|  |
| --- |
| B.Sc.,Geology |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|

|  |
| --- |
| **SYLLABUS** |
|  |
|  |
| **from the academic year****2023-2024** |

 |
|  |
|  |
|  |
| r |
|  |
|  |
|  |
| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005** |
|  |

**Contents**

1. Semester Index.
2. Subjects – Core, Elective, Nonmajor, Skill Enhanced, Ability Enhanced, Extension Activity, Environment, Professional Competency
3. Course Lesson Box
4. Course Objectives
5. Units
6. Learning Outcome
7. Refence and Text Books
8. Web Sources
9. PO Mapping tables

|  |
| --- |
| **LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME** |
| **Programme:** | **B.Sc. GEOLOGY** |
| **Programme Code:** |  |
| **Duration:** | **3 Years (UG)** |
| **Programme Outcomes:** | **PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study**PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.**PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one’s learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.**PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation**PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team**PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.**PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one’s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.**PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling. |
| **Programme Specific Outcomes:** | On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to:**PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.**PSO2: Critical Thinking:** Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively**PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.**PSO4: Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.**PSO5: Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.**PSO6: Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** |
| **PO1** |  |  |  |  |  |  |
| **PO2** |  |  |  |  |  |  |
| **PO3** |  |  |  |  |  |  |
| **PO4** |  |  |  |  |  |  |
| **PO5** |  |  |  |  |  |  |
| **PO6** |  |  |  |  |  |  |

**2. Highlights of the Revamped Curriculum**:

* Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
* The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
* The General Studies and Statistics based problem solving skills are included as mandatory components in the ‘Training for Competitive Examinations’ course at the final semester, a first of its kind.
* The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
* The Statistical Quality Control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
* The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
* Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
* State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest DBMS and Computer software for Analytics.

**Value additions in the Revamped Curriculum:**

|  |  |  |
| --- | --- | --- |
| **Semester** | **Newly introduced Components** | **Outcome / Benefits** |
| **I** | **Foundation Course**To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Literature and analysing the world through the literary lensgives rise to a new perspective. | * Instill confidence among students
* Create interest for the subject
 |
| **I, II, III, IV** | **Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial) | * Industry ready graduates
* Skilled human resource
* Students are equipped with essential skills to

make them employable |
| * Training on language and communication skills enable the students gain

knowledge andexposure in the competitive world. |
| * Discipline centric skill will improve the Technical knowhow of solving real life

problems. |
| **III, IV, V & VI** | Elective papers | * Strengthening the domain knowledge
* Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature
* Emerging topics in higher education/ industry/ communication network / health sector etc. are introduced with

hands-on-training. |

|  |  |  |
| --- | --- | --- |
| **IV** | Elective Papers | * Exposure to industry moulds students into solution providers
* Generates Industry ready graduates
* Employment opportunities enhanced
 |
| **V Semester** | Elective papers | * Self-learning is enhanced
* Application of the concept to real situation is conceived resulting

in tangible outcome |
| **VI Semester** | Elective papers | * Enriches the study beyond the course.
* Developing a research framework and

presenting theirindependent andintellectual ideas effectively. |
| **Extra Credits:****For Advanced Learners / Honors degree** | * To cater to the needs of peer learners / research

aspirants |
| **Skills acquired from the Courses** | Knowledge, Problem Solving, Analyticalability, Professional Competency, Professional Communication and Transferrable Skill |

**Credit Distribution for UG Programmes**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sem I** | **Credit** | **H** | **Sem II** | **Credit** | **H** | **Sem III** | **Credit** | **H** | **Sem IV** | **Credit** | **H** | **Sem V** | **Credit** | **H** | **Sem VI** | **Credit** | **H** |
| Part 1. Language – Tamil  | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | 5.1 Core Course –\CC IX  | 4 | 5 | 6.1 Core Course – CC XIII | 4 | 6 |
| Part.2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | 5.2 Core Course – CC X | 4 | 5 | 6.2 Core Course – CC XIV | 4 | 6 |
| 1.3 Core Course – CC I  | 5 | 5 | 2..3 Core Course – CC III  | 5 | 5 | 3.3 Core Course – CC V  | 5 | 5 | 4.3 Core Course – CC VII Core Industry Module  | 5 | 5 | 5. 3.Core Course CC -XI | 4 | 5 | 6.3 Core Course – CC XV | 4 | 6 |
| 1.4 Core Course – CC II | 5 | 5 | 2.4 Core Course – CC IV | 5 | 5 | 3.4 Core Course – CC VI | 5 | 5 | 4.4 Core Course – CC VIII | 5 | 5 | 5. 4.Core Course –/ Project with viva- voce CC -XII | 4 | 5 | 6.4 Elective -VII Generic/ Discipline Specific  | 3 | 5 |
| 1.5 Elective I Generic/ Discipline Specific  | 3 | 4 | 2.5 Elective II Generic/ Discipline Specific  | 3 | 4 | 3.5 Elective III Generic/ Discipline Specific  | 3 | 4 | 4.5 Elective IV Generic/ Discipline Specific  | 3 | 3 | 5.5 Elective V Generic/ Discipline Specific  | 3 | 4 | 6.5 Elective VIII Generic/ Discipline Specific  | 3 | 5 |
| 1.6 Skill Enhancement CourseSEC-1  | 2 | 2 | 2.6 Skill Enhancement CourseSEC-2  | 2 | 2 | 3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill) | 1 | 1 | 4.6 Skill Enhancement CourseSEC-6 | 2 | 2 | 5.6 Elective VI Generic/ Discipline Specific  | 3 | 4 | 6.6 Extension Activity | 1 | - |
| 1.7 Skill Enhancement -(Foundation Course) | 2 | 2 | 2.7 Skill Enhancement Course –SEC-3 | 2 | 2 | 3.7 Skill Enhancement Course SEC-5 | 2 | 2 | 4.7 Skill Enhancement Course SEC-7 | 2 | 2 | 5.7 Value Education  | 2 | 2 | 6.7 Professional Competency Skill | 2 | 2 |
|  |  |  |  |  |  | 3.8 E.V.S. | - | 1 | 4.8 E.V.S | 2 | 1 | 5.8 Summer Internship /Industrial Training | 2 |  |  |  |  |
|  | **23** | **30** |  | **23** | **30** |  | **22** | **30** |  | **25** | **30** |  | **26** | **30** |  | **21** | **30** |
| **Total – 140 Credits** |

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System**

**for all UG courses including Lab Hours**

**First Year – Semester-I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 |  Language – Tamil  | 3 | 6 |
| Part-2 |  English | 3 | 6 |
| Part-3 |  Core Courses & Elective Courses [in Total] | 13 | 14 |
| Part-4 |  Skill Enhancement Course SEC-1  | 2 | 2 |
| Foundation Course | 2 | 2 |
|  |  | **23** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language – Tamil | 3 | 6 |
| Part-2 |  English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-2  | 2 | 2 |
| Skill Enhancement Course -SEC-3 (Discipline / Subject Specific) | 2 | 2 |
|  |  | **23** | **30** |

**Second Year – Semester-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 |  English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-4 (Entrepreneurial Based) | 1 | 1 |
| Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) | 2 | 2 |
|  E.V.S  | - | 1 |
|  |  | **22** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 |  English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 13 |
| Part-4 | Skill Enhancement Course -SEC-6 (Discipline / Subject Specific) | 2 | 2 |
| Skill Enhancement Course -SEC-7 (Discipline / Subject Specific) | 2 | 2 |
|  E.V.S  | 2 | 1 |
|  |  | **25** | **30** |

