

|                                                                                                                                                         |                                                                                                                                                                                                                                                                                   |                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Estd. 1962<br>"A++" Accredited by<br>NAAC (2021)<br>With CGPA 3.52 | <b>SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA</b><br>PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in<br><b>शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र</b><br>दूरध्वनी-ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१-२६०९०९४<br>०२३१-२६०९४८७ |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Ref.No.SU/BOS/Science/148

Date: 26/05/2026

The Principal,  
 All Concerned Affiliated Colleges/Institutions  
 Shivaji University, Kolhapur.

**Subject:** Regarding revised syllabi of B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0)

**Sir/Madam,**

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper of B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

| B.Sc. Part-III (Sem. V & VI) as per NEP-2020 (2.0) |                             |     |                                     |
|----------------------------------------------------|-----------------------------|-----|-------------------------------------|
| 1.                                                 | Botany                      | 9.  | Geology                             |
| 2.                                                 | Physics                     | 10. | Zoology                             |
| 3.                                                 | Statistics                  | 11. | Chemistry                           |
| 4.                                                 | Mathematics                 | 12. | Electronics                         |
| 5.                                                 | Microbiology                | 13. | Drug Chemistry                      |
| 6.                                                 | Industrial Microbiology     | 14. | Pollution                           |
| 7.                                                 | Biochemistry                | 15. | Food Science and Quality Control    |
| 8.                                                 | Computer Science (Optional) | 16. | Biotechnology (Optional/Vocational) |

This syllabus, nature of question and equivalence shall be implemented from the academic year 2026-2027 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in)>Syllabus>Syllabus as per NEP2020.

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2026 & March/April 2027. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,



Dy Registrar

Encl: as above

for information and necessary action

Copy to:

|   |                                                |    |                                 |
|---|------------------------------------------------|----|---------------------------------|
| 1 | Dean, Faculty of Science & Technology          | 6  | Appointment Section A & B       |
| 2 | Director, Board of Examinations and Evaluation | 7  | I.T.Cell /Computer Centre       |
| 3 | Chairman, Respective Board of Studies          | 8  | Eligibility Section             |
| 4 | B.Sc.-M.Sc. Exam Section                       | 9  | Affiliation Section (T.1) (T.2) |
| 5 | Internal Quality Assurance Cell (IQAC Cell)    | 10 | P.G. Seminar Section            |

# SHIVAJI UNIVERSITY, KOLHAPUR



**Established: 1962**

**A++ Accredited by NAAC (2021) with CGPA 3.52**

**Structure and Syllabus in Accordance with**

**National Education Policy – 2020**

**With Multiple Entry and Multiple Exit**

**Syllabus for**

**Level 5.5**

**B.Sc. Part-III**

**GEOLOGY**

**(Faculty of Science and Technology)**

**SEMESTER V AND VI**

**(To be Implemented from Academic Year 2026-2027)**

**SHIVAJI UNIVERSITY, KOLHAPUR**

**NATIONAL EDUCATION POLICY (NEP-2020)**

# Bachelor of Science in Geology

## A) BASIC INFORMATION

### **ORDINANCE AND REGULATIONS: -as applicable to Under-Graduate Degree / Program**

1. **TITLE:** Subject Geology  
Optional under the Faculty of Science
2. **YEAR OF IMPLEMENTATION:** Revised Syllabus will be implemented from June 2026 onwards.

### **3. PREAMBLE: -**

The revised syllabus includes the foundation, core and applied components of the course/paper. The student should get into the prime objectives and expected level of study with required outcome in terms of basic and advance knowledge at examination level.

### **4. GENERAL OBJECTIVES OF THE COURSE/ PAPER/:**

The course is structured with a view to impart basic as well as advance knowledge of the subject to the students in the light of the present-day scenario in earth science.

#### **Course Learning Outcomes-**

1. Students will get knowledge regarding the economic minerals and methods of exploration.
2. Students will gain knowledge about various terms and their significance in hydrogeology.
3. Students should know various engineering properties of rocks and its significance.
4. Students should get acquainted with various prospecting methods and mining practices and mining methods and its significance.
5. Students should gain knowledge about elements of photogeology and remote sensing techniques and its uses.
6. Students will get acquainted with different geomorphological processes and tectonic phenomena and its significance.
7. Students will become aware of various environmental issues, their reasons and mitigation.

#### **Programme Learning Outcomes-**

1. Students will develop an insight into the various earth materials, systems and the interaction between them.
2. Students gain a knowledge of various factors affecting earth processes, their effects and their manifestation.
3. Students can assess, analyse, and appreciate the phenomena, processes and issues related to the earth and their effects and mitigation.

### **5. DURATION**

The course shall be a full-time course.

**6. PATTERN: -**

Pattern of Examination will be Semester pattern for theory papers. Practical examination will be in semester pattern.

**7. FEE STRUCTURE-**

As per government/ university rules.

**8. ELIGIBILITY FOR ADMISSION: -**

The students passing or ATKT the B. Sc. Part-II (or Undergraduate Certificate in Science) shall be allowed to enter the B. Sc. Part-III (or Undergraduate Diploma in Science). OR An Examination of any other Statutory University or an examining Body recognized as equivalent there to. OR Completed 3-year diploma course with subjects allied / related to the subject at B.Sc. Part II OR completed second year of B.E./B. Tech. with subjects allied / related to the subject at B.Sc. Part II.

**9. MEDIUM OF INSTRUCTION:**

The medium of instruction shall be English.

**SCHEME OF TEACHING AND EXAMINATION PATTERN (THEORY/  
PRACTICAL INTERNAL):**

**SCHEME OF TEACHING:**

**TEACHING HOURS:** All courses under the B. Sc. II will be of 2 credits each. The theory courses will be taught for 30 hours and Practical courses for 60 hours. All the major and minor subjects will have Practical Courses. In addition, VSC, OE and SEC have practical modules.

**EXAMINATION PATTERN (THEORY / PRACTICAL / INTERNAL):**

**Scheme of Examination:** Total marks shall be 50 for 2 credit courses.

1. The university exam question paper in each semester end examination for each theory course (paper) for B.Sc. (all Semesters) shall be of 40 marks. Total marks for each course shall be based on continuous assessments and semester-end examination. The division of internal assessment and semester-end examination for B.Sc. will be as follows:

| Particulars                 | 2 Credit | Course Duration |
|-----------------------------|----------|-----------------|
| 1. Semester-end Examination | 40 Marks | 1.5 hrs.        |
| 2. Internal Assessment      | 10 Marks | 1.0 hrs.        |
| Total marks for each course | 50 Marks | —               |

2. The Examination for practical course will be of 50 marks at end of each semester. The rule for practical examination shall be as per the circular/ letter issued by respective board of studies.
3. The examination pattern for Co-Curricular Activities (CC), Field Project (FP), On Job Training (OJT), Community Engagement Program (CEP) and Research Project (RP) as per the University guidelines.

Internal Assessment Process shall be as follows:

- (a) The internal assessment should be conducted after completing 50% of syllabus of the course/s.
- (b) In case a student has failed to attend internal assessment on scheduled date, it shall be deemed that the student has dropped the test. However, in case of student who could not take the test on scheduled date due to genuine reasons, such a candidate may appeal to the Programme coordinator /Principal /Head of the Department. The programme coordinator /Principal /Head of the Department in consultation with the concerned teacher shall decide about the genuineness of the case and decide to conduct special test to such candidate on the date fixed by the concerned teacher but before commencement of the concerned semester- end examination.

