KRANTIGURU SHYAMJI KRISHNA VERMA KACHCHH UNIVERSITY BHUJ-KACHCHH

Year: 2024-2025

B.Sc (Honours) Geology

(With Research /Without Research)

Semesters: III and IV

(Exit option)

FACULTY OF SCIENCE

SYLLABUS

Curriculum as per UGC Guideline
Framed according to National Education Policy (NEP) - 2020 With effect from June – 2023 (and thereafter)

NATURE AND EXTENT OF BACHELOR'S DEGREE PROGRAMME IN GEOLOGY HONOURS)

A bachelor's degree in Geology with Research or without Research is a 4 year degree course which is divided into 8 semesters.

Sr. No.	Type of Award	Stage of Exit	Mandatory Credits to secure Degree Award
1	Diploma in the Discipline	After successful completion of 1st Year	**Diploma With Exit 4 Credit course (44+4)**
2	Diploma in the Discipline	After successful completion of 1st and 2nd Years	**Diploma With Exit 4 Credit course (88+4)**
3	B.Sc. in Geology	After successful completion of 1st, 2nd and 3rd Years	**Bachelor degree (132)**
4	B.Sc. (Honours with Research/ without Research) in Geology	After successful completion of 1st, 2nd, 3rd and 4th Years	**Bachelor + Honors degree (176)** **Bachelor + Research degree (176)**

A student pursuing 4 years undergraduate programme with research in a specific discipline shall be awarded an appropriate Degree in that discipline on completion of 8th Semester if he/she secures required Credits. Similarly, for Diploma, diploma and degree, a student needs to fulfill the associated credits. An illustration of credits requirements in relation to the type of award is illustrated as above.

Bachelor's Degree (Honours) is a well-recognized, structured, and specialized graduate level qualification in tertiary, collegiate education. The contents of this degree are determined in terms of knowledge, understanding, qualification, skills, and values that a student intends to acquire to look for professional avenues or move to higher education at the postgraduate level.

Bachelor's Degree (Honours) programmes attract entrants from the secondary level or equivalent, often with subject knowledge that may or may not be directly relevant to the field of study/profession. Thus, B.Sc. (Honours) Course in Geology aims to prepare students to qualify for joining a profession or to provide development opportunities in particular employment settings.

AIMS:

1. To develop the curriculum for fostering subjective-learning.

2. To adopt recent pedagogical trends in education including e-learning, flipped class, hybrid learning and MOOCs
3. To shape students as a responsible and sensible citizen.
4. To offer an environment that guarantees intellectual development of students in an all-inclusive manner.
5. To provide updated subject matter theoretically and practically which can enhance student's core competency and learning.
6. To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
7. To enable the graduate to prepare for national as well as international competitive examinations, especially, IIT-JAM, UGC-CSIR NET, CUCET, GATE, GPSC, and UPSC Civil Services Examination.

COURSE INTRODUCTION

The redesigned curriculum of B.Sc. in Geology offers essential knowledge and technical skills to study earth in a holistic manner. Students would be exposed to different areas of earth science using a unique combination of core, elective and vocational papers with significant inter-disciplinary components. Students would be taught modern methods and technologies to understand dynamics of earth system & tectonics, minerals & rocks, geomorphology, stratigraphy, fossils science, natural recourses and its exploration techniques etc.

The entire programme of B.Sc. Geology will include classroom theories as well as practical field and laboratory component. The programme will also have field visits, study tours, outstations and field activities and projects as part of their curriculum.

Programme outcomes (POs):

Transformed curriculum shall develop educated outcome-oriented candidature, to develop into responsible citizen for nation-building and transforming the country towards the future with their knowledge gained in the field of earth science.

Programme specific objectives (PSOs):

- ✓ This course will enable students to learn avenues in Geology.
- ✓ The syllabus can help students to get ready for competitive exams.