**Third Year**

**Semester-V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based | 22 | 26 |
| **Part-4** | Value Education  | 2 | 2 |
| Internship / Industrial Visit / Field Visit | 2 | 2 |
|  |  | **26** | **30** |

**Semester-VI**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based & LAB | 18 | 28 |
| **Part-4** | Extension Activity | 1 | - |
| Professional Competency Skill | 2 | 2 |
|  |  | **21** | **30** |

**Consolidated Semester wise and Component wise Credit distribution**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parts**  | **Sem I** | **Sem II** | **Sem III** | **Sem IV** | **Sem V** | **Sem VI** | **Total Credits** |
| **Part I** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part II** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part III** | 13 | 13 | 13 | 13 | 22 | 18 | 92 |
| **Part IV**  | 4 | 4 | 3 | 6 | 4 | 1 | 22 |
| **Part V** | - | - | - | - | - | 2 | 2 |
| **Total** | 23 | 23 | 22 | 25 | 26 | 21 | **140** |

**\*Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

|  |
| --- |
| **Methods of Evaluation** |
| **Internal Evaluation** | Continuous Internal Assessment Test | 25 Marks |
| Assignments |
| Seminars |
| Attendance and Class Participation |
| **External Evaluation** | End Semester Examination | 75 Marks |
|  | Total | 100 Marks |
| **Methods of Assessment** |
| **Recall (K1)** | Simple definitions, MCQ, Recall steps, Concept definitions |
| **Understand/ Comprehend (K2)** | MCQ, True/False, Short essays, Concept explanations, Short summary oroverview |
| **Application (K3)** | Suggest idea/concept with examples, Suggest formulae, Solve problems,Observe, Explain |
| **Analyze (K4)** | Problem-solving questions, Finish a procedure in many steps, Differentiate |
|  | between various ideas, Map knowledge |
| **Evaluate (K5)** | Longer essay/ Evaluation essay, Critique or justify with pros and cons |
| **Create (K6)** | Check knowledge in specific or offbeat situations, Discussion, Debating orPresentations |

**Credit Distribution for all UG courses with LAB Hours**

**B.Sc., GEOLOGY**

**First Year : Semester-I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 |  Language - Tamil | 3 | 6 |
|  English | 3 | 6 |
| Part-3 | Core: General Geology and Crystallography | 5 | 5 |
| Geo-statistics - I | 5 | 5 |
| Part-2 | Allied Mathematics  | 3 | 4 |
| Part-4 |  Skill Enhancement Course SEC-1 (NME) | 2 | 2 |
| Foundation Course | 2 | 2 |
|  |  | **23** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 |  Language - Tamil | 3 | 6 |
|  English | 3 | 6 |
| Part-3 | Core: Crystallography Practical | 5 | 5 |
| Geo-statistics - II | 5 | 5 |
| Part-2 | Allied Chemsitry | 3 | 4 |
| Part-4 | Skill Enhancement Course -SEC-2 (NME) | 2 | 2 |
| Skill Enhancement Course -SEC-3 (Discipline / Subject Specific) | 2 | 2 |
|  |  | **23** | **30** |

**Second Year**

**Semester-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 |  Language - Tamil | 3 | 6 |
|  English | 3 | 6 |
| Part-3 | Core: Palaeontology | 5 | 5 |
| Core: Geomorphology and Geotectonics | 5 | 5 |
| Part-2 | Allied Physics - I | 3 | 4 |
| Part-4 | Skill Enhancement Course -SEC-4 (Entrepreneurial Based) | 1 | 1 |
| Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) | 2 | 2 |
|  E.V.S  | - | 1 |
|  |  | **22** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
|  English | 3 | 6 |
| Part-3 | Core: Structural Geology | 5 | 5 |
| Core: Structural Geology, Remote Sensing and Survey Practical | 5 | 5 |
| Part-2 | Allied Physics - II | 3 | 3 |
| Part-4 | Skill Enhancement Course -SEC-6 (Discipline / Subject Specific) | 2 | 2 |
| Skill Enhancement Course -SEC-7 (Discipline / Subject Specific) | 2 | 2 |
|  E.V.S  | 2 | 1 |
|  |  | **25** | **30** |

**Third Year**

**Semester-V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Stratigraphy  | 4 | 5 |
| Mineralogy | 4 | 5 |
| Igneous Petrology | 4 | 5 |
| Sedimentary and Metamorphology | 4 | 5 |
|  | Elective-V | 3 | 4 |
|  | Elective – VI | 3 | 4 |
| **Part-4** | Value Education  | 2 | 2 |
| Internship / Industrial Visit / Field Visit | 2 | - |
|  |  | **26** | **30** |

