

Department of Applied Geology School of Engineering & Technology

Curriculum Framework B.Sc. Geology Based on National Education Policy-2020 Date of BoS:12/09/2022



**Doctor Harisingh Gour Vishwavidyalaya, Sagar
(A Central University)
Sagar-Madhya Pradesh 470003**

About the Department

The Department of Geology was started in 1946 to offer B.Sc. and M.Sc. degrees classes under the headship of Professor G. W. Chiplonkar. The Department of Applied Geology started independently in the year 1956 offering three year's post graduate courses leading to M.Tech. degree in Applied, under the headship of Professor W. D. West. After six years both the departments (Pure and Applied Geology) were merged into the Department of Applied Geology. The Department was expanded when it enjoyed the status of a Centre of 'Advanced Study in Geology' from 1964.

The Department has laboratories in the major thrust areas of Metamorphic & Igneous Petrology, Micropaleontology, Ore Microscopy and Economic Geology, Mineralogy, Sedimentology, Photo Geology, and Geochemistry with basic laboratory equipment's required for teaching and research on various aspects in the major thrust area identified under R & D Programme. The students are given field training in geological mapping, mineral exploration, and oil exploration, from three to four weeks in even semesters.

Curriculum Framework based on National Education Policy-2020

NEP-2020 has conceptualized the idea to develop well rounded competent individuals for making the nation a self-reliant and global leader. In the same spirit, we have developed a curriculum frame work to encompass the goals of NEP-2020. To this end, we have incorporated choice of subject/disciplines of study, creating academic pathways having constructive combinations of disciplines for study with multiple entry and exit points as well as focus on **experiential learning** for students by introducing **multidisciplinary and skill enhancement courses** and actual Hand's on training in the recent and trending aspects of the area concern.

Under Graduate Curriculum Framework for Bachelor of Science (B.Sc. - Geology)

1. Name of the Programme: B.Sc. Geology

2. About the Programme: The Department of Applied Geology offering four year's under graduate course (VIII - Semesters) leading to Bachelor of Science.

3. Objectives of the Programme:

- The students are given geological field training for one week in each Semester.
- Geomorphology field training and report writing worth of 02 credits (Ability Enhancement) is a unique feature of the B.Sc. course.
- The scheme of Syllabi of B.Sc. has a Seminar of 02 credits (Skill Enhancement Course) in all the core courses offered to inculcate confidence among the UG students in developing PowerPoint presentation before the board of Coordinators involved in each Semester.
- The Syllabus of I-Semester in B.Sc. includes a Programme of (6 credits; Multi - Disciplinary: Major) to impart training for Toposheet, GPS and Compass Reading is unique for this course.
- The Syllabus of II Semester in B.Sc., includes a Programme of (6 credits under Multi Discipline: Major-3) Rock forming & Gem Minerals.
- Heritage Stone (Building Stones) of B.Sc. III Semester and Mathematical Geology & Elementary Geophysics is a part of the syllabus worth of 6 credits under Multi-Disciplinary: Major.
- Modern tools of teaching: Class room teachings are supported by Modern Tools of teaching such as PowerPoint, Video Lectures etc. Department has one smart classroom.
- Massive Open Online Courses (MOOCs)
- Faculty of Applied Geology Offered 08 MOOCs for SWAYAM platform which are running regularly since November, 2016 onwards. Among them few courses are very popular within and outside India, especially Petrology.