- ✓ Students will be able to know about the basics of earth system science and applied geoscience.
- ✓ Diploma and diploma courses are framed to generate self- entrepreneurship and self-employability, if multi exit option is opted.
- ✓ Students will increase the ability of critical thinking, reasoning and curiosity, development of scientific attitude, problem solving, improve practical skills, enhance communication skill, social interaction, and increase awareness in the field of earth science and environment.
- ✓ The training provided to the students will make them competent enough for doing jobs in Govt. and private sectors of academia, research and industry at entry level.

TEACHING LEARNING PROCESS

Teaching and learning in this programme involve classroom lectures as well tutorials.

It allows-

- Closer interaction between the students and the teacher as each student gets individual attention.
- Preparation of assignments and projects submitted by students
- Project-based learning
- Group discussion
- Home assignments
- Quizzes and class tests
- PPT presentations, Seminars, interactive sessions
- Co-curricular activity etc.
- Study Tour or Field visit

EVALUATION METHODS:

Academic performance in various courses *i.e.* **Major, Minor, IDC/MDC, AEC. VAC** and **SEC** are to be considered as parameters for assessing the achievement of students in the subject. A number of appropriate assessment methods of Geology will be used to determine the extent to which students demonstrate desired learning outcomes.

Following assessment methodology should be adopted:

1. The oral and written examinations (Scheduled and surprise tests),
2. Field learning of students
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports,
7. Efficient delivery using seminar presentations,
8. Viva voce interviews are majorly adopted assessment methods for this curriculum.
9. The computerized adaptive testing, literature surveys and evaluations, peers and selfassessment, outputs form individual and collaborative work are also other important approaches for assessment purposes.
10. A student shall be evaluated through Comprehensive Continuous Assessment (**CCA**)/ (***Internal Evaluation***) as well as the **End of Semester examination** (***External Evaluation***). The weight-age of CCA shall be 50%, whereas the weight-age of the Semester end examination shall be 50%.
11. The **End of Semester examination** (***External Evaluation***) shall have an assessment based upon following perspective with respect to all the courses:

    a. Evaluation with respect to Knowledge,
    b. Evaluation with respect to Understanding,
    c. Evaluation with respect to Skill,
    d. Evaluation with respect to Application and
    e. Higher Order Thinking Skills.

- The End of Semester Examination will be conducted by the University. A certified journal of the respective practical course must be produced at the time of practical examination by the student. The Field Excursion is highly essential for studying geological features. There shall be at least one field Excursion (local or outstation).
- This is compulsory to record laboratory work in the Journal. Certified journal has to be produced while appearing at the time of Practical examination

Year	Semester	Course Code	Paper Title	Credits	Marks		Total
					CA	UA	
Second Year	III	MJ GEO - 301	Paleontology and Stratigraphy	3	35	40	75
		MJ GEO - 302-P	As above (Lab Course)	1	10	15	25
		MJ GEO -303	Crystallography	3	35	40	75
		MJ GEO - 304-P	As above (Lab Course)	1	10	15	25
		MJ GEO- 305	Introduction to Petrology	3	35	40	75
		MJ GEO - 306-P	As above (Lab Course)	1	10	15	25
		MD GEO - 307	Palaeontology and Stratigraphy	3	35	40	75
		MD GEO- 308-P	As above (Lab Course)	1	10	15	25
		Total Credits		**16**			**400**
		SEC – Practical	Skill Course-1	2	25	25	50
		VAC		2	25	25	50
	IV	MJ GEO - 401	Geomorphology	3	35	40	75
		MJ GEO - 402-P	As above (Lab Course)	1	10	15	25
		MJ GEO - 403	Structural Geology	3	35	40	75
		MJ GEO - 404-P	As above (Lab Course)	1	10	15	25
		MJ GEO- 405	Mineralogy	3	35	40	75
		MJ GEO - 406-P	As above (Lab Course)	1	10	15	25
		MN GEO - 407	Geomorphology	3	35	40	75
		MN GEO- 408-P	As above (Lab Course)	1	10	15	25
		Total Credits		**16**			**400**
		SEC - Practical	Skill Course-2	2	25	25	50
		VAC		2	25	25	50
		Total Credits		**4**	**Total Marks**		**100**

