – Geology and society	
Number of Theory Credits	Number of lecture hours / semester	Number of Theory Credits	Number of lecture hours / semester
4	56	3	42

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.

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 – 2: Classification of Faults–

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.

Hydrogeology:

Unit – 3 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.

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 4: 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.

Water quality standards: pH, Electrical Conductivity, and Hardness of water.

Ca, Mg, Carbonates & Bicarbonates, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD). Water quality analysis by Most Probable Number (MPN) test.

Reference Books:

1. Basic Methods of Structural Geology (Pearson Paper Back Edition) By Marshak Stephen and Mitra Gautam. (2017).
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.
4. Structural Geology, By Haakon Fossen, (2016).
5. Structural Geology – Mechanics of Deforming Metamorphic Rocks, By Hobbs. (2015).
6. Structural Geology of Rocks and Regions, By George H. Davis, Stephen J. Ronalds, Charles F. Kluth. (2022).
7. Todd, D. K. 2006. Groundwater Hydrology, 2nd Ed., John Wiley & Sons, N.Y

FOURTH SEMESTER B.Sc / B.Sc., HONS. DEGREE PROGRAMME EARTH SCIENCE

DSC/P-3 : PRATICAL -3

LTP/Credits: 2

Teaching Hours / Week: 4

Exam Duration: 4 Hours

Practicals:

Water quality analysis:

1. Collection and preservation of water samples from: open well, tap, bore well, river, watertreatment plants, waste water treatment plants and proper labeling of samples.
2. Determination of : *pH*, Electrical Conductivity, and Hardness of water.
3. Estimation of Ca, Mg, Carbonates & Bicarbonates
4. Identification of fresh water algae and protozoa using Microscopic methods.

Structural geology:

5. Determination of Strike and Dip
6. Determination of thickness of strata
7. Preparation of geological maps.

Surveying:

8. Study of surveying equipments and accessories.
9. Study of Categories of Survey: Plane survey, Geodetic survey
10. Study of types of Survey: Aerial survey, Boundary survey, Control survey,
11. Engineering survey, Topographic survey, Hydrographic survey, Mine survey, construction survey, Route survey, Property survey
12. Study of Phases of Surveyor: Decision making, field work and data collection, computing and dataanalysis, Mapping or data representation, stakeout
13. Study of Methods of Surveying: Chain survey, Plane table survey, Compass survey, Dumpy levelsurvey, Theodolite survey, GPS survey and Total station survey

Thin section making:

14. Study of Precision thin section cutting and grinding machine. Cutting disc (diamond cut-off wheels), grinding wheel (Diamond cup grinding wheel), Standard slidesplates and cover glass.
15. Study of Thin section polishing and lapping Machine.
16. Study of Silicon Carbide (Carborundum) powder, Epoxy glue or Canada balsam.
17. Study of different types of microscopes used in studying thin sections.

18. Study of preparation of crystal samples for microscopic studies.

19. Feld visit / Study tour

Reference Books:

1. Elementary Surveying: An Introduction to Geomatics, By Paul R. Wolf and Charles D. Ghilani
2. Engineering Geology Practicals, By M.T Maruthesha Reddy, (2018).
3. Geology: A Practical Introduction for Surveyors, By Gareth W. Evans, (2004).
4. Manual of water & waste water analysis, NEERI, Nagpur.
5. Petrography Laboratory Manual : Handspecimen and Think Section
Petrography, By Loren A. Raymond, Publishers: GEOSI (2009).
6. Practical Methods in Ecology & Environmental Science, By R.K. Trivedi, P.K. Goel.
7. Standard Methods for Examination of water & waste wate APHA- AWWA- WPCE
8. Text book of water and waste water engineering by H. K. Hussen.
9. Water supply & sanitary engineering by Birdie.C.L. Trisal

OE 4 – Geology and Socieity

OE – 4 (3 Credits)

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.

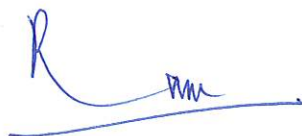
Water-Future: ground water exploration and exploitation, recycling water and pollution monitoring and water management. Desalination of coastal region water to improve the water quality. Understanding of hydrogeology and environmental conditions for water management.

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




Registrar
Davangere University
Shivangotri, Davangere