UG-MOOC – Petrology

https://onlinecourses.swayam2.ac.in/cec22_mm01/preview

Course Coordinator - Prof. Harel Thomas

UG-MOOC - Crystallography & Mineralogy

https://onlinecourses.swayam2.ac.in/cec21_ce01/preview

Course Coordinator - Prof. Harel Thomas

UG-MOOC-Geochemistry

Course Coordinator - Prof. Harel Thomas

UG-MOOC - Metamorphic Petrology

Course Coordinator - Prof. Harel Thomas

UG – MOOC - Photogeology & Remote Sensing

https://onlinecourses.swayam2.ac.in/cec21_mm02/preview

Course Coordinator - Prof. R. K. Rawat

UG – MOOC - Hydrogeology

Course Coordinator - Prof. L. P. Chourasia

UG – MOOC - Structure Geology

Course Coordinator - Prof. A. K. Shandilaya

UG – MOOC - Palaeontology & Stratigraphy

Course Coordinator - Dr. G. K. Singh

E-Content for B.Sc Geology Students - 276 Modules

Faculty of Applied Geology (Prof. H.Thomas Coordinator, along with Prof. P.O. Alexander, Prof. L.P. Chourasia, Prof. R.K. Rawat and Dr. G.K. Singh) have contributed for the development of E-content for UG Geology students which are available at CEC-UGC New Delhi web site.

- To emphasize on need-based syllabus to enable the students for economic independence.
- To cater to the educational needs of the society with an inclusive approach.

After completion of the Programme the learner will be able to:

- i. They should be able to join as government officers in State as mining inspector in DGM.
- ii. They should be able to work as consultant Geologist.

4. Programme Learning Outcomes:

The programme learning outcomes are attained by learners through the essential learning's acquired on completion of selected courses of study within a programme. The outcomes and attributes described in qualification descriptors are attained by students through learning acquired on completion of a programme of study.

5. Structure of the Programme:

Curriculum Framework Syllabus – B.Sc. (Geology) 2022-23 L-5 (I & II Semester)

I-Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 I Semester	Discipline Specific: Major	GEO-DSM-111	Geomorphology & Geodynamics	100	4	0	0	4
	Discipline Specific: Major	GEO-DSM-112	Geomorphology Practical	100	0	0	2	2
	Discipline Specific: Major	DSM-113	Other Department	100	6	0	0	6
	Ability Enhancement Course (Either in I or II Sem)	GEO-AEC-111	Geomorphology Field Training and Report Writing (within campus)	100	2	0	0	2
	Skill Enhancement Course (Either in I or II Sem)	GEO-SEC-111	Seminar/ Field Work	100	2	0	0	2
	Value Enhancement Course	VEC-111	Other Department					Qualifying
Total Credits								20

Note: Student can choose either AEC or SEC in one semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 I Semester	Multi-Disciplinary: Major	GEO-MDM-111	Toposheet, GPS and Compass Reading	100	6	0	0	6

II-Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 II Semester	Discipline Specific: Major	GEO-DSM-211	Mineralogy, Mineral Optics & Crystallography	100	4	0	0	4
	Discipline Specific: Major	GEO-DSM-212	Mineralogy, Mineral Optics & Crystallography Practical	100	0	0	2	2
	Discipline Specific: Major	DSM-213	Other Department	100	6	0	0	6
	Ability Enhancement Course (AEC) (Either in I or II Sem)	GEO-AEC-211	Geomorphology Field Training and Report Writing (within campus)	100	2	0	0	2
	Skill Enhancement Course (SEC) (Either in I or II Sem)	GEO-SEC-211	Seminar/ Field Work / Report writing	100	2	0	0	2
	Value Enhancement Course (VEC)	VEC-211	Other Department					Qualifying
Total Credits								20
Exit with Certificate								

*** Note: Student can choose either AEC or SEC in one semester**

***Note: UG-MOOC - Crystallography & Mineralogy offered by the University, Course Coordinator - Prof. H Thomas available on SWAYAM Platform.**

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 II Semester	Multi-Disciplinary: Major	GEO-MDM-211	Rock forming & Gem Minerals	100	6	0	0	6

L-6 III & IV Semester

III-Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-6 III Semester	Discipline Specific: Major	GEO-DSM-311	Igneous, Sedimentary & Metamorphic Petrology	100	4	0	0	4
	Discipline Specific: Major	GEO-DSM-312	Igneous, Sedimentary & Metamorphic Petrology Practical	100	0	0	2	2
	Discipline Specific: Major	DSM-213	Other Department	100	6	0	0	6
	Ability Enhancement Course (AEC) (Either in III or IV Sem)	GEO-AEC-311	Local Field Training and report writing	100	2	0	0	2
	Skill Enhancement Course (SEC) (Either in III or IV Sem)	GEO-SEC-311	Seminar / Field Work	100	2	0	0	2
	Value Enhancement Course (VEC)	VEC-311	Other Department					Qualifying
Total Credits								20

*Note: UG-MOOC – Petrology offered by the University, Course Coordinator Prof. H Thomas available on SWAYAM Platform.