Structure of the Question Paper for the University Exam

KSKV Kachchh University: BHUJ

SECOND YEAR B.Sc.: GEOLOGY THEORY (MAJOR/MINOR/MDC)

Total Marks: 40, Duration: 2 hours 30 min

Passing standard: 16 Marks

PATTERN OF QUESTION PAPER

FOR SEMESTER-END EXAMS (Sem III & IV)

Questions	Section	Marks
Question – 1 Unit – 1	**2 Questions of 10 Marks, student have to attempt any 1**	**10 marks**
Question – 2 Unit –II	–do-	**10 marks**
Question – 3 Unit – III	–do-	**10 marks**
Question – 4	**12 short questions of 1 mark, 4 questions from each unit and the students have to attempt any 10.**	**10 Marks**

- Types of questions for Question 4 may be varied like: one-line answer / two-line answers / definitions / reasoning / drawing small figures/ label the figure / one-word answer / match the pairs etc.

DETAILED SYLLABUS OF B.Sc. 2nd YEAR FOR FOR DIPLOMA COURSE IN BASIC GEOLOGY

KSKV Kachchh University, Bhuj - Kachchh

(Effective from June 2024-25 UNDER NEP-2020)

SEMESTER III:

Course Outcome

After the completion of the course the students will be able to:

1. The course enables the students to understand the scope and application of Geology and gives them the confidence to go to the next level of learning in the subject.
2. The students will learn about fossils, their types, and the fossilization process as well as students will gain the understanding of deep history of geologic time along with origin and evolution of life.
3. The students will learn about various laws of stratigraphy, different stratigraphic techniques and their application in geological science.
4. Students will gain the understanding different crystal forms and crystallographic laws and also learn axial characteristics and crystal systems with 32 point groups.
5. The concept of x ray crystallography will help students to understand the internal structure of crystal.
6. The students will learn about different rock types, their origin, characteristics and will gain the understanding various forms, structures and textures related to igneous, sedimentary and metamorphic rocks.
7. The students will learn classification of Igneous, sedimentary and metamorphic rocks and descriptive study of common verities of igneous, sedimentary and metamorphic rocks

SEMESTER III:

Paper: MJ GEO - 301: Paleontology and Stratigraphy

(Course code: MJ GEO - 301) Credit: 3

GEOLOGY SPECIFIC CORE COURSE							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
Diploma Course	**B.Sc.-III**	*MJ GEO-301*	*Paleontology and Stratigraphy*	**3**	**45**	*40 Marks*	*35 Marks*

UNIT	*TOPIC*	*No. of Lectures* **(45 hrs)**
Unit 1	**Introduction to Paleantology** • Paleontology definition, subdivision and scope, its relationship with other subdisciplines of geology. • Origin of life and theories of evolution, Paleontological evidences of evolution. • Fossils and process of fossilization; modes of preservation, Physio-chemical Conditions for fossilization. • Significance of fossils Studies.	**15**
Unit 2	**Geological time scale and Evolution of mammals** • Organisms through the dimension of time – geological time scale and evolution of fauna and flora. • Evolution of mammals and intercontinental migrations. • Imperfection of geological records. • Dating techniques for rocks and fossils. • Collection preparation and nomenclature of fossils.	**15**
Unit 3	**Introduction to Stratigraphy** • Stratigraphy definition, Fundamental laws of stratigraphy. • Stratification, Correlation and Homataxis of strata. • Lithostratigraphic, chronostratigraphic, biostratigraphy and their units. • Application of fossils in Stratigraphy; Biozones, index fossils, correlation, Role of fossils in sequence stratigraphy. • Fossils and paleoenvironmental analysis.	**15**

Suggested readings:

- P.C Jain, (2016). Palaeontology: (Palaeobiology) evolution and Animal Distribution
- Benton, M.J. & Harper, D.A.T. (2016). Introduction to Paleobiology and the fossil record. Wiley.
- Boggs, S. (2012) Principles of Sedimentology and Stratigraphy, Prentic Hall, New Jersey.
- Mukherjee, P. K. (1997) A text book of Geology, The World Press Pvt. Ltd., Calcutta.