The outline for continuous internal assessment activities shall be as under: Outline for

continuous internal assessment activities:

| Level | Semester       | Activities Semester                     | Per | Marks    |
|-------|----------------|-----------------------------------------|-----|----------|
| 4.5   | Semester–I     | Assignment                              |     | 10 marks |
|       | Semester–II    | Unit test                               |     | 10 marks |
| 5.0   | Semester–III   | Unit test                               |     | 10 marks |
|       | Semester–IV    | Oral examination/<br>Group discussion   |     | 10 marks |
| 5.5   | Semester– V    | Seminar/Group<br>discussion/Field Work  |     | 10 marks |
|       | Semester– VI   | Study tour / Field<br>Work/Project Work |     | 10 marks |
| 6.0   | Semester– VII  | Case Study/Field<br>Work/ Project Work  |     | 10 marks |
|       | Semester– VIII | Case Study/ Field<br>Work/ Project Work |     | 10 marks |

## EQUIVALANCE OF THE PAPER

Equivalence of papers and chances for the students in previous-Semester pattern: Two additional chances in subsequent semesters shall be provided for the repeater students of old three-year B.Sc. program. In such case the scores obtained by the students in NEP 1.0/CBCS scheme should be converted into equivalent credits in NEP 2.0. After that the students concerned shall have to appear for the examination as per this revised pattern. If a student fails in two consecutive chances, he/she must take admission for the respective course in NEP 2.0. In such cases his previous performance of incomplete academic years (B. Sc. I, B. Sc. II, or B. Sc. III) will be cancelled.

## 10. Course Structure

| SHIVAJI UNIVERSITY, KOLHAPUR                                                                       |                                                             |                                              |                                                   |               |                                                          |                                                                         |                   |               |                                                        |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------|---------------------------------------------------|---------------|----------------------------------------------------------|-------------------------------------------------------------------------|-------------------|---------------|--------------------------------------------------------|
| NEP-2020 (2.0): Credit Framework for UG (B. Sc.) Programme under Faculty of Science and Technology |                                                             |                                              |                                                   |               |                                                          |                                                                         |                   |               |                                                        |
| SEM (Level)                                                                                        | COURSES                                                     |                                              |                                                   | OE            | VSC/SEC                                                  | AEC/VEC/IKS                                                             | OJT/FP/CEP /CC/RP | Total Credits | Degree/Cum. Cr. MEME                                   |
|                                                                                                    | Course-1                                                    | Course-2                                     | Course-3                                          |               |                                                          |                                                                         |                   |               |                                                        |
| SEM I (4.5)                                                                                        | DSC-I (2)<br>DSC-II (2)<br>DSC P-I (2)                      | DSC-I (2)<br>DSC-II (2)<br>DSC P-I (2)       | DSC-I (2)<br>DSC-II (2)<br>DSC P-I (2)            | OE-1(2) (T/P) |                                                          | IKS-I (2)                                                               |                   | 22            | UG Certificate 44                                      |
| SEM II (4.5)                                                                                       | DSC-III (2)<br>DSC-IV (2)<br>DSC P-II (2)                   | DSC-III (2)<br>DSC-IV (2)<br>DSC P-II (2)    | DSC-III (2)<br>DSC-IV (2)<br>DSC P-II (2)         | OE-2(2) (T/P) |                                                          | VEC-I (2)<br>(Democracy, Election and Constitution)                     |                   | 22            |                                                        |
| Credits                                                                                            | 8(T)+4(P)=12                                                | 8(T)+4(P)=12                                 | 8(T)+4(P)=12                                      | 2+2=4 (T/P)   | --                                                       | 2+2=4                                                                   | --                | 44            | Exit Option:4 credits<br>NSQF/Internship/Skill courses |
|                                                                                                    | MAJOR                                                       |                                              | MINOR                                             |               |                                                          |                                                                         |                   |               |                                                        |
| SEMIII (5.0)                                                                                       | Major V (2)<br>Major VI (2)<br>Major P III (2)              | --                                           | Minor V (2)<br>Minor VI (2)<br>Minor P III (2)    | OE-3(2) (T/P) | VSC I (2) (P)<br>(Major specific)<br>SEC I(2) (T/P)      | AEC I (2)<br>(English)                                                  | CC-I (2)          | 22            | UG Diploma 88                                          |
| SEMIV (5.0)                                                                                        | Major VII (2)<br>Major VIII (2)<br>Major P IV (2)           | --                                           | Minor VII (2)<br>Minor VIII (2)<br>Minor P IV (2) | OE-4(2) (T/P) | SEC-II (2) (T/P)                                         | AEC-II (2)<br>(Englis)<br><br>VEC<br>-II (2)<br>(Environmental studies) | CEP-I (2)         | 22            |                                                        |
| Credits                                                                                            | 8(T)+4(P)=12                                                |                                              | 8(T)+4(P)=12                                      | 2+2=4(T/P)    | 4(T/P) +2(P)=6                                           | 2+4=6                                                                   | 2+2=4             | 44            | Exit Option:4 credits<br>NSQF/Internship/Skill courses |
|                                                                                                    |                                                             |                                              |                                                   |               |                                                          |                                                                         |                   |               |                                                        |
| SEMV (5.5)                                                                                         | Major IX (2)<br>Major X (2)<br>Major P V a (2), V b (2)     | Major I (ELEC) (2)<br>Major P-I (ELEC) (2)   | -                                                 | OE-5(2) (T/P) | VSC II (2)<br>(Major specific) (P)                       | AEC III (2)<br>(English)                                                | OJT (04)          | 22            | UG Degree 132                                          |
| SEM VI (5.5)                                                                                       | Major XI (2)<br>Major XII (2)<br>Major P VI a (2), VI b (2) | Major II (ELEC) (2)<br>Major P-II (2) (ELEC) | -                                                 |               | VSC III (2)<br>(Major specific) (P)<br>SEC III (2) (T/P) | AEC IV (2)<br>(English)<br>) IKS 2<br>(Major specific) (2)              | FP-(02)           | 22            |                                                        |
| Credits                                                                                            | 8(T)+8(P)=16                                                | 4(T)+4(P)=8                                  | -                                                 | 2(T/P)        | 2(T/P) + 4(P)=6                                          | 4+2=6                                                                   | 4+2=6             | 44            |                                                        |

| Total Credits  | 40+20=60                                                                       | 24                   | 10       | 12 | 16 | 10      | 132 | Exit Option                        |
|----------------|--------------------------------------------------------------------------------|----------------------|----------|----|----|---------|-----|------------------------------------|
| SEMVI I (6.0)  | Major - XIII(4)<br>Major - XIV(4)<br>Major(P).- VII(4)<br>Major (P) .- VIII(2) | MAJOR III (4) (ELEC) | RM-I(4)  | -  | -  | -       | 22  | UG Honours Degree 176              |
| SEMVI II (6.0) | Major -XV(4)<br>Major - XVI(4) Major (P)- IX(4)<br>Major (P). - X(2)           | MAJOR IV (4) (ELEC)  | -        | -  | -  | OJT(04) | 22  |                                    |
| Credits        | 16(T)+12(P)=28                                                                 | 8(T)                 | 4        | -  | -  | -       | 04  | 44                                 |
| Total Credits  | 68+28=96                                                                       | 28                   | 10       | 12 | 16 | 14      | 176 | Exit Option                        |
| SEMVI I (6.0)  | Major -XIII (4)<br>Major -XIV (4)<br>Major(P).-VII (2)                         | MAJOR (4) (ELEC)     | RM-I (4) | -  | -  | RP-4    | 22  | UG Honors with Research Degree 176 |
| SEMVI II (6.0) | Major -XV (4)<br>Major -XVI (4)<br>Major (P)-VIII (2)                          | MAJOR (4) (ELEC)     | -        | -  | -  | RP-8    | 22  |                                    |
| Credits        | 16(T)+4(P)=20                                                                  | 8(T)                 | 4        | -  | -  | 12      | 44  |                                    |
| Total Credits  | 60+28=88                                                                       | 28                   | 10       | 12 | 16 | 22      | 176 |                                    |

## Note:

- University may decide to offer maximum of three subjects (Courses) in the first year. The student may select one subject out of combination of three subjects (Courses), (which a student has chosen in the first year) as a **MAJOR** subject (Course) and one subject (Course) as **MINOR** Subject in the second year. Thereby it is inferred that the remaining third subject (Course) shall stand discontinued.
- **DSC:** Discipline Specific Course
- **MAJOR:** Mandatory/Elective
- **MINOR:** Course may be from different disciplines of same faculty of DSC Major
- **OE (Open Elective):** Elective courses/Open Elective to be chosen compulsorily from faculty other than that of the Major.
- **VSC/SEC: Vocational Skill Courses (MAJOR related)/Skill Enhancement Courses**
- **AEC/ VEC / IKS:** Ability Enhancement Courses (English, Modern Indian Language)/Value Education Courses/ Indian Knowledge System (Generic & Specific))

- **OJT/FP/RP/CEP/CC:** On-Job Training (Internship/Apprenticeship) / Field Project (Major related)/ Research Projects (Major related) Community Engagement (**Major related**)/ **Co-Curricular courses (CC)** such as Health& Wellness, Yoga Education, Sport, and Fitness,

Cultural activities, NSS/NCC and Fine /applied/visual/performing Arts / Vivek Vahini etc.