*Note: Note: Student can choose either AEC or SEC in one semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-6 III Semester	Multi-Disciplinary: Major	GEO-MDM-311	Heritage Stone (Building Stones)	100	6	0	0	6

IV Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-6 IV Semester	Discipline Specific: Major	GEO-DSM-411	Structure Geology & Tectonics	100	4	0	0	4
	Discipline Specific: Major	GEO-DSM-412	Structure Geology & Tectonics Practical	100	0	0	2	2
	Discipline Specific: Major	DSM-413	Other Department	100	6	0	0	6
	Ability Enhancement Course (AEC) (Either in III or IV Sem)	GEO-AEC-411	Local Field Training and report writing	100	2	0	0	2
	Skill Enhancement Course (SEC) (Either in III or IV Sem)	GEO-SEC-411	Seminar	100	2	0	0	2
	Value Enhancement Course (VEC)	VEC-411	Other Department					Qualifying
Total Credits								22

Exit With Diploma

Note: UG-MOOC - Structure Geology offered by the University, available on SWAYAM Platform

Note: Note: Student can choose either AEC or SEC in one semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-6 IV Semester	Multi-Disciplinary: Major	GEO-MDM-411	Mathematical Geology & Elementary Geophysics	100	6	0	0	6

L-7 V & VI Semester

V Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-7 V Semester	Discipline Specific: Major	GEO-DSM-511	Palaeontology	100	4	0	0	4
	Discipline Specific: Major	GEO-DSM-512	Palaeontology Practical	100	0	0	2	2
	Discipline Specific: Major	DSM-513	Other Department	100	6	0	0	6
	Ability Enhancement Course (Either in V or VI Sem)	GEO-AEC-511	Seminar / Field Work	100	2	0	0	2
	Skill Enhancement Course (Either in V or VI Sem)	GEO-SEC-511	Photo Geology and Remote Sensing	100	2	0	0	2
	Value Enhancement Course	VEC-511	Other Department					Qualifying
Total Credits								20

*Note: UG-MOOC - Palaeontology offered by the University, Course Coordinator Dr. G.K. Singh, available on SWAYAM Platform.

*Note: UG-MOOC – Photogeology and Remote Sensing offered by the University, Course Coordinator Prof. R.K. Rawat, available on SWAYAM Platform.

* Note: Student can choose either AEC or SEC in one semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-7 V Semester	Multi-Disciplinary: Major	GEO-MDM-511	Environmental Geology	100	6	0	0	6

VI Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-7 VI Semester	Discipline Specific: Major-1	GEO-DSM-611	Indian Stratigraphy	100	6	0	0	6
	Discipline Specific: Major-2	DSM-613	Other Department	100	6	0	0	6
	Multi- Disciplinary: Major-3	GEO-MDM-611	Geochemistry	100	6	0	0	6
	Ability Enhancement Course (Either in V or VI Sem)	GEO-AEC-611	Soil & Water Chemistry	100	2	0	0	2
	Skill Enhancement Course (Either in V or VI Sem)	GEO-SEC-611	Seminar / Field Work	100	2	0	0	2
	Value Enhancement Course	VEC-611	Other Department					Qualifying
Total Credits								22
Exit with Degree								

*Note: UG-MOOC - Stratigraphy offered by the University, Course Coordinator Dr. G.K. Singh, available on SWAYAM Platform.

*Note: UG-MOOC - Geochemistry offered by the University, Course Coordinator Prof. H Thomas, available on SWAYAM Platform.