**Semester-VI**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Regional Geology | 4 | 6 |
| Economic Geology and Mineral Economics | 4 | 6 |
| Applied Geology | 4 | 6 |
| **MINERALOGY AND PETROLOGY PRACTICAL** | 3 | 5 |
| ECONOMIC GEOLOGY AND ORE ANALYSIS PRACTICAL | 3 | 5 |
| **Part-4** | Extension Activity | 1 | - |
| Professional Competency Skill | 2 | 2 |
|  |  | **21** | **30** |
|  | **Total Credits – 140** |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **GENERAL GEOLOGY AND CRYSTALLOGRAPHY** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | The main objective of this course is to enumerate the origin of Earth. |
| CO2 | To describe the concepts of Dating and internal structure of the Earth |
| CO3 | To explain various components of crystals and crystallography |
| CO4 | To study various class and forms of an crystal system. |
| CO5 | To determine various crystallographic properties of crystals with suitable examples.  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Universe – Evolution of the Universe – Stellar system – Milky Way Galaxy –Evolution of Galaxy. Solar System – Inner and outer planets – characteristics of solar system. Satellites – Asteroids – Meteors – comets. Earth – movements – revolution – rotation – solstice – equinox – time – GMT – IST. Atmosphere – Monsoon- El Nino – hydrosphere – lithosphere- Origin of the Earth – Nebular and Planetesimal hypothesis – Tidal & Vonweizacker’s hypothesis – merits and demerits of the above hypotheses | 12 | CO1 |
| II | Age of the Earth – old methods – new methods – Radioactivity – Half-life period – Radiometric methods – Uranium / Lead method – Rubidium / Strontium method – Lead / Lead method – Potassium/Argon -Carbon 14 method. Numerical methods in dating. Interior of the Earth – Density – Shape – Seismic waves – Composition and thickness of the crust, mantle and core. Discontinuities: Conrad Discontinuity – Mohorovicic Discontinuity – Weichert-Guttenberg Discontinuity | 12 | CO2 |
| III | Definition of crystal – Unit cell, Bravais Lattices, Plane groups, Point groups & Space groups - Crystallographic axes – Symmetry Elements – Division of crystals into systems and Point groups – Axial Ratio – Parameters – Indices – Miller Indices – Symbol – Hermann Mauguin notations –Law of Rational Indices – Forms – simple – combination – open – closed – unit – holohedral – hemihedral – tetrahedral – hemimorphic – enantiomorphous forms – Interfacial angle and its measurement with Contact Goniometer. Types of Goniometers | 12 | CO3 |
| IV | Study of common forms and combinations of the following systems and classes: Isometric System: Hexoctahedral, Diploidal, Hextetrahedral – Tetragonal System: Ditetragonal bipyramidal, Tetragonal bipyramidal, Tetragonal Pyramidal, Tetragonal Sphenoidal – Hexagonal System: Dihexagonal Bipyramidal, Hexagonal Bipyramidal Trigonal System – Ditrigonal Scalenohedral - Ditrigonal pyramidal, Trirhombohedral, Trigonal trapezohedral. | 12 | CO4 |
| V | Study of common forms and combinations of the following systems and classes: Orthorhombic System: Rhombic Bipyramidal, Rhombic pyramidal, Rhombic Disphenoidal – Monoclinic System: Prismatic – Triclinic System: Pinacoidal – Twinning in crystals – laws of twinning – types: contact, interpenetration, polysynthetic, repeated – important examples from six systems – Irregularities of crystals-An introduction to stereographic projection. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the origin of Galaxy, Our Solar System and Crystal Science | PO1 |
| **CO2** | Knowledge on Dating of Earth Age | PO1, PO2 |
| **CO3** | Correlate various Hypothesis on Origin of Earth | PO4, PO6 |
| **CO4** | Analyze the importance of Crystallography Studies | PO4, PO5, PO6 |
| **CO5** | Various Type minerals and their respective crystal system | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. |
| 2. | Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. |
| 3. | Patwardhan,A.M., Dynamic Earth System, PrenticeHall, New Delhi(1999)  |
| 4. | Mukherjee A.K, Principles of Geology, EW Press, KoIkata(1990)  |
| 5. | Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. |
| 2. | Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi. |
| 3. | Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons, England. |
| 4. | Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer |
| 5. | Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996) |
| **Web Resources** |
| 1. | "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005*.* Retrieved 2006-01-10. |
| 2. | Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London. |
| 3. | Geo.libretexts.org  |
| 4. | www.nationalgeographic.org  |
| 5. | Solarsysytem.nasa.gov  |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **Geo-Statistics - I** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | The main objective of this course is to importance of statistics in science. |
| CO2 | To describe the concepts of basic statistics |
| CO3 | To explain various components of advanced statistical methods |
| CO4 | To study various graphical methods and its applications |
| CO5 | To determine various correlation and regression studies and its importance in the field of Geology  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Definition and scope of statistics-Tabulation of data- Formation of Frequency Distribution-Diagrammatic representation of data-Bar diagrams, Pie diagrams-Graphic Representation of data-Histogram, Frequency polygon-Ogives. | 12 | CO1 |
| II | Measures of Central Tendency-Arithmetic Mean Median, Mode, Combined arithmetic mean-merits and demerits. | 12 | CO2 |
| III | Measures of Dispersion- Absolute and Relative measures Range, Quartile deviation, Mean deviation, Standard deviation | 12 | CO3 |
| IV | Cure filling by the Method of Least square-Fitting straight line of the form Y=ax+b and parabola Y= a x2 + b x +c (Simple problems) | 12 | CO4 |
| V | Correlation-Karl person’s coefficient of correlation, Rank correlation- Spearman’s Rank correlation coefficient. Reregression-regression equation and their properties.  | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | To describe the definition, scope, classification, tabulation, drawing diagrams and plotting graphs of Statistics through Geological information. | PO1 |
| **CO2** | To measure and interpret the various measures of averages using Geological data. | PO1, PO2 |
| **CO3** | To measure and interpret the various measures of dispersions using Geological data. | PO4, PO6 |
| **CO4** | To measure and interpret the relationship among the geological variables and to estimate and predict the unknown and future value through the regression lines using geological data. | PO4, PO5, PO6 |
| **CO5** | To fit the curve using geological data. | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Statistics – R.S.N. Pillai and V. Bhagavathi, Publications S. Chand. |
| 2. | Statistical Methods, Gupta, S.P. (2007): Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition. |
| 3. | Statistics for Geoscientists - Marsal, D. Pergamon press, New York. |
| 4. | Cline, Graysen (2019). [Nonparametric Statistical Methods Using R](https://www.worldcat.org/oclc/1132348139). EDTECH. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-1-83947-325-8](https://en.wikipedia.org/wiki/Special%3ABookSources/978-1-83947-325-8). [OCLC](https://en.wikipedia.org/wiki/OCLC_%28identifier%29) [1132348139](https://www.worldcat.org/oclc/1132348139). [Archived](https://web.archive.org/web/20220515012840/https%3A/www.worldcat.org/title/nonparametric-statistical-methods-using-r/oclc/1132348139) from the original on 2022-05-15. Retrieved 2021-09-16. |
| 5. | Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-0-314-03309-3](https://en.wikipedia.org/wiki/Special%3ABookSources/978-0-314-03309-3) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Statistics for Geoscientists - Marsal, D. Pergamon press, New York. |
| 2. | Statistics – R.S.N. Pillai and V. Bhagavathi, Publications S. Chand. |
| 3. | Statistical Methods, Gupta, S.P. (2007): Sultan Chand & Sons Pvt Ltd, New Delhi, 35th Revised Edition. |