Note: Students may refer variety of material available online and on web resources for further understanding.

SEMESTER III:
Paleontology and Stratigraphy
(Course code: MJ GEO – 302-P) Credit: 1

Practical/ Lab course

Course Outcome

After the completion of the course the students will be able to:

1. Basic understanding of modes of fossilization.
2. Learn identification of stratigraphic zones
3. Develop skills for stratigraphic correlation
4. They will learn preparing small reports and field observations.

DISCIPLINE SPECIFIC CORE COURSE						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*Lectures*	*INTERNAL/ External*
Diploma Course	B.Sc -III	MJ GEO – 302-P	Paleontology and Stratigraphy	1	30 hrs	*25 (15+10) Marks*

- Study of modes of fossilization:
  - Petrifaction
  - Carbonization or Distillation
  - Replacement
  - Molds and Casts
  - Imprints
  - Tracks and Trails
  - Preservation of Original hard parts of the organisms.
- Stratigraphic correlation lithologic columns
- Identification of stratigraphic zones.

Note: Additional practical related to syllabus may be included during class work.

Journal / Submission

Note: It is compulsory to record laboratory work (all the practicals) in the journal. The journal is to be certified by the incharge teacher and the Head of the Department within time frame. Certified journal must be produced while appearing at the time of Practical examination.

SEMESTER III:
Paper: MJ GEO – 303
Crystallography
(Course code: MJ GEO - 303) Credit: 3

GEOLOGY SPECIFIC CORE COURSE							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
Diploma Course	**B.Sc.-III**	**MJ GEO - 303**	*Crystallography*	**3**	**45**	*40 Marks*	*35 Marks*

UNIT	*TOPIC*	*No. of Lectures* **(45 hrs)**
Unit 1	**Introduction to Crystallography** • Crystal: definition, elementary idea of crystal structure and atomic arrangements: Unit cell, CCP, FCC and HCP; Ionic radius and coordination, Pauling's rules. • Crystal external morphology - faces, edges, solid angles, interfacial angle. Contact Goniometry; measurement of crystal angles. • Crystallographic laws; law of constancy of interfacial angles, the law of rationality of indices, the law of symmetry.	**15**
Unit 2	**Introduction to crystal systems** • Crystallographic axes, lettering and order of crystallographic axes, parameters, axial ratio, indices, parameter system of Weiss, index system of Miller, Law of rational indices. • Introduction to symmetry elements and operations, crystal forms. • Study of six crystallographic systems with respect to their elements of symmetry and crystallographic axes.	**15**
Unit 3	**X-Ray crystallography** • Study of 32-Points group. • Introduction to X-ray crystallography, X-ray spectra • Diffraction effects and Bragg's equation.	**15**

Suggested readings

- Read, H. H. (1966) Rutley's Elements of Mineralogy 26th Edition, S. K. Jain and CBS Publishers and distributors.
- Cornelius K, and Cornelius S. H. (1895) Manual of Mineralogy John Wiley & Sons.
- Hurlbut, C. S., & Klein, C. (1977). Manual of mineralogy (after James D. Dana). Wiley.

Note: Students may refer variety of material available online and on web resources for further understanding.

KSKV Kachchh University, Bhuj - Kachchh
SEMESTER III:
Crystallography

(Course code: **MJ GEO - 304 P)**

Credit: 1

Course Outcome

After the completion of the course the students will be able to:

1. Understand the crystal structures and crystal forms with the help of wooden modles.
2. Students will develop observational skills to understand crystal systems and 32-point groups.
3. Using stereograms, students will be able to visualize the 3D structure of crystal in to 2D or Vise versa.

DISCIPLINE SPECIFIC CORE COURSE						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*Lectures*	*INTERNAL/ External*
Diploma Course	**B.SC -III**	**MAJ GEO - 304 P**	*Crystallography*	**1**	**30 hrs**	*25 (15+10) Marks*

- Elementary Study of 6 crystal system;
  - Cubic,
  - Orthorhombic,
  - Tetragonal,
  - Hexagonal,
  - Monoclinic,
  - Triclinic.
- Study of crystal models of 32-point groups
- Stereographic projections

Note: Additional practical related to syllabus may be included during class work.