*Note: Student can choose either AEC or SEC in one semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-7 VI Semester	Multi-Disciplinary: Major	GEO-MDM-611	Environmental Geology	100	6	0	0	6

I-Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 I Semester	Discipline Specific: Major	GEO-DSM-111	Geomorphology & Geodynamics	100	4	0	0	4
	Discipline Specific: Major	GEO-DSM-112	Geomorphology Practical	100	0	0	2	2
	Discipline Specific: Major	DSM-113	Other Department	100	6	0	0	6
	Ability Enhancement Course (Either in I or II Sem)	GEO-AEC-111	Geomorphology Field Training and report writing (within campus)	100	2	0	0	2
	Skill Enhancement Course (Either in I or II Sem)	GEO-SEC-111	Seminar/ Field Work	100	2	0	0	2
	Value Enhancement Course	VEC-111	Other Department					Qualifying
Total Credits								20

Note: Student can choose either AEC or SEC in one semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 I Semester	Multi-Disciplinary: Major	GEO-MDM-111	Toposheet, GPS and Compass Reading	100	6	0	0	6

Discipline Specific: Major
GEO-DSM-111 - Geomorphology & Geodynamics

(Credits 4; 60 Hrs; M.M. 100 = 60 End Sem. + 40 sessional)

Course Coordinator: Prof. R. K. Rawat

Learning Objective of the Course

The course for the geomorphology & Geodynamics is running with a view to provide a glance to different exogenic processes that shape landforms on earth.

Unit - I

Introduction of Geology and its perspectives. Pure and applied branches of geology, scopes and applications. Basic concepts of geomorphology. Definition and scope; geomorphic agents & processes; weathering – their types: erosional processes; soil & their types. **(Lectures 12)**

Unit - II

Geological work of rivers and fluvial landforms. Geological work of glaciers and glacial landforms, geological work of wind and aeolian landforms. Geological work of oceans and coastal landforms Geological work of groundwater; karst topography. Volcanic landforms. Toposheets or topographic maps, representation of landforms by various methods. **(Lectures 12)**

Unit - III

Earth - our solar system - size, shape, mass and density of the earth. Origin of the earth, radioactivity & age of the earth. Interior of the earth - crust, mantle and core. Earthquakes – distribution causes and effects; volcanoes - types and distribution. **(Lectures 12)**

Unit - IV

Midoceanic ridges and trenches. Origin and distribution of Island arcs. Concept of palaeomagnetism & application of palaeomagnetism . Concept and theories of Isostasy; origin of oceans, continents and mountains.. **(Lectures 12)**

Unit - V

Concept of plate tectonics. Continental drift, concept of plate tectonics. Nature and types of plate margins. Evidences of sea floor spreading. **(Lectures 12)**

Expected Learning Outcome

The students get an insight to study the cause, effects and consequences that any geomorphic area shows.

Essential Reading:

- 1- Thornbury W. D., (1958) Principles of Geomorphology John Wiley and Sons.
- 2- Mukherjee P. K., (1991) A Text Book of Geology CBS Publisher and Dist., New Delhi.
- 3- Homes A., (1993) Principle of Physical Geology 4th Ed., Chapman and Hall, London.
- 4- Datta A. K., An introduction to Physical Geology –Dastane Ram chandra and Co. Pune.

Suggested Reading:

1. Chiplonkar G.W. and Powar K.B. (1979) Geological Maps.
2. Lahee, (1961) Field Geology Frederic Henry, Mc-Graw Hill Book Comp., London, N. York.
3. E-content on the website:cec.gov.in

Discipline Specific: Major
GEO-DSM-112- Geomorphology & Geodynamics Practical
(Credits 2; 30 Hrs; M.M. 100 = 60 End Sem. + 40 sessional)
Course Coordinator: Dr. K.K. Prajapati

- Study of physical models showing geomorphic features.
- Configuration and Numbering of topographic maps on various scales.
- Interpretation of various geomorphic landforms and drainage patterns on toposheet.
- Map exercise related to plotting of major mountain ranges, lakes and rivers of India & seismic data on map of India.