| 4. | Cline, Graysen (2019). [Nonparametric Statistical Methods Using R](https://www.worldcat.org/oclc/1132348139). EDTECH. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-1-83947-325-8](https://en.wikipedia.org/wiki/Special%3ABookSources/978-1-83947-325-8). [OCLC](https://en.wikipedia.org/wiki/OCLC_%28identifier%29) [1132348139](https://www.worldcat.org/oclc/1132348139). [Archived](https://web.archive.org/web/20220515012840/https%3A/www.worldcat.org/title/nonparametric-statistical-methods-using-r/oclc/1132348139) from the original on 2022-05-15. Retrieved 2021-09-16. |
| 5. | Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-0-314-03309-3](https://en.wikipedia.org/wiki/Special%3ABookSources/978-0-314-03309-3) |
| **Web Resources** |
| 1. | [**https://en.wikipedia.org/wiki/Statistics**](https://en.wikipedia.org/wiki/Statistics) |
| 2. | [**http://onlinestatbook.com/2/introduction/descriptive.html**](http://onlinestatbook.com/2/introduction/descriptive.html) |
| 3. | [**https://socialresearchmethods.net/kb/statdesc.php**](https://socialresearchmethods.net/kb/statdesc.php) |
| 4. | [**https://en.wikipedia.org/wiki/Descriptive\_statistics**](https://en.wikipedia.org/wiki/Descriptive_statistics) |
| 5. | [Philosophy of Statistics](https://plato.stanford.edu/entries/statistics/) from the [Stanford Encyclopedia of Philosophy](https://en.wikipedia.org/wiki/Stanford_Encyclopedia_of_Philosophy) |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **Understanding the Earth** | NME | Y | - | - | - | 2 | 2 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | The main objective of this course is to understand various properties of Earth. |
| CO2 | To describe the concepts of internal structure of the Earth |
| CO3 | To explain various components related to external processes of Earth |
| CO4 | To study concepts of various currents and atmospheric circulation. |
| CO5 | To understand the availability of elements in the Earth.  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Understanding of planet Earth: Astronomy, Geology, Meteorology and Oceanography. General characteristics and origin of the Universe, Solar System and its planets. The terrestrial and jovian planets. Meteorites and Asteroids Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters and its age. | 12 | CO1 |
| II | Internal structure: core, mantle, crust; External Structure: hydrosphere, atmosphere and biosphere. Earth's magnetic field. | 12 | CO2 |
| III | Plate tectonics, sea-floor spreading and continental drift; Mid Oceanic Ridges, trenches, transform faults and island arcs Origin of oceans, continents, mountains and rift valleys Earthquake and Volcanoes. | 12 | CO3 |
| IV | Concepts of eustasy; Land-air-sea interaction Oceanic current system and effect of Coriolis force; Wave erosion and beach processes Atmospheric circulation; Weather and climatic changes. | 12 | CO4 |
| V | Distribution of elements in solar system and in Earth; Chemical differentiation and composition of the Earth; General concepts about geochemical cycles and mass balanceProperties of elements; Geochemical behavior of major elements; Mass conservation of elements and isotopic fractionation. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the properties of Earth | PO1 |
| **CO2** | Knowledge on Dating of Earth Age | PO1, PO2 |
| **CO3** | Correlate various Hypothesis on Origin of Earth | PO4, PO6 |
| **CO4** | Analyze the importance of Crystallography Studies | PO4, PO5, PO6 |
| **CO5** | Various Type minerals and their respective crystal system | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Duff, P. M. D., & Duff, D. (Eds.). (1993). Holmes' principles of physical geology. Taylor & Francis. |
| 2. | Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press. |
| 3. | Patwardhan,A.M., Dynamic Earth System, PrenticeHall, New Delhi(1999)  |
| 4. | Mukherjee A.K, Principles of Geology, EW Press, KoIkata(1990)  |
| 5. | Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Gross, M. G. (1977). Oceanography: A view of the earth. |
| 2. | Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. |
| 3. | Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons, England. |
| 4. | Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer |
| 5. | Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)  |
| **Web Resources** |
| 1. | "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005*.* Retrieved 2006-01-10. |
| 2. | Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London. |
| 3. | Geo.libretexts.org  |
| 4. | www.nationalgeographic.org  |
| 5. | Solarsysytem.nasa.gov  |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **CRYSTALLOGRAPHY AND PALOENTOLOGY PRACTICAL** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | The main objective of this course is to enumerate the origin of Earth. |
| CO2 | To describe the concepts of Dating and internal structure of the Earth |
| CO3 | To explain various components of crystals and crystallography |
| CO4 | To study various class and forms of an crystal system. |
| CO5 | To determine various crystallographic properties of crystals with suitable examples.  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Isometric System: Normal Class – Galena, Fluorite, Magnetite, Garnet, and Leucite, Copper- Pyritohedral class – Pyrite, Tetrahedral Class – Tetrahedrite.Tetragonal System: Normal Class – Zircon, Vesuvianite, Cassiterite, and Rutile. Tripyramidal – Scheelite, MeioniteSphenidal Class – Chalcopyrite.Hexagonal System: Normal Class – Beryl, Tripyramidal – Apatite, Hemimorphic – Zincite, Rhombohedral Normal – Calcite, Trapezohedral Class – Quartz. | 12 | CO1 |
| II | Orthorhombic System: Normal – Barite, Sulphur, Stibnite, Topaz, Staurolite, and Aragonite. Hemimorphic – Calymene, Sphenoidal Class – Epsomite.Monoclinic System: Normal – Gypsum, Pyroxenes and Amphiboles.Triclinic System: Normal – Axinite, Albite, and Rhodonite.Twin Crystals: Contact and Penetration twins of Fluorite, Iron Cross Twin of Pyrite, Knee type twin of Cassiterite, Polysynthetic twin of Aragonite, Cyclic twin of Cerussite, Swallow Tail of Gypsum, Twins of Carlsbad, Baveno, Manebach, Albite law of Albite. | 12 | CO2 |
| III | Identification and description of the following fossils: Lamellibranchs: Arca, Meretrix, Pecten, Cardita, Lima, Allectronia, Inoceramus, Gryphaea, Exogyra, Radiolites, Ostrea, Unio, Trigonia. Gastropods: Turritella, Turbo, Cerithium, Trochus, Physa, Murex, Voluta, Helix, Euomphalus, Cyprea. | 12 | CO3 |
| IV | Cephalopods: Nautilus, Orthoceras, Ceratite, Goniatite, Belemnites, Baculites, and Perisphinctes. Echinodermata: Cidaris, Holaster, Hemiaster, Stigmatophygus, Apiocrinus. Trilobites: Paradoxides, Olenus, Olenellus, Phacops, Calymene. | 12 | CO4 |
| V | Corals: Calceola, Zaphrentis, Lithostrotion, Omphyma, Thecosmelia. Brachiopoda: Terebratula, Spirifer, Productus, Monograptus, Tetragraptus, Diplograptus. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | The main objective of this course is to enumerate the fundamental aspects of Mineralogy in such a way as to stimulate the minds of the post-graduate students. | PO1 |
| **CO2** | To describe the concepts of Mineralogy is essential to comprehend the concepts of Petrology. | PO1, PO2 |
| **CO3** | To explain the importance of instrumentation techniques for better analysis | PO4, PO6 |
| **CO4** | To compare and contrast between the fascinating plethora of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject | PO4, PO5, PO6 |
| **CO5** | Can evaluate the accuracy and summaries the methods adapted for certain practical activities. | PO3, PO8 |
| **Text Books** **(Latest Editions)** | Can explain and summarise problem. |
| 1. | Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. |
| 2. | Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. |
| 3. | Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995)  |
| 4. | Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) |
| 5. | Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952).  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. |
| 2. | Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi. |
| 3. | Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons, England. |
| 4. | Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer |
| 5. | Colbert E.H. et al.,Evolution of the Vertebrates, Wiley. New Delhi 2002)  |
| **Web Resources** |
| 1. | "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005*.* Retrieved 2006-01-10. |