## **STANDARD OF PASSING AND DETERMINATION OF SGPA/CGPA, GRADING AND DECLARATION OF RESULT**

### **STANDARD OF PASSING:**

The standard of passing shall be as per shown in the following table:

|                                    | <b>Semester End Exam</b> | <b>Internal Assessment</b> | <b>Course Exam (Total</b> |
|------------------------------------|--------------------------|----------------------------|---------------------------|
| Maximum Marks                      | <b>40</b>                | <b>10</b>                  | <b>50</b>                 |
| Minimum Marks required for passing | <b>14</b>                | <b>04</b>                  | <b>18</b>                 |

### **DETERMINATION OF SGPA/CGPA:**

#### **1. Semester Grade Point Average (SGPA)**

$$\text{SGPA} = \frac{\sum (\text{Course credits} \times \text{Grade points obtained}) \text{ of a semester}}{\sum (\text{Course credits}) \text{ of respective semester}}$$

#### **2. Cumulative Grade Point Average (CGPA)**

$$\text{CGPA} = \frac{\sum (\text{Total credits of a semester} \times \text{SGPA of respective semester}) \text{ of all semesters}}{\sum (\text{Total course credits}) \text{ of all semesters}}$$

**Gradation Chart:**

| <b>% of Marks<br/>Obtained</b> | <b>Numerical Grade<br/>(Grade Point)</b> | <b>CGPA</b> | <b>Letter Grade</b> |
|--------------------------------|------------------------------------------|-------------|---------------------|
| Absent                         | -                                        | -           | -                   |
| - 0 – 34                       | 0                                        | 0.0 – 4.99  | F (Fail)            |
| 35 – 44                        | 5                                        | 5.00 – 5.49 | C                   |
| 45 – 54                        | 6                                        | 5.50 – 6.49 | B                   |
| 55 – 64                        | 7                                        | 6.50 – 7.49 | B+                  |
| 65 – 74                        | 8                                        | 7.50 – 8.49 | A                   |
| 75 – 84                        | 9                                        | 8.50 – 9.49 | A+                  |
| 85 – 100                       | 10                                       | 9.50 – 10.0 | O (Outstanding)     |

## DECLARATION OF RESULT:

The result of each semester shall be declared as Pass or Fail with grade/grade points. However, ATKIT rules will be followed as per university guidelines.

**Revised Rules** - These revised rules shall be gradually implemented with effect from the academic year 2026-27 for B.Sc. Degree Programme. However, the existing (i.e. pre-revised) rules shall remain in force for the students of old semester pattern during the transition period.

### 13: NATURE OF QUESTION PAPER, DURATION AND SCHEME OF MARKING

#### NATURE OF QUESTION PAPER

Nature of Question Paper for B.Sc. Part – II (40 + 10 Pattern) according to Revised Structure as Per NEP – 2020 to be implemented from academic year 2025-26 Maximum Marks: 40 Duration: 1.5 hrs.

Choose the correct alternative from the following and rewrite the sentence

[8]

] 1 to 8 MCQ one mark each with four options

- a)
- b)
- c)
- d)

Attempt any TWO of the following

[16]

- a)
- b)
- c)

Attempt any FOUR of the following

[16]

- a)
- b)
- c)
- d)
- e)
- f)

## SEMESTER – V

T.Y. B. Sc. (GEOLOGY) SEMESTER V

### MAJOR COURSE – DSC – IX

**Course Title:**

**DSC: Engineering Geology**

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

**Learning Objectives:**

1. To introduce students to an applied discipline of engineering geology.
2. To introduce students to different concepts in engineering geology.
3. To introduce students to different engineering properties of rocks.
4. To impart knowledge about various geological criterion of site selection for different engineering projects.

| Unit I/<br>Credit 1  | Engineering Geology                                                                                                                                                                                                                                                                                                                                                               | No. of<br>Hours: 15 |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|                      | Role of Engineering geologists in planning, design, and construction of major man-made structural features, Building Stones; Engineering properties of rocks and Soils. Concept, Mechanism and Significance of Rock Quality Designation (RQD), Concept, Mechanism and Significance of: a. Rock Structure Rating (RSR), b. Rock Mass Rating (RMR), c. Tunnelling Quality Index (Q) |                     |
|                      |                                                                                                                                                                                                                                                                                                                                                                                   |                     |
| Unit II/<br>Credit 1 | Soil and Soil groups of India. Geology of Bridge sites; Types of bridges, Dam Types, and their geological and environmental considerations; Geological problem of reservoirs; Tunnels: geology, structure, seepage problem, and role of water table.                                                                                                                              | No. of<br>Hours: 15 |

#### Books Recommended:

1. Krynine D.P. and Judd W.R. Principles of Engineering Geology & Geotechnics. McGraw-Hill Book
2. Kesavulu, N.C., A text book of engineering geology. Macmillan P publishing India Ltd.
3. Bell, F.G., Fundamentals of Engineering Geology. Butterworth and Co.
4. Parbeen Singh., Principles of Engineering and General Geology.
5. e-PG Pathshala: <https://epgp.inflibnet.ac.in/>
6. MOOCS - NPTEL: <https://nptel.ac.in/>
7. MOOCS - SWAYAM: <https://swayam.gov.in/>
8. National Digital Library of India: <https://ndl.iitkgp.ac.in/>
9. Shivaji University Library (E-Resources): <http://www.unishivaji.ac.in/library/E-Resources>

**T.Y. B.Sc. (GEOLOGY) SEMESTER V**

**MAJOR COURSE – DSC –X**

**Course Title: DSC-Photogeology and Remote Sensing**  
[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

**Learning Objectives:**

1. To introduce the students to photogeology.
2. To introduce the students to various elements of photogeology.
3. To impart knowledge about various remote sensing systems.
4. To introduce students to different types of sensors.
5. To impart knowledge of geographical information system.
6. To introduce students to the types of satellites.

| <b>Unit I/<br/>Credit 1</b>  | <b>Photogeology and Remote Sensing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>No. of<br/>Hours:<br/>15</b> |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|                              | Elementary idea about photogeology: electro-magnetic spectrum, types & geometry of aerial photographs; factors affecting aerial photography; types of cameras, film, and filters; factors affecting scale; Fundamentals of remote sensing; remote sensing systems; remote sensing sensors; Significance in Geology – geomorphological features like lineaments, fractures, faults, folds, unconformities, and dykes; Igneous, sedimentary, and metamorphic terrain identification, delineation of economic mineral deposits |                                 |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                 |
| <b>Unit II/<br/>Credit 1</b> | <b>Photogeology and Remote Sensing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>No. of<br/>Hours:<br/>15</b> |
|                              | Types of Indian and Foreign Remote Sensing Satellites, Introduction to Digital image processing; fundamental steps in image processing; elements of pattern recognition and image classification. Introduction to Geographic Information System (GIS); components of GIS; integration of GIS with remote sensing.                                                                                                                                                                                                           |                                 |