Journal / Submission

• Note: It is compulsory to record laboratory work (all the practicals) in the journal. The journal is to be certified by the incharge teacher and the Head of the Department within time frame. Certified journal must be produced while appearing at the time of Practical examination.

SEMESTER III:
Paper: MJ GEO - 305:
Petrology
(Course code: MJ GEO - 305) Credit: 3

GEOLOGY SPECIFIC CORE COURSE							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
Diploma Course	**B.Sc.-III**	*MJ GEO-305*	*Paleontology and Stratigraphy*	**3**	**45**	*40 Marks*	*35 Marks*

UNIT	*TOPIC*	*No. of Lectures* **(45 hrs)**
Unit 1	**Igneous Petrology** • Origin and types; Physical properties of magma (temperature, viscosity, density and volatile content) and chemical composition. Bowen's Reaction Series. • Intrusive and extrusive forms. • Structure and textures of igneous rocks and its petrogenetic significance. • Classification of igneous rocks- based on mode of occurrence, chemical and mineralogical composition. • Descriptive study of verities of igneous rocks	**15**
Unit 2	**Sedimentary Petrology** • Role of weathering in sedimentation. • Origin of sedimentary rocks; Concept of grain size and texture of sediments. • Primary sedimentary structures. • Classification of Sedimentary Rocks. • Descriptive study of verities of sedimentary rocks	**15**
Unit 3	**Metamorphic Petrology** • Metamorphism; limits of metamorphism; factors controlling metamorphism. • Agents and types and of metamorphism. • Texture and structure of metamorphic rocks. • Classification of metamorphic rocks. • Descriptive studies of common metamorphic rocks.	**15**

Suggested readings:

- Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
- Bose M.K. (1997). Igneous Petrology.
- Sengupta, S. M., 2007. *Introduction to sedimentology. Second edition.* CBS Publishers and Distributors Pvt. Ltd.

- The Principles of Petrology, G. W. Tyrell (1960)

Note: Students may refer variety of material available online and on web resources for further understanding.

KSKV Kachchh University, Bhuj - Kachchh
SEMESTER III:

Petrology

(Course code: **MJ GEO - 306 P**) Credit: 1

Course Outcome

After the completion of the course the students will be able to:

1. The students will learn identification of rocks.
2. Understand various texture and structures of rocks.
3. Students will learn the usage of rocks.

DISCIPLINE SPECIFIC CORE COURSE						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credit s	*Lectures*	*INTERNAL/ External*
Diploma Course	**B.SC -III**	**MJ GEO - 306 P**	**Petrology**	**1**	**30 hrs**	***25 (15+10) Marks***

- **Megascopic study of typical Igneous rocks:**
  - Granite, Porphyritic Granite, Graphic granite, Basalt, Pegmatite, Syenite, Gabbro, Dolerite, Rhyolite, Trachyte, Andesite, Obsidian, Pumice, and Dunite.
- **Megascopic study of typical Sedimentary rocks:**
  - Conglomerate, Breccia, Sandstone, Shale, Limestone.
- **Megascopic study of typical metamorphic rocks.**
  - Slate, Phyllite, Quartzite, Marble, Schist, Gneiss

Note: Additional practical related to syllabus may be included during class work.