| 2. | Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London. |
| 3. | Digitalatlas.cose.ISU.edu>geo>basics>fossil  |
| 4. | www.sciencedirect.com>topic>hemichordata  |
| 5. | w.qm.qid.au>biodiscovery>corals  |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **Geo-Statistics - II** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | The main objective of this course is to importance of statistics in science. |
| CO2 | To describe the concepts of basic statistics |
| CO3 | To explain various components of advanced statistical methods |
| CO4 | To study various graphical methods and its applications |
| CO5 | To determine various correlation and regression studies and its importance in the field of Geology  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Definition and scope of statistics-Tabulation of data- Formation of Frequency Distribution-Diagrammatic representation of data-Bar diagrams, Pie diagrams-Graphic Representation of data-Histogram, Frequency polygon-Ogives. | 12 | CO1 |
| II | Measures of Central Tendency-Arithmetic Mean Median, Mode, Combined arithmetic mean-merits and demerits. | 12 | CO2 |
| III | Measures of Dispersion- Absolute and Relative measures Range, Quartile deviation, Mean deviation, Standard deviation | 12 | CO3 |
| IV | Cure filling by the Method of Least square-Fitting straight line of the form Y=ax+b and parabola Y= a x2 + b x +c (Simple problems) | 12 | CO4 |
| V | Correlation-Karl person’s coefficient of correlation, Rank correlation- Spearman’s Rank correlation coefficient. Reregression-regression equation and their properties.  | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | To describe the definition, scope, classification, tabulation, drawing diagrams and plotting graphs of Statistics through Geological information. | PO1 |
| **CO2** | To measure and interpret the various measures of averages using Geological data. | PO1, PO2 |
| **CO3** | To measure and interpret the various measures of dispersions using Geological data. | PO4, PO6 |
| **CO4** | To measure and interpret the relationship among the geological variables and to estimate and predict the unknown and future value through the regression lines using geological data. | PO4, PO5, PO6 |
| **CO5** | To fit the curve using geological data. | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Statistics – R.S.N. Pillai and V. Bhagavathi, Publications s. Chand. |
| 2. | Statistical Methods, Gupta, S.P. (2007): sultan Chand & sons Pvt Ltd, New Delhi, s5th Revised Edition. |
| 3. | Statistics for Geoscientists - Marsal, D. Pergamon press, New York. |
| 4. | Cline, Graysen (2019). [Nonparametric Statistical Methods Using R](https://www.worldcat.org/oclc/1132348139). EDTECH. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-1-83947-325-8](https://en.wikipedia.org/wiki/Special%3ABookSources/978-1-83947-325-8). [OCLC](https://en.wikipedia.org/wiki/OCLC_%28identifier%29) [1132348139](https://www.worldcat.org/oclc/1132348139). [Archived](https://web.archive.org/web/20220515012840/https%3A/www.worldcat.org/title/nonparametric-statistical-methods-using-r/oclc/1132348139) from the original on 2022-05-15. Retrieved 2021-09-16. |
| 5. | Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-0-314-03309-3](https://en.wikipedia.org/wiki/Special%3ABookSources/978-0-314-03309-3) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Statistics for Geoscientists - Marsal, D. Pergamon press, New York. |
| 2. | Statistics – R.S.N. Pillai and V. Bhagavathi, Publications. Chand. |
| 3. | Statistical Methods, Gupta, S.P. (2007): sultan Chand & sons Pvt Ltd, New Delhi, 5th Revised Edition. |
| 4. | Cline, Graysen (2019). [Nonparametric Statistical Methods Using R](https://www.worldcat.org/oclc/1132348139). EDTECH. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-1-83947-325-8](https://en.wikipedia.org/wiki/Special%3ABookSources/978-1-83947-325-8). [OCLC](https://en.wikipedia.org/wiki/OCLC_%28identifier%29) [1132348139](https://www.worldcat.org/oclc/1132348139). [Archived](https://web.archive.org/web/20220515012840/https%3A/www.worldcat.org/title/nonparametric-statistical-methods-using-r/oclc/1132348139) from the original on 2022-05-15. Retrieved 2021-09-16. |
| 5. | Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. [ISBN](https://en.wikipedia.org/wiki/ISBN_%28identifier%29) [978-0-314-03309-3](https://en.wikipedia.org/wiki/Special%3ABookSources/978-0-314-03309-3) |
| **Web Resources** |
| 1. | [**https://en.wikipedia.org/wiki/Statistics**](https://en.wikipedia.org/wiki/Statistics) |
| 2. | [**http://onlinestatbook.com/2/introduction/descriptive.html**](http://onlinestatbook.com/2/introduction/descriptive.html) |
| 3. | [**https://socialresearchmethods.net/kb/statdesc.php**](https://socialresearchmethods.net/kb/statdesc.php) |
| 4. | [**https://en.wikipedia.org/wiki/Descriptive\_statistics**](https://en.wikipedia.org/wiki/Descriptive_statistics) |
| 5. | [Philosophy of Statistics](https://plato.stanford.edu/entries/statistics/) from the [Stanford Encyclopedia of Philosophy](https://en.wikipedia.org/wiki/Stanford_Encyclopedia_of_Philosophy) |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **Basics of Earth Science** | NME | Y | - | - | - | 2 | 2 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | The main objective of this course is to understand various properties of Earth. |
| CO2 | To describe the concepts of internal structure of the Earth |
| CO3 | To explain various components related to external processes of Earth |
| CO4 | To study concepts of various currents and atmospheric circulation. |
| CO5 | To understand the availability of elements in the Earth.  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | 1. Universe – Evolution of the Universe. Solar System – Inner and outer planets – characteristics of solar system. Satellites – Asteroids – Meteors – comets. Earth – movements – revolution – rotation – solstice – equinox. Atmosphere - El Nino – hydrosphere – lithosphere- Origin of the Earth.
 | 12 | CO1 |
| II | Age of the Earth - old methods – new methods – Radioactivity – Half-life period – Radiometric methods. Interior of the Earth – Density – Shape – Seismic waves – Composition and thickness of the crust, mantle and core. Discontinuities: Conrad Discontinuity – Mohorovicic Discontinuity. | 12 | CO2 |
| III | Introduction to Geomorphology: Geological action of wind, water, glaciers and ground water. Volcanoes and earthquakes. Rock deformation: Folds, Faults, Joints, Cleavage, Unconformities, Concepts of plate tectonics, sea floor spreading and geosynclines. | 12 | CO3 |
| IV | **Study of Fossils-** Introduction, Geological Record and its nature. Geological Time Scale. Introduction, Definition of Paleontology, Classification of Plants, Invertebrate and Vertebrate fossils. Fossils -Tophonomy (Burial Law), Types of Fossilization, Mode of preservation- Applications of Fossils – National fossil parks across India. | 12 | CO4 |
| V | **Applications of Geology:** Environmental impacts due to mining and mineral process, Engineering Geology: Dams, Reservoirs and Tunnels, strategic, critical and essential mineral –Mineral resources of India. Fossil Fuels and Groundwater. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Gather basic information on Earth Sciences | PO1 |
| **CO2** | Understand the importance of various components of Earth | PO1, PO2 |
| **CO3** | Process of Geomorphological features  | PO4, PO6 |
| **CO4** | Understand, predict and analyze the fossil and dating | PO4, PO5, PO6 |
| **CO5** | Apply the geological knowledge in various civil structures | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. |
| 2. | Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. |
| 3. | Patwardhan,A.M., Dynamic Earth System, PrenticeHall, New Delhi(1999)  |
| 4. | Mukherjee A.K, Principles of Geology, EW Press, KoIkata(1990)  |
| 5. | Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. |
| 2. | Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi. |
| 3. | Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons, England. |
| 4. | Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer |
| 5. | Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)  |
| **Web Resources** |