Ability Enhancement Course (AEC)
GEO-AEC-111- Geomorphology Field Training and report writing (within campus)
(Credits 2; 30 Hrs; M.M. 100)
Course Coordinator: Prof. S.H. Adil

Learning Objective of the Course

The course for the geomorphology Field Training and report writing (within campus) is running with a view to provide a glance to different exogenic processes that shape landforms on earth.

Unit – I

Maps: Components and classification, application of scales. Topographic Sheets: Scale, symbols and Legends – Types and Categories, Interpretation of contours and Identification of Natural Landscape Elements, Scale Measurements, Slope Calculation. Determination of latitude and longitude from toposheet. Measurement of distance between two Points.

(Lectures 30)**Expected Learning Outcome**

The student gets familiar with the fundamental idea of reading topographical and structural features from the map and basic methods of geomorphological mapping.

Essential Reading

1. Lahee, (1961) Field Geology Frederic Henry, Mc-Graw Hill Book Comp., London, N. York.
2. Kennedy, M., Kopp, S. 2001. Understanding Map Projections, Esri Press.
3. Kimerling, A .J., Buckley, A.R., Muehrcke, P.C., Muehrcke, J. O. 2011. Map Use: Reading, Analysis, Interpretation, 7th ed, Esri Press.
4. Monkhouse, F. J., Wilkinson, H.R. 1971. Maps and Diagrams: Their Compilation and Construction, 3rd ed (2017 reprint), Alphaneumera-Kolkata.
5. Pearson II, F. 1990. Map Projections: Theory and Applications 2nd ed, CRC Press.
6. Robinson, A. H., Morrison, J.L., Phillip, C.M., Kimerling, A.J., Guptill, S.C. 1995. Elements of Cartography, 6th ed, Wiley.
7. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Private Ltd.
8. Vaidyanadhan, R., Subbarao, K.V. 2014. Landforms of India from Topomaps and Images, Geological Society of India.

Skill Enhancement Course (SEC)
GEO-SEC-111- Seminar/ Field Work
(Credits 2; 30 Hrs; M.M. 100)
Course Coordinator: Prof. R. K. Rawat

Seminar will be based on GEO-DSM

Note: Note: Student can choose either AEC or SEC in one semester

Multi - Disciplinary: Major
GEO-MDM-111- Toposheet, GPS and Compass Reading
(Credits 6; 90 Hrs Lab work; M.M. 100 = 60 End Sem. + 40 sessional)
Course Coordinator: Dr. G.K. Singh

Learning Objective of the Course

This course is aimed to provide the basic idea of topographical maps and handling of essential instruments in geological field work.

Unit - I

Maps: Components and classification, application of scales. Topographic Sheets: Scale, symbols and Legends – Types and Categories, Interpretation of contours and Identification of Natural Landscape Elements, Scale Measurements, Slope Calculation. Determination of latitude and longitude from toposheets. Measurement of distance between two Points. **(Lectures 05)**

Unit - II

Study of toposheets to identify different drainage pattern and its illustration. Delineation of drainage basins and identification of stream order in toposheets and their illustration. Identification and representation of different landforms in toposheets. **(Lectures-05)**

Unit - III

Coordinate systems: Polar and rectangular. Grids: Angular and linear systems of measurement. Bearing: Magnetic and true, whole-circle and reduced. Concept of geoid and spheroid with special reference to Everest and WGS-84. **(Lectures 05)**

Unit - IV

The elementary idea and application of GPS, Clinometer and Pocket Transit in geological field work. Map projections: Classification, properties and uses. Concept and significance of UTM projection. Representation of data using stereonet. Survey of India topographical maps: Reference scheme of old and open series. **(Lectures 05)**

Expected Learning Outcome

The student gets familiar with the fundamental idea of reading topographical and structural features from the map and learns to use basic geological instruments.