Journal / Field reports Submission

• Note: It is compulsory to record laboratory work (all the practicals) in the journal. The journal is to be certified by the incharge teacher and the Head of the Department within time frame. Certified journal must be produced while appearing at the time of Practical examination

KSKV Kachchh University, Bhuj - Kachchh
SEMESTER III:
Paper: MJ GEO - 307: Paleontology and Stratigraphy
(Course code: MJ GEO - 307) Credit: 3

GEOLOGY SPECIFIC CORE COURSE							
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*THEORY*			
				Credits	*Lectures*	*External*	*Internal*
Diploma Course	**B.Sc.-III**	*MD GEO-307*	*Paleontology and Stratigraphy*	**3**	**45**	*40 Marks*	*35 Marks*

UNIT	*TOPIC*	*No. of Lectures* (45 hrs)
Unit 1	**Introduction to Paleantology** • Paleontology definition, subdivision and scope, its relationship with other subdisciplines of geology. • Origin of life and theories of evolution, Paleontological evidences of evolution. • Fossils and process of fossilization; modes of preservation, Physio-chemical Conditions for fossilization. • Significance of fossils Studies.	15
Unit 2	**Geological time scale and Evolution of mammals** • Organisms through the dimension of time – geological time scale and evolution of fauna and flora. • Evolution of mammals and intercontinental migrations. • Imperfection of geological records. • Dating techniques for rocks and fossils. • Collection preparation and nomenclature of fossils.	15
Unit 3	**Introduction to Stratigraphy** • Stratigraphy definition, Fundamental laws of stratigraphy. • Stratification, Correlation and Homataxis of strata. • Lithostratigraphic, chronostratigraphic, biostratigraphy and their units. • Application of fossils in Stratigraphy; Biozones, index fossils, correlation, Role of fossils in sequence stratigraphy. • Fossils and paleoenvironmental analysis.	15

SEMESTER III:
Paleontology and Stratigraphy
(Course code: MD GEO – 308-P) Credit: 1

Practical/ Lab course

Course Outcome

After the completion of the course the students will be able to:

1. Basic understanding of modes of fossilization.
2. Learn identification of stratigraphic zones
3. Develop skills for stratigraphic correlation
4. They will learn preparing small reports and field observations.

DISCIPLINE SPECIFIC CORE COURSE						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*Lectures*	*INTERNAL/ External*
Diploma Course	**B.Sc -III**	MD GEO – 308-P	**Paleontology and Stratigraphy**	**1**	**30 hrs**	*25 (15+10) Marks*

- Study of modes of fossilization:
  - Petrifaction
  - Carbonization or Distillation
  - Replacement
  - Molds and Casts
  - Imprints
  - Tracks and Trails
  - Preservation of Original hard parts of the organisms.
- Stratigraphic correlation lithologic columns
- Identification of stratigraphic zones.

Note: Additional practical related to syllabus may be included during class work.

Journal / Submission

Note: It is compulsory to record laboratory work (all the practicals) in the journal. The journal is to be certified by the incharge teacher and the Head of the Department within time frame. Certified journal must be produced while appearing at the time of Practical examination.

SEMESTER III:
Skill Course - 1
(Course code: SEC GEO -1 P) Credit: 2

Practical/ Lab course

Course Outcome

After the completion of the course the students will be able to:

1. Developing skill with respect of fossils observation and identification.
2. Understanding fossils morphology and nomenclature.
3. Understanding fossils excavation techniques.
4. Developing filed work skills and report writing skills.

DISCIPLINE SPECIFIC CORE COURSE						
COURSE	*SEMESTER*	*COURSE CODE*	*COURSE TITLE*	*PRACTICAL*		
				Credits	*Lectures*	*INTERNAL/ External*
Diploma Course	**B.Sc -III**	**SEC GEO -1 P**	**Skill Course - 1**	**1**	**30 hrs**	***25 (15+10) Marks***

Unit-1 Laboratory skills in paleontological studies.

- Practical studies of tools and techniques used in the field of fossil studies.
- Study of Morphological characteristics of various fossils in laboratory.
- Introduction to Fossil preparation in laboratory.

Unit-2 Fossil collection and preparation skills in paleontological studies

- Identification of fossils in the field
- Excavation techniques for invertebrate and vertebrate fossils in the field.
- Preparation of fossils in field.

Note: Additional practical related to syllabus may be included during class work/field work.

Journal / Field report/ Submission

Note: It is compulsory to record laboratory work (all the practicals) in the journal. The journal is to be certified by the incharge teacher and the Head of the Department within time frame. Certified journal must be produced while appearing at the time of Practical examination.