| 1. | "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005*.* Retrieved 2006-01-10. |
| 2. | Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London. |
| 3. | Geo.libretexts.org  |
| 4. | www.nationalgeographic.org  |
| 5. | Solarsysytem.nasa.gov  |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **PALAEONTOLOGY** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basics of Fossils |
| CO2 | Understand the importance of fossils in Geological studies |
| CO3 | Know different phulum and their species with morphological changes |
| CO4 | Understand and correlate fossil with various rock formations  |
| CO5 | Understand the importance of Palaeontology in dating and evolution studies  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Fossils –Definition-conditions required for fossilization-Modes of preservation-Uses of fossils. Geological time scale. | 12 | CO1 |
| II | The morphology and geological distribution of Mollusca- classes, Pelecypoda, gastropoda, Cephalopoda – orders - Nautiloidea, Ammonoidea, Dibranchia – Belemnites. | 12 | CO2 |
| III | Phylum – Brachiopoda, Phylum – Coelenterata.Class Anthozoa – Subclass Zoantharia Orders Rugosa, Tabulata and Scaleractina. Phylum – Hemichordata – Class Graptozoa, order Dendroidea, Order Graptolitoidea. | 12 | CO3 |
| IV | Phylum – Arthropoda Class – Trilobita Phylum – Echinodermata Class - Echinoidea Class – Crinoidea. Class: Blastoidea. Introduction to Paleobotany, Gondwana Flora. | 12 | CO4 |
| V | Short account of the following Dinosaurs, Saurischian Dinosaur and Ornithistian Dinosaurs, Archaeopteryx, Elementary idea of Verterbrate fossils of India, Morphological character of Phylum – Protozoa, Order – Foraminifera. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basics of Fossils | PO1 |
| **CO2** | Understand the importance of fossils in Geological studies | PO1, PO2 |
| **CO3** | Know different phulum and their species with morphological changes | PO4, PO6 |
| **CO4** | Understand and correlate fossil with various rock formations  | PO4, PO5, PO6 |
| **CO5** | Understand the importance of Palaeontology in dating and evolution studies  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Palaeontology Evolution and animal distribution. .C. Jain and M.S. Anantharaman, (1996), Vishal Publications, Jalandhar. |
| 2. | Invertebrate Palaeontology - H.Woods, (1985), CBS Publishers and Distributors, New Delhi. |
| 3. | Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995)  |
| 4. | Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) |
| 5. | Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952).  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Principles of Invertebrate Palaeontology, Shrock R.R and Twenohofel W.H, (2005), CBS Publishers and Distributors, New Delhi. |
| 2. | Invertebrate Fossils. Moore R.C, Lalicker C.G and Fisher A.G (1952) McGraw Hill. |
| 3. | The Vertebrate Story, Romer A.S, (1959) University of Chicago Press, 4thEdt. Chicago. |
| 4. | Palaeontology An Introduction, E.W.Nield and V.C.T.Tucker (1985) Pergamon Press, Oxford. |
| 5. | Colbert E.H. et al.,Evolution of the Vertebrates, Wiley. New Delhi 2002) |
| **Web Resources** |
| 1. | "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005*.* Retrieved 2006-01-10. |
| 2. | Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London. |
| 3. | Digitalatlas.cose.ISU.edu>geo>basics>fossil  |
| 4. | www.sciencedirect.com>topic>hemichordata  |
| 5. | w.qm.qid.au>biodiscovery>corals  |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | **GEOMORPHOLOGY AND GEOTECTONICS** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Know the basics of Geotectonics and landforms |
| CO2 | Understand the importance of various geomorphological agencies |
| CO3 | Process of Geomorphological features and creation of landforms |
| CO4 | Understand and predict Earth’s Internal and external processes  |
| CO5 | Predict the future from the past formed features |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Interpretation of fluvial cycle - Landforms developed by running water – valley development, river capture, waterfalls, meandering, river terraces, Lakes, their types and deposits. Geological work of wind and Underground water. | 12 | CO1 |
| II | Glaciers – formation, movement, types and landforms due to their erosional and transportational activity. Topography of ocean floor –erosional and depositional features of oceans – Coral reefs, types, theories for the origin of coral reefs – Submarine Canyons. | 12 | CO2 |
| III | Mountains – their kinds, development and important mountain building movements. Processes of weathering – types and products- Mass Movements. | 12 | CO3 |
| IV | Earthquakes – types – seismographs – intensity and Magnitude scales (Richter &Mercalli) –Tsunami-Global Distribution; Volcanoes – structure, types – products – Global Distribution . | 12 | CO4 |
| V | Continental drift – Wegner Concept – various evidences. Plate tectonics – concept – plate characteristics – larger and smaller plates – types of plate boundaries – causes and mechanism of plate motions.  | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Know the basics of Geotectonics and landforms | PO1 |
| **CO2** | Understand the importance of various geomorphological agencies | PO1, PO2 |
| **CO3** | Process of Geomorphological features and creation of landforms | PO4, PO6 |
| **CO4** | Understand and predict Earth’s Internal and external processes  | PO4, PO5, PO6 |
| **CO5** | To fit the curve using geological data. | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Worcester ,P.G.,A Text Book of Geomorphology, East West Press Ltd.Delhi.(1960)  |
| 2. | Sathya Narayanaswami,B.S. Structural Geology. Dhanpat Rai & Sons. New Delhi.(1994) |
| 3. | GokhaIe,N.W. , Theory of Structural Geology, CBS, Delhi(1995) |
| 4. | . Davis,G.H, Structural Geology of Rocks and Regions. Elements of Structural geology, Wiley(1985) |
| 5. | Ragan D.M., Structural Geology-An Introduction to geometrical Techniques. Wiley. New York(2000) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | HiIIs E.S., Elements of Structural Geology, Chapman &Hall. London(1963) |
| 2. | Mahapatra G.B. Textbook of PhysicalGeology, CBS publications, Delhi(1994).  |
| 3. | Park,P.G., Foundations of Structural Geology, BIackie. London (1983).  |
| 4. | Radhakrishnan V, General Geology, V.V.P. Publications, Tuticorin(1996), |
| 5. | Bloom A., Principles of Geomorphology (1985). |
| **Web Resources** |
| 1. |  http://www.labotka.net  |
| 2. | <http://www.patnasciencecollege.org> |
| 3. | <https://geomorphology.org.uk> |
| 4. | <https://gradeup.co> |
| 5. | https://www.nps.gov>subjects>gla |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **Structural Geology and Photo Geology** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basics components of Structural Geology |
| CO2 | Know the formations of geological formations |
| CO3 | Basics of Aerial Photographs |
| CO4 | Understand the Application of Satellite science |
| CO5 | Analyse various physiographical features through GIS  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Definition and scope of structural geology – topographic forms – topographic map – geological map – contour lines – stratum contours – outcrops and exposures.Attitude of beds – dip and strike – slope – Clinometer, Brunton compass and GPS (Global Positioning System) and its uses. | 12 | CO1 |
| II | Fold: Definition and parts of fold; classification of folds. Joints: Description and classification. Description and origin of foliations and lineations.  | 12 | CO2 |
| III | Fault: Definition and parts of fault; classification of faults – Horst – Graben – Nappe – Fenster – Klippe – overthrust. Unconformity: Definition – types of unconformity – inlier and outlier. | 12 | CO3 |
| IV | Aerial Remote Sensing: Definition and scope of photogeology - Aerial photographs – types – geometry of aerial photographs – tip and tilt – nadir point – principal point – fiducial marks – scale of photographs – vertical exaggeration – Stereoscopy – pocket lens and mirror stereoscope - mosaics – controlled and uncontrolled. | 12 | CO4 |