Essential Reading

- Lahee, (1961) Field Geology Frederic Henry, Mc-Graw Hill Book Comp., London, N. York.
 Kennedy, M., Kopp, S. 2001. Understanding Map Projections, Esri Press.
 Kimerling, A .J., Buckley, A.R., Muehrcke, P.C., Muehrcke, J. O. 2011. Map Use: Reading, Analysis, Interpretation, 7th ed, Esri Press.
 Monkhouse, F. J., Wilkinson, H.R. 1971. Maps and Diagrams: Their Compilation and Construction, 3rd ed (2017 reprint), Alphaneumera-Kolkata.
 Pearson II, F. 1990. Map Projections: Theory and Applications 2nd ed, CRC Press.
 Robinson, A. H., Morrison, J.L., Phillip, C.M., Kimerling, A.J., Guptill, S.C. 1995. Elements of Cartography, 6th ed, Wiley.
 Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Private Ltd.
 Vaidyanadhan, R., Subbarao, K.V. 2014. Landforms of India from Topomaps and Images, Geological Society of India.

Websites: Geological Survey of India: www.gsi.gov.in
Indian National Cartographic Association: www.incaindia.org
Indian Naval Hydrographic Department: www.hydrobharat.nic.in

II-Semester

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 II Semester	Discipline Specific: Major	GEO-DSM-211	Mineralogy, Mineral Optics & Crystallography	100	4	0	0	4
	Discipline Specific: Major	GEO-DSM-212	Mineralogy, Mineral Optics & Crystallography Practical	100	0	0	2	2
	Discipline Specific: Major	DSM-213	Other Department	100	6	0	0	6
	Ability Enhancement Course (AEC) (Either in I or II Sem)	GEO-AEC-211	Geomorphology Field Training and Report Writing (within campus)	100	2	0	0	2
	Skill Enhancement Course (SEC) (Either in I or II Sem)	GEO-SEC-211	Seminar/ Field Work / Report writing	100	2	0	0	2
	Value Enhancement Course (VEC)	VEC-211	Other Department					Qualifying
Total Credits								20
Exit with Certificate								

*** Note: Student can choose either AEC or SEC in one semester**

***Note: UG-MOOC - Crystallography & Mineralogy offered by the University, Course Coordinator - Prof. H Thomas available on SWAYAM Platform.**

Level / Semester	Nature of Course	Courses Code	Course Title	MM	L	T	P	C
L-5 II Semester	Multi-Disciplinary: Major	GEO-MDM-211	Rock forming & Gem Minerals	100	6	0	0	6

Discipline Specific: Major
GEO-DSM-211- Mineralogy, Mineral Optics & Crystallography
(MOOC- Crystallography & Mineralogy on SWAYAM Platform)
(Credits 4; 60 Hrs; M.M. 100 = 60 End Sem. + 40 sessional)
Course Coordinator: Prof. H. Thomas

Learning Objective of the Course

The course for the mineralogy is running with a view to provide a glance to different rock forming minerals processes, structure and others physicochemical properties of minerals and its significance.

Unit - I

What is mineral? Principles of classification of the minerals. Chemical bonding, Silicate structures, Isomorphism, Polymorphism, Pseudomorphism and Solid solution, Physical properties of minerals- form, colour, streak, lusture, cleavage, fracture, and hardness. Specific gravity, electrical, magnetic and radioactive properties of minerals. Chemical composition, physical and optical properties of the ortho / nesosilicate group of mineral: Olivine, Garnet, Aluminosilicate group of minerals (Kyanite, Sillimanite and Andalusite) and Zircon.

(Lectures 15)

Unit - II

Sorosilicate & Cyclosilicate group of minerals: Epidote, Tourmaline etc. Chemical composition, physical and optical properties of the inosilicate group of minerals: Pyroxene, and amphibole Chemical composition,

(Lectures 07)

Unit - III

Physical and optical properties of the phyllosilicates group of minerals: Clay. Chlorite, Biotite. Chemical composition, physical and optical properties of the tectosilicate group of minerals: Silica, Feldspar, Feldspathoid and zeolite. Optical properties under microscope: Petrological microscope - its parts and functioning, Optical properties of minerals-twinkling, birefringence and pleochroism, Interference colour, Extinction angle and twinning.