**Books Recommended:**

1. Pandey, S.N., Principles and Application of Photogeology. Wiley Eastern, New Delhi. Sabbins, F.F., Remote Sensing – Principles and Applications. Freeman.
2. Siegal, B.S. and Gillespie, A.R., Remote Sensing in Geology. John Wiley.
3. Rampal K.K. Hand book of aerial photography and interpretation. Concept publication.
4. e-PG Pathshala: <https://epgp.inflibnet.ac.in/>

5. MOOCS - NPTEL: <https://nptel.ac.in/>
6. MOOCS - SWAYAM: <https://swayam.gov.in/>
7. National Digital Library of India: <https://ndl.iitkgp.ac.in/>
8. e-PG Pathshala: <https://epgp.inflibnet.ac.in/>
9. MOOCS - NPTEL: <https://nptel.ac.in/>
10. MOOCS - SWAYAM: <https://swayam.gov.in/>
11. National Digital Library of India: <https://ndl.iitkgp.ac.in/>

## T.Y. B. Sc (GEOLOGY) SEMESTER V

### MAJOR COURSE – Practical DSC Practical - V

#### Course Title: Practicals Based on Major Subjects IX, X

[ CREDITS – 04; Practicals – 60 hours; PRACTICAL/WEEK – 04]

#### Engineering Geology & Photogeology and Remote Sensing

#### Major P V (a) and (b)- 2 Credits for each

##### Learning Objectives:

1. Study of different soil types.
2. Learn to prepare engineering maps.
3. To study aerial photographs.
4. To determine the scale of photograph.

|                                   |                                                                                                                                                                                        |                                     |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Unit I:<br/>Credit<br/>02</b>  | <b>Major P V (a) Engineering Geology</b>                                                                                                                                               | <b>No. of Hours:<br/>30 (15+15)</b> |
|                                   | Preparation and study of engineering geological maps; Preparation of maps showing soil types of India, Computation of Index properties of rocks., Computation of RQD, RSR, RMR and 'Q' |                                     |
| <b>Unit II:<br/>Credit<br/>02</b> | <b>Major P V (b) Photogeology and Remote Sensing</b>                                                                                                                                   | <b>No. of Hours:<br/>30 (15+15)</b> |
|                                   | Photogeology and Remote sensing- Study of aerial photographs, Determination of scale of photograph by comparison with toposheet; Study of imageries                                    |                                     |

**T.Y. B.Sc. (GEOLOGY) SEMESTER V**

**MAJOR COURSE I – Elective (any one of the two)**

**DSE- Course Title: Indian Stratigraphy**

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

**Learning Objectives:**

1. To introduce the students to stratigraphy.
2. To introduce the students to various principles of stratigraphy.
3. To impart knowledge about various physiographic divisions.
4. To introduce students to different successions.

| <b>Unit I/<br/>Credit 1</b>  | <b>Stratigraphy</b>                                                                                                                                                                                                                                                                                         | <b>No. of<br/>Hours: 15</b> |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                              | Definition, Principle of stratigraphy- stratigraphic correlation, Concepts of Uniformitarianism and catastrophism; Geological Time Scale and stratigraphic classification; Physiographic division of India<br>Study of following Precambrian succession: Dharwar, Cuddapah, Vindhyan and Delhi Supergroups; |                             |
|                              |                                                                                                                                                                                                                                                                                                             |                             |
| <b>Unit II/<br/>Credit 1</b> | Brief idea of Palaeozoic succession of northwestern Himalaya; Brief idea of Mesozoic succession: Triassic of Spiti; Jurassic of Kutch; Cretaceous of Tiruchirapalli, Study of following type localities: Gondwana with flora and fauna; Deccan Volcanic Province                                            | <b>No. of<br/>Hours: 15</b> |

**Books Recommended:**

1. Wadia, D. Geology of India. Mc Graw Hill Book co.
2. Krishnan, M.S., Geology of India and Burma, 6th Edition. CBS Publ.
3. Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley
4. Ramakrishnan, M. & Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.
5. Valdiya, K. S. (2010) The making of India, Macmillan India Pvt. Ltd.
6. Schoch, R.M. 1989. Stratigraphy, Principles and Methods. VanNostrand Reinhold.

**T.Y. B.Sc. (GEOLOGY) SEMESTER V**

**MAJOR COURSE I – Elective**

**DSE- Course Title: Fuel Geology**

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

1. To introduce the students to fuel geology.
2. To introduce the students to various fundamentals of coal.
3. To impart knowledge about origin of petroleum.
4. To introduce students to different types and attributes of reservoir rocks.

| <b>Unit I/<br/>Credit 1</b>  | <b>Fuel Geology</b>                                                                                                                                                                                                                                                                                                                                                                                                 | <b>No. of<br/>Hours: 15</b> |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                              | Definition and origin of Coal, Basic classification of coal<br>Fundamentals of Coal Petrology - Introduction to lithotypes,<br>micro lithotypes and macerals in coal,<br>Proximate and Ultimate analysis, Coal Bed<br>Methane<br>(CBM): global and Indian scenario, Underground coal<br>gasification, Coal liquefaction                                                                                             |                             |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |
| <b>Unit II/<br/>Credit 1</b> | Petroleum, Origin of petroleum, Maturation of kerogen;<br>Biogenic and Thermal effect, Petroleum Reservoirs and<br>Traps, Reservoir rocks: general attributes and petrophysical<br>properties. Classification of reservoir rocks - clastic and<br>chemical. Hydrocarbon traps, Classification of<br>hydrocarbon traps - structural, stratigraphic and<br>combination, Cap rocks - definition and general properties | <b>No. of<br/>Hours: 15</b> |

**Books Recommended:**

1. Chandra D. (2007). Chandra's Textbook on applied coal petrology. Jijnasa Publishing House.
2. Shelly R. C. (2014). Elements of Petroleum geology: Third Edition, Academic Press
3. Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.
4. Bastia, R., & Radhakrishna, M. (2012). Basin evolution and petroleum prospectivity of the continental margins of India (Vol. 59). Newnes

**T.Y. B. Sc (GEOLOGY) SEMESTER V**

**MAJOR COURSE – Practical DSE Practical - V**

**Course Title: Practicals Based on Major elective  
(any one of the two)**

[ CREDITS – 02; Practicals – 30 hours; PRACTICAL/WEEK – 02]

**Learning Objectives:**

1. Study of stratigraphic units of India.
2. To study petrology of different stratigraphic units.
3. To estimate coal reserve.
4. To estimate hydrocarbon prospect.

|                                          |                            |                             |
|------------------------------------------|----------------------------|-----------------------------|
| <b>Unit I &amp;<br/>II Credit<br/>02</b> | <b>Indian Stratigraphy</b> | <b>No. of Hours:<br/>30</b> |
|------------------------------------------|----------------------------|-----------------------------|

|                                       |                                                                                                                                                                      |                             |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                                       | 1. Study of geological map of India and identification of major stratigraphic units.<br>2. Study of rocks in hand specimens from known Indian stratigraphic horizons |                             |
| <b>Unit I &amp; II:<br/>Credit 02</b> | <b>Fuel Geology</b>                                                                                                                                                  | <b>No. of Hours:<br/>30</b> |
|                                       | 1. Study of hand specimens of coal, Reserve estimation of coal.<br>2. Section correlation and identification of hydrocarbon prospect, Panel and Fence diagrams       |                             |

**T.Y. B. Sc (GEOLOGY) SEMESTER V**

**VSC II -Practical**

**Course Title: paleontology**

**Course Title: Practicals Based on VSC II**

[ CREDITS – 02; Practicals – 30 hours; PRACTICAL/WEEK – 02]

**paleontology**

**Learning Objectives:**

1. Study of different types of fossils.
2. Study of classification and morphology of different phyla.
3. Study of various modes of preservation of fossils.