| V | Satellite Remote Sensing –Principles of Remote Sensing –Components of remote sensing system Electro Magnetic Radiations (EMR) – Satellites – Sensors and platforms – Indian and foreign Satellites.Introduction to Geographic Information System (GIS); components of GIS; productgeneration in GIS; tools for map analysis; integration of GIS and remote sensing | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basics components of Structural Geology | PO1 |
| **CO2** | Know the formations of geological formations | PO1, PO2 |
| **CO3** | Basics of Aerial Photographs | PO4, PO6 |
| **CO4** | Understand the Application of Satellite science | PO4, PO5, PO6 |
| **CO5** | Analyse various physiographical features through GIS  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Structural geology, Billing. M.P. (1974), Prentice Hall, New Delhi |
| 2. | An outline of Structural Geology, Hobbs, B.E., Means, W.D. and Williams, P.F. (1976):, John Wiley, New York. |
| 3. | Curran P.B, Principles of Remote Sensing, ELBS. London(1985).  |
| 4. | Sabins F.F, Remote Sensing Principles and Interpretation. Freeman. New  York(1974)  |
| 5. | Reddy A, Principles of Remote Sensing and GIS, CBS. Delhi(2010) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Basic Problems of Geotectonics Belousov.V.V. (1962):, McGraw Hill, New York |
| 2. | Structural Geology De Sitter. L.U. (1956):, McGraw Hill, New York |
| 3. | Elements of Structural Geology Hill. E.S. (1972):, John Wiley, New York |
| 4. | Aerial Photographic Interpretation Lueder.D.R. (1959):, McGraw Hill, New York. |
| 5. | LiIIisand T.M & R.W.Kiefer, Remote Sensing and Image Interpretation, WileDelhi(2000)  |
| **Web Resources** |
| 1. | https://stratigraphy.org/ |
| 2. | https://www.sepm.org/ |
| 3. | https://www.geosocindia.org/ |
| 4. | https://www.moes.gov.in/ |
| 5. | https://isegindia.org/ |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | **Structural Geology, Remote Sensing and Survey Practical** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basics components of Structural Geology |
| CO2 | Know the formations of geological formations |
| CO3 | Basics of Aerial Photographs |
| CO4 | Understand the Application of Satellite science |
| CO5 | Analyse various physiographical features through GIS  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Contour Maps and their interpretation – Exercises to find out trend of the outcrop of horizontal, vertical, inclined beds with respect to topography – Reading of solid, conformable maps – Deciphering dip and strike of outcrops - Completion of map when three points over a bedding plane are given – Determination of vertical thickness of formations. | 12 | CO1 |
| II | Reading of solid fold and fault maps – Determination of throw of faults – Construction of vertical sections – Reading of unconformable solid maps – Construction of sections – Reading of solid maps of areas with more than one structure and intrusion – Writing of geological history. | 12 | CO2 |
| III | Solving of dip and strike problems by trignometrical method – Determination of true thickness of beds by calculations | 12 | CO3 |
| IV | nterpretation of geomorphology, lithology and geological structures on aerial photographs. Visit to nearby geological organizations | 12 | CO4 |
| V | Definition – Primary divisions – classification – Chain survey – description of instruments employed – chain traverse – Compass survey – description of prismatic compass – whole circle bearings – reduced bearings – quadrantal bearings – open traverse – closed traverse – finding distance between inaccessible stations – locating the instrument station - GPS - Clinometer compass – finding dip and strike of beds – Modern Surveying | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basics components of Structural Geology | PO1 |
| **CO2** | Know the formations of geological formations | PO1, PO2 |
| **CO3** | Basics of Aerial Photographs | PO4, PO6 |
| **CO4** | Understand the Application of Satellite science | PO4, PO5, PO6 |
| **CO5** | Analyse various physiographical features through GIS  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | GokhaIe,N.W. , Theory of Structural Geology, CBS, Delhi(1995)  |
| 2. | Sathya Narayanaswami,B.S. Structural Geology. Dhanpat Rai & Sons. New Delhi.(1994)  |
| 3. | LiIIisand T.M & R.W.Kiefer, Remote Sensing and Image Interpretation, WileDelhi(2000)  |
| 4. | Reddy A, Principles of Remote Sensing and GIS, CBS. Delhi(2010)  |
| 5. | Subramanian, Surveying and Levelling,Oxford University Press(2ndedition) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Park,P.G., Foundations of Structural Geology, BIackie. London (1983).  |
| 2. | Mahapatra G.B. Textbook of PhysicalGeology, CBS publications, Delhi(1994).  |
| 3. | Ragan D.M., Structural Geology-An Introduction to geometrical Techniques. Wiley. New York(2000)  |
| 4. | Guptha,R.P, Remote Sensing Geology, Springer New Delhi(2003)  |
| 5. | T.P. Kanetkarand S.V .Kulkarni, Surveying and Levelling Vol. I and Vol. II, Pune Vidyarthi Griha Prakashan 2006  |
|  |  |
| **Web Resources** |
| 1. | http://www.labotka.net  |
| 2. | http://www.patnasciencecollege.org |
| 3. | www.wamis.org  |
| 4. | www.sciencedirect.com>earth-and-planetaryh-sciences |
| 5. | https://www.geo.cornell.edu  |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**SEMESTER - V**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | 1. **STRATIGRAPHY**
 | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basic of Historical Geology |
| CO2 | Know the Important group of Stratigraphic systems  |
| CO3 | Know various economic importance of various periods |
| CO4 | Understand the various rocks of different periods from the formation of Earth |
| CO5 | Present is the Key to the Past – Critical Analyse  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | General Stratigraphy: Principles of Stratigraphy, – Time units – Time rock units – Standard Geological Time scale. INDIAN STRATIGRAPHY: ARCHAEAN: DharwarSupergroup – Champian Gneiss – Peninsular Gneiss – Closepet Granite- Sakoli Series – Saucer Series – Bundelkhand Gneiss – Banded gneissic complex – Aravalli Supergroup – Raiolo Series - Singhbhum Iron ore Series – Singhbhum copper belt shear zone – Newer Dolerite – Mineral riches of Archaean. | 12 | CO1 |
| II | PROTEROZOIC: CuddapahSupergroup – Kaladgi series – Delhi Supergroup – Erinpura Granite – Malani Igneous suite – Hazara slates – Attock slates – Dogra Slates – Mineral riches of Cuddapah - VindyanSupergroup – Kurnool Supergroup – Bhima Series – Mineral riches of Vindhyan. | 12 | CO2 |
| III | PALAEOZOIC: Cambrian of Salt range – Age of Saline series – Haimanta System – MuthQuartzites – Kanawar System – Fenestella Shales – Kuling System – Everest Limestone – Panjal Volcanic Series. GondwanaSupergroup – Climate and Sedimentation – Classification – Lithology – Fossil contents – Distribution of Coal Deposits. | 12 | CO3 |
| IV | MESOZOIC: Triassic of Spiti – Succession and fossil contents Jurassic of Kutch – Succession and fossil content – Cretaceous of Tiruchirapalli and Bagh beds. CENOZOIC: Deccan traps – Age – Distribution – Petrology – Lametabeds – Infratrappean and Intertrappean beds  | 12 | CO4 |
| V | Tertiary of Assam and Tamilnadu Siwalik Supergroup – Varkala and Quilon beds of Kerala – Tertiary of Cambay a Karewa formation – Rise of Himalayas- Pleistocene Glaciation – Indo-Gangetic alluvium – Laterite. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basic of Historical Geology | PO1 |
| **CO2** | Know the Important group of Stratigraphic systems  | PO1, PO2 |
| **CO3** | Know various economic importance of various periods | PO4, PO6 |
| **CO4** | Understand the various rocks of different periods from the formation of Earth | PO4, PO5, PO6 |
| **CO5** | Present is the Key to the Past – Critical Analyse  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Geology of India and Burma M.S. Krishnan, (2010), 6th Edi., C.B.S publishers and Distributors, Delhi |
| 2. | Geology of India, D.N. Wadia, (1966), McMillan company, London |
| 3. | Vaidyanadhan.R&M.Ramakrishnan, Geology of India. Geological Society of India. Bangalore(2008)  |
| 4. | Mehdiratta R.C,Geology of India, Pakisthan, Bangladesh and Burma. Atma Ram &Sons.Delhi(1974)  |