(Lectures-15)

Unit - IV

Crystallography; Definition of crystal, Elementary ideas about crystal structure, Crystal faces, edges and interfacial angles, Solid angle, zone and crystal forms. Crystallographic axes and axial angles. Crystal symmetry elements. Parameters and indices of crystal notations, Twinning in crystals. **(Lectures 12)**

Unit - V

Classification of crystals into seven systems. Study of symmetry of normal classes of crystal systems, Study of forms of normal classes. Wave Optics, Ordinary and polarized light, isotropic and anisotropic minerals, their wave surfaces and wave fronts, Reflection and refraction of light, Refractive index, critical angle, total internal reflection and Becke's effect, Double refraction, Nicol Prism its construction and working. **(Lectures 08)**

Essential Reading:

1. Read, H.H. (1962) Rutley's **Elements of Mineralogy** Reprint CBS Pub. & Dist., New Delhi
2. Ford W. E., (2006) Dana's Text Book of **Mineralogy** CBS Pub. & Dist., New Delhi

Suggested Reading:

1. Alexander P. O. (2008), Handbook of **Minerals, Crystals, Rocks and Ores**, New Age India.
2. Thomas, H. (2018) MOOC on Crystallography & Mineralogy offered by the
3. E-content on the website:cec.gov.in
4. Massive Open Online Course on (MOOC) Crystallography & Mineralogy Offered by Prof. Harel Thomas

Discipline Specific: Major
GEO-DSM-212 – Mineralogy, Mineral Optics & Crystallography Practical
(Credits 2; 30 Hrs Lab work; M.M. 100 = 60 End Sem. + 40 sessional)
Course Coordinator: Mr. Rajiv Khalkho

- Study of physical properties of the rock forming minerals.
- Olivine, Garnet, Aluminosilicate group of minerals (Kyanite, Sillimanite and Andalusite) and Zircon. Epidote, Tourmaline, Pyroxene, and Amphibole. Chlorite, Biotite and Muscovite. Silica, Feldspar, Feldspathoid and zeolite.
- Occurrence and distribution of Minerals India.
- Study of symmetry elements in crystal models.
- Study of Fundamental forms of normal classes of all crystal systems.
- Verification of Euler's theorem.
- Study of the optical properties of important rock forming minerals using polarizing microscope.

Ability Enhancement Course (AEC)
GEO-AEC-111- Geomorphology Field Training and report writing (within campus)
(Credits 2; 30 Hrs; M.M. 100)
Course Coordinator: Prof. S.H. Adil

Learning Objective of the Course

The course for the geomorphology Field Training and report writing (within campus) is running with a view to provide a glance to different exogenic processes that shape landforms on earth.

Unit – I

Maps: Components and classification, application of scales. Topographic Sheets: Scale, symbols and Legends – Types and Categories, Interpretation of contours and Identification of Natural Landscape Elements, Scale Measurements, Slope Calculation. Determination of latitude and longitude from toposheet. Measurement of distance between two Points. **(Lectures 15)**

Unit – II

Landforms of Fluvial landforms, Glacial landforms, Aeolian landforms, Coastal landforms, karst topography and Volcanic landforms. Map representation of landforms by various methods. **(Lectures 15)**

Expected Learning Outcome

The student gets familiar with the fundamental idea of reading topographical and structural features from the map and basic methods of geomorphological mapping.

Essential Reading

9. Lahee, (1961) Field Geology Frederic Henry, Mc-Graw Hill Book Comp., London, N. York.
10. Kennedy, M., Kopp, S. 2001. Understanding Map Projections, Esri Press.
11. Kimerling, A. J., Buckley, A.R., Muehrcke, P.C., Muehrcke, J. O. 2011. Map Use: Reading, Analysis, Interpretation, 7th ed, Esri Press.
12. Monkhouse, F. J., Wilkinson, H.R. 1971. Maps and Diagrams: Their Compilation and Construction, 3rd ed (2017 reprint), Alphaenumera-Kolkata.
13. Pearson II, F. 1990. Map Projections: Theory and Applications 2nd ed, CRC Press.
14. Robinson, A. H., Morrison, J.L., Phillip, C.M., Kimerling, A.J., Guptill, S.C. 1995. Elements of Cartography, 6th ed, Wiley.
15. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Private Ltd.
16. Vaidyanadhan, R., Subbarao, K.V. 2014. Landforms of India from Topomaps and Images, Geological Society of India.