|                               |                                                                                                                                                      |                             |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Unit I:<br/>Credit 01</b>  | <b>paleontology</b>                                                                                                                                  | <b>No. of Hours:<br/>15</b> |
|                               | Morphological characters, systematic position, and age of fossil genera pertaining to brachiopods, pelecypods, cephalopods, trilobite, and Echinoid. |                             |
| <b>Unit II:<br/>Credit 01</b> | <b>Paleontology</b>                                                                                                                                  | <b>No. of Hours:<br/>15</b> |
|                               | vertebrate and plant fossils, Study of fossils showing various modes of preservation                                                                 |                             |

**Books Recommended:**

1. Swinerton, HH.,. Outlines of paleontology. Edward Arnold Publishers
2. Jain, P.C. & Anantharaman, M.S., paleontology: Evolution & Animal Distribution. Vishal Publ.
3. Lehmann, U. Fossil Invertebrate. Cambridge Univ. Press.
4. Rastogi, Organic evolution. Kedarnath and Ramnath Publ.
5. Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of paleontology
6. Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing.
7. Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.
8. Shukla, A. C., & Misra, S. P. (1975). Essentials of paleobotany. Vikas Publisher
9. Armstrong, H. A., & Brasier, M.D. (2005) Microfossils. Blackwell Publishing.

**SEMESTER – V****T.Y. B. Sc (GEOLOGY) SEMESTER V****Open Elective-V (Theory)****Course Title: Urban Geology**

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

**Learning Objectives:**

1. To understand the scope, application, and importance of Urban Geology.
2. To understand in situ geology, terrain which will help in development, planning, and management of urban areas.
3. Acquaint the students with availability of surface water and groundwater in an urban area.
4. To impart knowledge regarding the geological hazards like floods, Earthquakes, landslides, Volcanic activity in the urban areas.
5. To make aware the students about effects of anthropogenic activities and environmental issues in the urban areas.

| <b>Unit I/<br/>Credit 1</b> | <b>Geology and Society</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of<br/>Hours: 15</b> |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                             | 1. Introduction to Urban Geology – Necessity of Geology in Urban life<br>2. Study of geology and geomorphology of urban domains in understanding the terrain and Land Use/Land Cover (LULC) of the cities<br>3. Urban Land Use – <ol style="list-style-type: none"> <li>a. Geotechnical site characterization</li> <li>b. Geotechnical and land-use mapping</li> <li>c. Geological problems in construction of underground structures in urban areas</li> <li>d. Urban Tunnelling – Tunnelling for road and rail in urban areas, importance of Geology</li> </ol> |                             |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                              | 4. Geology and Urban Agriculture <ul style="list-style-type: none"> <li>a. Soil Studies</li> <li>b. Chemistry and geochemistry of soil in relation to groundwater and fertilizers</li> <li>c. Effects of pollutants on vegetable contamination</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |
| <b>Unit II/<br/>Credit 1</b> | <b>Urban Water and Waste</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>No. of<br/>Hours: 15</b> |
|                              | 1. Urban Water - <ul style="list-style-type: none"> <li>a. Introduction</li> <li>b. Source of water, Standards for various uses of water</li> <li>c. Water-logging in built-up areas</li> <li>d. Sources of contamination</li> <li>e. Treatment of waste waters</li> <li>f. Groundwater surveys and resource development</li> </ul> 2. Urban Wastes – <ul style="list-style-type: none"> <li>a. Geotechnical characterization for waste sites</li> <li>b. Domestic waste, Industrial waste, Mine drainage, Power production waste, Radioactive waste</li> <li>c. Need for special purpose mapping for selection of waste disposal sites</li> </ul> 3. GIS in Urban Geology – <ul style="list-style-type: none"> <li>a. GIS – An Introduction</li> <li>b. Application of GIS in Urban development</li> <li>c. Application of GIS in Land-use</li> <li>d. Application of GIS in Groundwater exploration</li> </ul> 4. Precautions in Urban Planning – <ul style="list-style-type: none"> <li>a. Precautions from Seismic hazards</li> <li>b. Precautions from Floods</li> <li>c. Precautions from Landslides</li> <li>d. Precautions from Volcanic activity</li> </ul> |                             |

**Books recommended:**

1. Urban Geology – Philip Carvalho, Discovery Publishing House
2. Town Geology – Charles Kingsley, Good Press
3. Urban Geology – Peter Huggenberger and Tannis Epling, Springer
4. Principles of Engineering Geology – K.M. Bangar, Standard Publishers Distributors
5. Modelling the Underground Infrastructure of Urban Environments – Nataliya Pankratova and Hanadi Haiko, Springer
6. Engineering Geology for Society and Territory (Vol. 5) – Giorgio Lollino and Andrea Manconi, Springer
7. Environmental Geology and Sustainability: Risk mitigation in Urban areas – Daniel T. Rogers, CRC Press

## **SEMESTER – V**

### **T.Y. B. Sc (GEOLOGY) SEMESTER V**

#### **OJT – 4 credits**

Unit 1: On site visit & to study various geotechnical aspects related to the project site. Orientation of Topographic sheet in field, marking location in toposheet, Bearing (Front and back). Concepts of map reading, Distance, height

Unit 2: Identification of rock types in field; structures and texture of rocks

Unit 3: Basic field measurement techniques: Bedding dip and strike

Unit 4: Reading contours and topography Orientation of Topographic sheet in field, marking location in toposheet, Bearing (Front and back). Concepts of map reading, Distance, height

## **SEMESTER – VI**

### **T.Y. B. Sc (GEOLOGY) SEMESTER VI**

#### **MAJOR COURSE – DSC – XI**

#### **Course Title: Prospecting and Mining Geology**

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

#### **Learning Objectives:**

1. To introduce students to an important discipline of prospecting and mining geology.
2. To introduce students to different concepts in mining geology.
3. To introduce students to different geophysical methods of prospecting.
4. To impart knowledge about environmental issues related with mining.

| <b>Unit I/<br/>Credit 1</b>  | <b>Prospecting and Mining Geology</b>                                                                                                                                                                                                                                      | <b>No. of Hours: 15</b> |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
|                              | Prospecting; Elementary idea of geological and geophysical prospecting.<br>Electrical methods, Magnetic Methods, Seismic Methods, Gravity Methods<br>Mineral Exploration – Sampling Methods- Random sampling, grab sampling, Coning, and Quartering, Pitting and Trenching |                         |
| <b>Unit II/<br/>Credit 2</b> | Elementary idea of mining – Winning, Shaft, Hanging Wall, Adit, Drift, Level, Cross cut, Tunnel, raise Winze, Ore Basin, Chute, Stope, Air Crossing; Open cast and Underground mining. Environmental considerations for mining,                                            | <b>No. of Hours: 15</b> |

### Books Recommended:

1. Valdiya, K.S., Environmental Geology – Indian Context. Tata McGraw Hill.
2. Rajendran S., Mineral Exploration: Recent Strategies.
3. Dobrin, M.B. & Savit, CH., Introduction to Geophysical Prospecting, McGraw-Hill.
4. Arogyaswamy, R.N.P., Courses in Mining Geology. Oxford and IBH Publ.
5. Parasins, D.S., Principles of applied geophysics. Chapman Hall.
6. Readman, J.H., Techniques in Mineral exploration. Applied Science Publishers.
7. e-PG Pathshala: <https://epgp.inflibnet.ac.in/>
8. MOOCS - NPTEL: <https://nptel.ac.in/>
9. MOOCS - SWAYAM: <https://swayam.gov.in/>
10. National Digital Library of India: <https://ndl.iitkgp.ac.in/>
11. Shivaji University Library (E-Resources): <http://www.unishivaji.ac.in/library/E-Resources>

## SEMESTER – VI

### T.Y. B. Sc (GEOLOGY) SEMESTER VI

### MAJOR COURSE – DSC – XII

#### Course Title: Geomorphology

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

#### Learning Objectives:

1. To introduce students to an important discipline of geomorphology.
2. To introduce students to different cycles in geomorphology.
3. To introduce students to different geophysical methods of prospecting.
4. To impart knowledge about environmental issues related with mining.

| Unit I/<br>Credit 1  | Geomorphology                                                                                                                                                                   | No. of Hours: 15 |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                      | Basic Concepts of Geomorphology, Slope – geometric properties and classification, geomorphological cyclic concept, Geomorphic erosion cycle of W.M. Davis, Penck and C.L. King; |                  |
| Unit II/<br>Credit 2 | Epigenic/exogenic processes: degradation and aggradation. Hypogene/endogenic processes; Geological work of wind, glacier, river, underground water, and ocean.                  | No. of Hours: 15 |

### Books Recommended:

1. Allen, P., 1997. Earth Surface Processes. Blackwell

2. Bloom, A.L., 1998. Geomorphology: A systematic Analysis of Late Cenozoic Landforms (3rd Edition). Pearson Education, Inc.
3. . Kale, V.S. and Gupta, A., 2001. Introduction to Geomorphology. Orient Longman Ltd.
4. Patwardhan, A. M., 1999. The Dynamic Earth System. Prentice Hall.
5. Summerfield, M.A., 2000. Geomorphology and Global tectonic. Springer Verlag.
6. WD Thornbury, 2002. Principles of Geomorphology. CBS Publ. New Delhi.
7. Savindar Singh; Principles of Geomorphology.
8. e-PG Pathshala: <https://epgp.inflibnet.ac.in/>
9. MOOCS - NPTEL: <https://nptel.ac.in/>
10. MOOCS - SWAYAM: <https://swayam.gov.in/>
11. National Digital Library of India: <https://ndl.iitkgp.ac.in/>
12. Shivaji University Library (E-Resources): <http://www.unishivaji.ac.in/library/E-Resources>

## T.Y. B. Sc (GEOLOGY) SEMESTER VI

### MAJOR COURSE – Practical DSC Practical - VI

#### Course Title: Practicals Based on Major Subjects XI and XII

[ CREDITS – 04; Practicals – 60 hours; PRACTICAL/WEEK – 04]

Paper XI and XII: **Prospecting and Mining Geology & Geomorphology**

**Major P VI (a) and (b)- 2 Credits for each**

#### Learning Objectives:

1. To make students aware about the distribution of water zones in India.
2. To impart knowledge of preparation of water table maps.
3. To introduce students the climatic zones of India.
4. To introduce students the earthquake zones of India.
5. To make students able to interpret the wind patterns.

|                               |                                                                                                                                                                                                                |                                     |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Unit I:<br/>Credit 02</b>  | <b>Major P VI (a) Prospecting and Mining Geology</b>                                                                                                                                                           | <b>No. of Hours:<br/>30 (15+15)</b> |
|                               | Study of ore minerals, Determination, and evaluation of ores in mines, Identification of anomaly, Concept of weighted average in anomaly detection                                                             |                                     |
| <b>Unit II:<br/>Credit 02</b> | <b>Major P VI (b) Geomorphology</b>                                                                                                                                                                            | <b>No. of Hours:<br/>30 (15+15)</b> |
|                               | Drainage Basin Analysis by Strahler's method- Stream number, Stream Length, Basin area, Basin area ratio, Drainage density, and Bifurcation ratio; Identification of geomorphological features from toposheets |                                     |

T.Y. B.Sc. (GEOLOGY) SEMESTER VI

**MAJOR COURSE I – Elective (any one of the two)**

**Course Title: Dynamics of Earth**

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

**Learning Objectives:**

1. To introduce an important discipline of Earth Sciences
2. To introduce the students to the concepts and processes related with earth.
3. To introduce the students to different types of mountains.
4. To impart knowledge regarding the tectonic framework of India.

| Unit I/<br>Credit 1  | Dynamics of Earth                                                                                                                                                                                               | No. of<br>Hours: 15 |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|                      | Earth as a dynamic system, Crustal movement, Types of Mountains; Concepts of eustasy, Concepts of isostasy Continental drift, Sea-floor spreading and mid-oceanic ridges.                                       |                     |
| Unit II/<br>Credit 1 | Paleomagnetism and its application; Plate Tectonics: the concept, plate margins, deep sea trenches, island arcs, and volcanic arcs; Hot spots and Mantle plumes, Triple Junctions; Tectonic Framework of India. | No. of<br>Hours: 15 |

**Books Recommended:**

1. Keary, P. and Vine, F.J., 1997. Global Tectonics. Blackwell and crustal evolution. Butterworth-Heinemann.
2. Moores, E and Twiss. R.J., 1995. Tectonics. Freeman.
3. Patwardhan, A. M., 1999. The Dynamic Earth System. Prentice Hall.
4. Valdia, K.S., 1988. Dynamic Himalaya. Universities Press, Hyderabad.
5. e-PG Pathshala: <https://epgp.inflibnet.ac.in/>
6. MOOCS - NPTEL: <https://nptel.ac.in/>
7. MOOCS - SWAYAM: <https://swayam.gov.in/>
8. National Digital Library of India: <https://ndl.iitkgp.ac.in/>
9. Shivaji University Library (E-Resources): <http://www.unishivaji.ac.in/library/E-Resources>

T.Y. B.Sc. (GEOLOGY) SEMESTER VI

**MAJOR COURSE I – Elective**

**Course Title: Ocean Sciences**

[ CREDITS – 02; LECTURES – 30 hours; LEC/WEEK – 02]

**Learning Objectives:**

1. To introduce an important discipline of Earth Sciences
2. To introduce the students to the basic concepts of Oceanography and Marine Geology

3. To introduce the students to different Oceanic processes
4. To impart knowledge regarding tectonics at the ocean floor, Economic resources related to oceans
5. To make aware the students about the Marine Pollution

| <b>Unit I/<br/>Credit 1</b>  | <b>Oceanography</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of<br/>Hours: 15</b> |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                              | <ol style="list-style-type: none"> <li>1. Introduction to Oceanography and Marine Geology</li> <li>2. Physiographic divisions of oceans – Continental Shelf, Continental Slope, Deep Sea Plain and Ocean Deep</li> <li>3. Marine Sediments – Introduction, Importance, Sources, Composition, Distribution and Classification of marine sediments</li> <li>4. Physical Oceanography -<br/>Introduction, Pressure, Temperature and Density<br/>Ocean Salinity – Definition, Salinity Variations, Surface Salinity variation, Salinity variation with depth, Processes affecting Seawater salinity</li> <li>5. Ocean Circulations -<br/>Introduction<br/>Surface currents and Deep Currents<br/>Origin of Surface currents<br/>Components of Ocean Surface Circulation<br/>Indian Ocean Circulation<br/>Ocean Currents and Climate</li> </ol> |                             |
|                              | <b>Marine Geology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |
| <b>Unit II/<br/>Credit 1</b> | <ol style="list-style-type: none"> <li>1. Coast               <ol style="list-style-type: none"> <li>a. Definition</li> <li>b. Beach – Definition, Beach Terminology, movement of sand on the beach</li> <li>c. Erosional features on the coast</li> <li>d. Depositional features on the coast</li> <li>e. Types of coasts</li> <li>f. Conservation methods of the coast</li> </ol> </li> <li>2. Marine Pollution               <ol style="list-style-type: none"> <li>a. Introduction</li> <li>b. Causes of Marine Pollution – Oil Spills, Offshore drilling, Maritime transport, Atmospheric deposition of pollutants, Pollution due to land- based activities like urban sewage including non-degradable materials, industrial chemicals, Agricultural run-off</li> <li>c. Effects of Marine Pollution</li> </ol> </li> </ol>           | <b>No. of<br/>Hours: 15</b> |