Skill Enhancement Course (SEC)
GEO-SEC-211- Seminar/ Field Work
(Credits 2; 30 Hrs; M.M. 100)
Course Coordinator: Prof. R. K. Rawat

Seminar will be based on GEO-DSM or Field work around Sagar

Note: Student can choose either AEC or SEC in one semester

Multi - Disciplinary: Major
GEO-MDM-211- Rock forming & Gem Minerals
(Credits 6; 90 Hrs Lab work; M.M. 100 = 60 End Sem. + 40 sessional)
Course Coordinator: Prof. H. Thomas

Learning Objective of the Course

The course for the rock forming & gem minerals is running with a view to provide a glance to different rock forming minerals processes, structure and others physicochemical properties of minerals and its significance.

Unit - I

Minerals is mineral? Principles of classification minerals. Physical properties of minerals- form, colour, streak, lusture, cleavage, fracture, and hardness. **(Lectures 15)**

Unit – II

Chemical composition, physical and optical properties of the ortho / nesosilicate group of mineral: Olivine, Garnet, Aluminosilicate group of minerals (Kyanite, Sillimanite and Andalusite) and Zircon. Sorosilicate & Cyclosilicate group of minerals: Epidote, Tourmaline etc. **(Lectures 15)**

Unit - III

Chemical composition, physical and optical properties of the inosilicate group of minerals: Pyroxene, and amphibole **(Lectures-15)**

Unit - IV

Chemical composition, physical and optical properties of the phyllosilicate group of minerals: Clay. Chlorite, Biotite and Muscovite. **(Lectures-15)**

Unit - V

Chemical composition, physical and optical properties of the tectosilicate group of minerals: Silica, Feldspar, Feldspathoid and zeolite **(Lectures-15)**

Unit - VI

Chemical composition, physical and optical properties of the gem minerals **(Lectures-15)**

Essential Reading:

1. Read, H.H. (1962) Rutley's Elements of Mineralogy Reprint CBS Pub. & Dist., New Delhi
2. Ford W. E., (2006) Dana's Text Book of Mineralogy CBS Pub. & Dist., New Delhi

Suggested Reading:

5. Alexander P. O. (2008), Handbook of Minerals, Crystals, Rocks and Ores, New Age India.
6. Thomas, H. (2018) MOOC on Crystallography & Mineralogy
7. E-content on the website:cec.gov.in

EXIT with Certificate

Board of Studies Meeting held on 12th September, 2022

(Prof. P.K. Kathal)
Member

(Prof. R. K. Rawat)
Member

(Prof. S.H. Adil)
Member

(Dr. G. K. Singh)
Member

(Prof. Ashish Verma)
Member

(Prof. Ratnesh Das)
External Member

(Prof. A.D. Singh)
External Member

(Prof. Santosh Kumar)
External Member

(Prof. H. Thomas)
Chairman

School Board of Studies Meeting held on 15th September, 2022

(Prof. P.K.Kathal)
Member

(Prof. Sanjay K. Jain)
Member

(Prof. S. H. Adil)
Member

(Prof. Asmita Gajbhiye)
Member

(Prof. H. Thomas)
Member

(Prof. Vandana Soni)
Member

(Prof. Umesh K. Patil)
Member

(Dr. Sushil K. Kashav)
Member

(Dr. Dharmendra Jain)
Member

(Mr. Rajiv Khalkho)
Member

(Prof. A.P. Mishra)
Member

(Prof. Ranveer Kumar)
Member

(Prof. Devesh Walia)
External Member

(Prof. Pankaj K. Shrivastava)
External Member

(Prof. Sailendra Saraf)
External Member

(Prof. Sushant Shrivastava)
External Member

(Dr. Anil Kharia)
External Member

(Prof. R.K. Rawat)
Chairperson