**Books Recommended:**

1. Webb P. (2023) – Introduction to Oceanography, Rebus Community
2. Charles Jones – Introduction to Oceanography, Kruger Brentt Publisher
3. A. P. Trujillo and H.V. Thurman – Essentials of Oceanography, Xth Ed, PHI Learning Pvt. Ltd.
4. Savinder Singh (2015) – Oceanography, Pravalika Publications
5. J.A. Knauss - Introduction to Physical Oceanography, Waveland Pr. Inc
6. E. Seibold, W.H. Berger – The Sea Floor: An Introduction to Marine Geology, Springer
7. Woodroffe C.D. (2013) – Coast: Form, Process and Evolution, Cambridge University Press
8. Dronkars J. (2005) – Dynamics of Coastal System, World Scientific
9. Stewart R. H. (2000) – Introduction to Physical Oceanography
10. Kenneth J. (1982) – Marine Geology and Geophysics

### T.Y. B. Sc (GEOLOGY) SEMESTER VI

#### MAJOR COURSE – Practical DSC Practical - VI

#### Course Title: Practicals Based on Major elective (any one of the two)

[ CREDITS – 02; Practicals – 30 hours; PRACTICAL/WEEK – 02]

#### Learning Objectives:

#### Learning Objectives:

1. Study of hot spots and hot plumes.
2. Study of classification of mountain ranges.
3. Study of physiographic divisions of oceans.

| <b>Unit I &amp; II:<br/>Credit 02</b> | <b>Dynamics of Earth</b>                                                                                                                                                                                                                                                                                                                    | <b>No. of Hours:<br/>30</b> |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                                       | <ol style="list-style-type: none"> <li>1. Study of world map and showing hot spots and hot plumes in the map.</li> <li>2. Describe and demarcate tectonic plates in the world map.</li> <li>3. Plot and describe types of mountains in the world map.</li> <li>4. Describe and demarcate tectonic divisions in the map of India.</li> </ol> |                             |
| <b>Unit I &amp; II:<br/>Credit 02</b> | <b>Ocean Sciences</b>                                                                                                                                                                                                                                                                                                                       | <b>No. of Hours:<br/>30</b> |
|                                       | <ol style="list-style-type: none"> <li>1. Plotting of physiographic divisions of ocean.</li> <li>2. Salinity determination problems.</li> <li>3. Determination of temperature, pressure and density of sea water.</li> </ol>                                                                                                                |                             |

|  |                                              |  |
|--|----------------------------------------------|--|
|  | 4. Study of erosional features on the coast. |  |
|--|----------------------------------------------|--|

**T.Y. B. Sc (GEOLOGY) SEMESTER VI**

**VSC III - Practical**

**Course Title: Economic Geology**

**Course Title: Practicals Based on VSC**

[ CREDITS – 02; Practicals – 30 hours; PRACTICAL/WEEK – 02]

**Economic Geology**

**Learning Objectives:**

1. Study of different ores and economic minerals.
2. Study of distribution of important mineral deposits.
3. To study coal and oil fields.

|                                  |                                                                                                    |                             |
|----------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Unit I:<br/>Credit<br/>01</b> | <b>Economic Geology</b>                                                                            | <b>No. of Hours:<br/>15</b> |
|                                  | Study of ore and economic minerals in hand specimen, Map of Important coal and oil fields of India |                             |
|                                  |                                                                                                    |                             |
| <b>Unit I:<br/>Credit<br/>01</b> | <b>Economic Geology</b>                                                                            | <b>No. of Hours:<br/>15</b> |
|                                  | Preparation of maps showing distribution of important metallic and non- metallic deposits;         |                             |

**Books Recommended:**

1. Brown, C. and Dey, A.K.; Indian Mineral Wealth. Oxford Univ.
1. Gokhale, K.V.G.K. and Rao, T.C., Ore Deposits of India. East West Press Pvt. Ltd.
4. Jense, M.L. and Bateman A.M., Economic Mineral Deposits. John Wiley and Sons.
5. Krishnaswamy, S., India's Minerals Resources. Oxford and IBH Publ.
6. Deb, S., Industrial minerals, and Rocks of India. Allied Publishers Pvt. Ltd.
7. Umeshwar Prasad, Economic Geology. CBS Publishers and distributors.

**SKILL ENHANCEMENT COURSE – III (SEC – III)**

**COURSE TITLE: Soil Mechanics- Theory**

Credits: 02      Lectures: 30      Lectures/week: 02

**Objectives of the Course:**

1. To understand the different types of soil.
2. To study the characteristics of soil.
3. To study the different Soil parameters.
4. To study soil conservation techniques.
5. To impart knowledge regarding the importance of Soil Cover in Engineering Geology

**Course Learning Outcomes:**

1. Students will understand the importance of soil Management.
2. Students will understand technical measures for soil erosion.

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Credit<br>1 | <b>Introduction</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | No. of Lectures 15 |
|             | <ol style="list-style-type: none"><li>1. Definition of Soil; Soil Profile</li><li>2. Soil Forming Processes (Residual and Transported)<ol style="list-style-type: none"><li>a. Physical Weathering</li><li>b. Chemical Weathering</li><li>c. Additions, Losses, Transformations, Translocations</li><li>d. Factors influencing Soil Formation</li></ol></li><li>3. Soil Identification methods (wet shaking, rolling)</li><li>4. Classification System of Soils – BIS (Indian Standard) and Unified Soil Classification System (USCS)</li><li>5. Constituents of Soils (gravel, sand, silt, clay), clay mineralogy</li><li>6. Soil structure, fabric, and particle interaction</li><li>7. Permeability and Seepage</li><li>8. Darcy's law, Coefficient of Permeability (constant head and falling head tests)</li></ol> |                    |
| Credit<br>2 | <b>Soil Characteristics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No. of Lectures 15 |
|             | <ol style="list-style-type: none"><li>1. Soil Compaction<ol style="list-style-type: none"><li>a. Proctor Compaction</li><li>b. Lab Tests</li><li>c. Field methods</li><li>d. Factors affecting compaction, zero air void line</li></ol></li><li>2. Phase Relations and Index properties<ol style="list-style-type: none"><li>a. Phase diagrams (2-phase, 3-phase)</li><li>b. Definitions (void ratio, porosity, water content, degree of saturation)</li></ol></li></ol>                                                                                                                                                                                                                                                                                                                                                |                    |

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|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <ul style="list-style-type: none"> <li>c. Index Properties: Specific Gravity, Grain size Distribution, Atterberg Limits (LL, PL, SL)</li> </ul> <p>3. Stress Distribution and Settlement</p> <ul style="list-style-type: none"> <li>a. Principles of Effective Stress (Terzaghi), Capillarity, Seepage force</li> <li>b. Stress Distribution theories (Boussinesq, Westergaard)</li> </ul> <p>4. Shear Strength of Soils</p> <ul style="list-style-type: none"> <li>a. Mohr-Coulomb failure Theory, effective and total stress parameters</li> <li>b. Lab tests: Unconfined Compression Test (UCT), Direct Shear Test, Triaxial Test (UU, CU, CD)</li> </ul> <p>5. Slope Stability:</p> <ul style="list-style-type: none"> <li>a. Infinite and finite slopes, Factor of Safety (FOS)</li> </ul> <p>6. Earth Pressure Theories</p> <ul style="list-style-type: none"> <li>a. Rankine's theory, Coulomb theory, Culmann's graphical method</li> <li>b. Earth pressure on retaining walls, Layered soils</li> </ul> <p>7. Introduction to Foundation Engineering</p> <ul style="list-style-type: none"> <li>a. Bearing capacity, shallow/deep foundations, pile foundations</li> </ul> |  |
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**Books recommended:**

1. A Laboratory Manual on Soil Mechanics: Testing and Interpretation – Ravi Kumar Sharma, Tech Sar Pvt. Ltd.
2. Basic and Applied Soil Mechanics – Gopal Ranjan, New Age International Pvt. Ltd.
3. Soil Mechanics and Foundation Engineering – B.N.D. Narasinga Rao, Wiley
4. Basic Introduction of Soil Science – Guru Dayal
5. The Nature and Properties of Soils – R.R. Weil and N.C. Brady, Wiley India Pvt. Ltd.
6. Fundamentals of Soil Science – H.D. Foth, Wiley India Pvt. Ltd.
7. Soil Genesis and Classification – S.W. Buol, Wiley Publication
8. Basics of Foundation Engineering – Akin C, Notion Press
9. Principles of Foundation Engineering – B.M. Das, Cengage Learning
10. Slope Stability and Liquefaction – Pijush Samui, Scriptum Publishing
11. The Engineering of foundations Slopes and Retaining Structures, 2<sup>nd</sup>, - Rodrigo Salgado, Taylor, and Francis

## Indian Knowledge System (IKS)- Theory

### COURSE TITLE: Gemstone and Gemology

Credit: 02    Lectures: 30    Lectures/Week: 02

#### Course Objectives:

1. To understand the fundamentals of various precious and semiprecious gemstones
2. To study and understand the formation of gemstones and gem materials
3. To understand the Geological association of gemstones
4. To study the different physical and optical properties of Gemstones
5. To study the different gem testing methods and instruments used in identification of gemstones
6. To understand the difference between natural and synthetic gems

#### Course Outcome:

1. Students will understand the importance of Indian Knowledge System
2. Students will understand the importance of gems and precious and semiprecious stones in industry.
- 3.

| Credit 1 | Introduction to Gemology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | No. of Lectures: 15 |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|          | <ol style="list-style-type: none"><li>1. Definition of gemstone</li><li>2. Origin and Occurrence of Gemstones</li><li>3. Formation –<ol style="list-style-type: none"><li>a. Geology related to gem minerals</li><li>b. Inorganic and Organic gemstones and semiprecious stones</li><li>c. Crystalline state and Crystalline materials</li><li>d. Crystal Lattice, Amorphous and Metamict minerals</li><li>e. Internal Growth (Twinning), Crystal surface markings, Crystalline features in important gemstones</li></ol></li><li>4. Physical properties of Gemstones like Hardness, Cleavage, Specific gravity</li><li>5. Optical Properties of Gemstones<ol style="list-style-type: none"><li>a. Visible spectrum in Electromagnetic spectrum</li><li>b. Transparency for gem identification, cutting and grading</li><li>c. Refraction and reflection, Birefringence</li><li>d. Special optical properties like Sheen, Opalescence, Adularescence, Iridescence, Asterism, Chatoyancy, Labradorescence</li></ol></li></ol> |                     |

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                     |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|          | <p>e. Colour in gemstones – colouring elements and causes of colour in gemstones</p> <p>6. 4 Cs of Gemstones</p> <p>7. Description of gem materials of organic origin</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     |
| Credit 2 | <b>Treatments on Gemstones and Instrumentation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | No. of Lectures: 15 |
|          | <p>1. Treatments – Heat Treatment, Glass or fracture filling, Impregnation, Bleaching, Dyeing, Irradiation and Diffusion</p> <p>2. Gemstone Enhancement and its types</p> <p>3. Varieties of Gems –<br/>Chemical composition, Colour, Crystal system, Physical and optical properties, characteristic inclusions, geographical occurrence – Corundum, Beryl, Garnet, Feldspar, Silica, Tourmaline, Topaz, Spinel, Chrysoberyl, Diamond, Opaque gem varieties, Peridot, Kyanite, Iolite, Sphene, Zircon, apatite etc.</p> <p>4. Inclusions in gemstones – cause, optical effect, different inclusions in gemstones</p> <p>5. Synthesis processes – Different types of synthetics and their identification, Distinction and Identification of natural and synthetic stones</p> <p>6. Gem Testing Instruments – Hand lens (10X), Gemmological Microscope, Diamond Tester, UV Lamp, Chelsea Filter, Dichroscope, Polariscope, Gem-Testing Refractometer</p> |                     |

**Books recommended:**

1. Beginners Guide to Gemmology – P.G. Read, Butterworth-Heinemann Ltd.
2. Gems and Gem Industry in India – R.V. Karanth, Geological Society of India Publication
3. Gems: Their Sources, Descriptions, and Identification – R. Webster and B.W. Anderson, Butterworth-Heinemann Ltd.
4. Gem Testing, 10<sup>th</sup> ed., - B.W. Anderson, Butterworth-Heinemann Ltd.
5. Handbook of Gem Identification 12<sup>th</sup> ed., – R. Liddicoat, GIA, Santa Monica, CA
6. Gemstones of the World, 5<sup>th</sup> ed., - W. Schumann, Sterling New York

### Modality of Assessment

Students appearing for the NEP B. Sc III Geology will be evaluated as per the 80: 20 schemes, wherein the term end exam will be of 80 marks while 20 marks will be through internal Evaluation

#### I. THEORY

##### A. Internal Assessment: 20%

| Sr. No. | Evaluation Type                                                                                                                                                                                                                                                            | Marks 15 |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1.      | Evaluation Modalities:<br>1. Two Assignments per paper covering the whole paper syllabus and can include:<br>a. Essay Type Questions<br>b. Objective Questions<br>c. Problem Solving<br>d. Figure based Questions<br>2. Two Tests per paper cover the whole paper syllabus | 10       |
| 2.      | 1. Participation in Group Discussions/Debates related to the subject<br>2. Participation in Workshops/Seminars/ Poster Presentation competitions<br>3. Participation in Exhibitions<br>4. Attendance in the Class-room                                                     | 05       |
| 3.      | 1. Study Tour Participation*                                                                                                                                                                                                                                               | 05       |

\* Study Tour is Compulsory for all students. The students will have to submit a tour report after the successful completion of the tour.

##### B. External Assessment: 80%

- Semester End Theory assessment is of 40 marks for each paper separately
- Duration of each Theory paper will be of 1.30 hours or 90 minutes
- Question paper will cover all the units of the syllabus
- Question paper will have three questions which are compulsory
- Question No. 1 will be of objective type and will be of 8 marks
- Question No.2 will be of subjective type with internal choice and will be of 16 marks
- Question No. 3 will be notes or brief answers with internal choice and will be of 16 marks

#### II. PRACTICAL EXAMINATION PATTERN

- Practical Examination will be held at the end of each semester
- Practical will be of one day duration and of six-hour duration
- Practical will be of 100 marks each
- Practical Journal is compulsory for the practical

| Particulars                 | 2 Credit Course | Duration |
|-----------------------------|-----------------|----------|
| 1. Semester-end Examination | 40 Marks        | 1.5 hrs. |
| 2. Internal Assessment      | 10 Marks        | 1 hr.    |
| Total marks for each course | 50 Marks        | --       |

**Semester V**

| <b>Practical Course</b>                 | <b>Marks 45</b>                  | <b>Journal Marks</b> | <b>Total Marks</b> |
|-----------------------------------------|----------------------------------|----------------------|--------------------|
| DSC Practical I<br>a + b                | Based on Papers DSC 9 and DSC 10 | 05                   | 100                |
| Major Course<br>Elective<br>Practical I | Based on Major elective          | 10                   | 40                 |
| VSC practical                           | Based on VSC II                  | 10                   | 40                 |

**Semester VI**

| <b>Practical Course</b>                 | <b>Marks 45</b>                   | <b>Journal Marks 10</b> | <b>Total Marks</b> |
|-----------------------------------------|-----------------------------------|-------------------------|--------------------|
| DSC Practical II<br>a + b               | Based on Papers DSC 11 and DSC 12 | 05                      | 100                |
| Major Course<br>Elective<br>Practical I | Based on Major elective           | 10                      | 40                 |
| VSC practical                           | Based on VSC III                  | 10                      | 40                 |
|                                         |                                   | Tour report-05          |                    |