| 5. | Geology& Mineral Resources of the States of India. Misc Pub.No.30.Geological Survey of India. Kolkota. (Several individual volumes available online at GSI portal) GSI(2005). |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Fundamentals of Historical Geology and Stratigraphy of India, Ravindrakumar (1985), Wiley Eastern ltd, New Delhi. |
| 2. | Principle of Stratigraphy, Dunbar and Roggers, (1964), John Wiley and co, New York |
| 3. | An Introduction in Stratigraphy, Stamp L.D, (1964), Thomas Murby, Museum St, WCI, London. |
| 4. | Stratigraphic Principles and Practices, Weller, J.M, (1962), Harper & Bros, New York |
| 5. | Kumar R,Fundamentals of Historical Geology and Stratigraphy of India,WiIey.New Delhi (1988).  |
| **Web Resources** |
| 1. | https://stratigraphy.org/  |
| 2. | https://www.sepm.org/ |
| 3. | https://www.geosocindia.org/ |
| 4. | https://www.moes.gov.in/ |
| 5. | https://isegindia.org/ |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  MINERALOGY | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basics of Minerals |
| CO2 | Understand the importance of Minerals in Geological studies |
| CO3 | Know different group of minerals systems |
| CO4 | Understand the descriptive mineralogy of different groups |
| CO5 | Understand the importance of Minerals and mineralogical studies  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Definition of mineral – General principles of chemistry as applied to minerals. Atoms, Molecules, Atomic Number, Valence, Ionic Radii, Coordinating Number, Bonding – Isomorphism, Polymorphism, Pseudomorphism. Physical properties of minerals depending upon Cohesion and Elasticity, Specific Gravity, Light, Heat, Electricity, Magnetism and of the Senses. | 12 | CO1 |
| II | Nature of light – ordinary and polarized light – monochromatic light – Refraction and Reflection – Refractive Index – Critical Angle and Total reflection – Single refraction - Double refraction – Nicol Prism. Petrological Microscope and its parts – Behavior of light in its passage through a petrological microscope – Uses of quartz wedge, gypsum plate and mica plate - Classification of minerals into Isotropic and Anisotropic. | 12 | CO2 |
| III | Uniaxial and Biaxial minerals – Uniaxial and Biaxial indicatrices – Dichroism and Pleochroism – Types of Extinction – straight or parallel, symmetrical and inclined – Extinction angle – Determination of extinction angle - A brief account of Silicate structure | 12 | CO3 |
| IV | Descriptive mineralogy of the following essential rock forming minerals:- Quartz and its varieties – Families of Feldspar and Feldspathoids - Olivine and Garnet groups-Epidote, Beryl & Tourmaline | 12 | CO4 |
| V | Descriptive mineralogy of the following rock forming mineral groups: - Amphibole and Pyroxene. Mica and Chlorite groups – Serpentine – Kaolin- Talc and Steatite - . Zircon – Sphene – Topaz – Andalusite – Sillimanite – Kyanite – Staurolite - Rutile – Calcite – Dolomite – Apatite – Fluorite. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basics of Minerals | PO1 |
| **CO2** | Understand the importance of Minerals in Geological studies | PO1, PO2 |
| **CO3** | Know different group of minerals systems | PO4, PO6 |
| **CO4** | Understand the descriptive mineralogy of different groups | PO4, PO5, PO6 |
| **CO5** | Understand the importance of Minerals and mineralogical studies  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | A Text book of Mineralogy , E.S. Dana, (2000) CBS Publishers & Distributors, New Delhi.  |
| 2. | Rutley’s Elements of Mineralogy, C.D. Gribble, (1991), CBS Publishers and Distributors, New Delhi. |
| 3. | Wenk,H.R&A. Bulakh, Minerals, Cambridge University Press,New Delhi(2006)  |
| 4. | Perkins D, 3rd ed. Prentice Hall India, NewDelhi(2010) |
| 5. | HaIdar,S.K.&J.Tisjlar, Introduction to Mineralogy and Petrology, Elsevier,(2014)  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Dana’s Manual of Mineralogy, C. Hurlbut, John Wiley & Sons, New York |
| 2. | Optical Mineralogy, P.F. Kerr, (1959), McGraw Hill Book company, New York. |
| 3. | An Introduction to Rock forming Minerals, Deer, Howie and Hussmann, (1982), 2nd Edit., Orient Longman, London. |
| 4. | Deer,W.A.,R.A.Howie&J.Zussman. An Introduction to the Rock-Forming Minerals. ELBS.London(1992) |
| 5. | Berry L.G.,B.Mason &R.V. Dietrich, Mineralogy, CBS New Delhi (1985). |
| **Web Resources** |
| 1. | https://en.m.wikipedia.org/wiki/mineral  |
| 2. | https://britannica.com/science/chlorite-mineral |
| 3. | https://mineralseducationcoalition.org/minerals-database/zeolite |
| 4. | https://www.britannica.com/science/epidote |
| 5. | <https://www.abracom.es> |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | **IGNEOUS PETROLOGY** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basic Petrology |
| CO2 | Know the textures and micro-structures  |
| CO3 | Know composition of magma and various system of rock formation |
| CO4 | Understand the Petrographical characters of rocks |
| CO5 | Analyse Origin of various rock types  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | **UNIT I**Rocks – Classification into Igneous, Sedimentary and Metamorphic groups. Distribution of elements in the crust – Divisions of igneous rocks as plutonic, hypabyssal and volcanic – Intrusive and extrusive forms – Structures. | 12 | CO1 |
| II | Textures and Microstructures – Classification of Igneous rocks (Tyrell and Streikeisen). | 12 | CO2 |
| III | Composition and constitution of magma – Study of unicomponent magma – Binary system: Diopside and Anorthite, Albite and Anorthite, and Forsterite and Silica systems – Ternary System represented by Albite – Anorthite – Diopside – Bowen‘s reaction principle | 12 | CO3 |
| IV | Petrographic characters of Granites, Diorites, Syenites, Gabbros, Dolerite, Basalt, Pegmatites, Aplites and Lamprophyres. | 12 | CO4 |
| V | Origin of igneous rocks - Differentiation – Assimilation, - Petrography of special rock types, Anorthosite and Carbonatites. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basic Petrology | PO1 |
| **CO2** | Know the textures and micro-structures  | PO1, PO2 |
| **CO3** | Know composition of magma and various system of rock formation | PO4, PO6 |
| **CO4** | Understand the Petrographical characters of rocks | PO4, PO5, PO6 |
| **CO5** | Analyse Origin of various rock types  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Best,M.G,Igneous and Metamorphic Petrology, Wiley.New Delhi(2003)  |
| 2. | McbirneyA.R,Igneous Petrology, CBSNew Delhi(1993)  |
| 3. | Best M.G,Igneous Petrology.Wiley.NewDelhi(2005) |
| 4. | Hatch,F.H. et al,Petrology of the Igneous Rooks, CBSDelhi.  |
| 5. | Hyndman D.W, Petrology of the Igneous and Metamorphic Rocks McGrawHill.NewYork(1985) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | TyreII,G.W,Principles of Petrology, B.I.Publications New Delhi(1958) |
| 2. | Haung,W.T, Petrology, McGrawHill. New York (1962) |
| 3. | Winter,J.D,Principles of Igneous and Metamorphic Petrology, PHI.New |
| 4. | Middlemost E.A.K,Magmas and Magmatic Rocks.Longman UK(1985) |
| 5. | Winkler,H.G.F, Petrology of the Metamorphic Rocks. Springer,New Delhi(1970) |
| **Web Resources** |
| 1. | https://minerva.union.edu/hollochk/c-petrology/resources.html |
| 2. | https://topex.ucsd.edu/es10/lecture/lecture10/lecture10.html |
| 3. | https://geology.com/rocks/igneous-rocks.shtml |
| 4. | https://course.lumenlearning.com/wmopen-geology/chapter/outcome-metamorphic-rocks/ |
| 5. | https://serc.carleton.edu/NAGTWorkshops/coursedesign/goalsdb/10875.html |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | **SEDIMENTARY AND METAMORPHIC ETROLOGY** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basic Petrology |
| CO2 | Know the macro and micro-structures  |
| CO3 | Know various agents of sedimentary and metamorphic petrology |
| CO4 | Understand the Petrographical characters of rocks |
| CO5 | Analyse Origin of various rock types  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Classification (Tyrrel and Pettijohn) **–** Structures – Descriptive Petrography of Residual sediments. | 12 | CO1 |
| II | Descriptive Petrography of clastic - Arenaceous, Argillaceous and Rudaceous - Chemical and Organic deposits. | 12 | CO2 |
| III | Definition – Agents and kinds of metamorphism – structure and textures – Depth zones – A brief study of Facies and grades. | 12 | CO3 |
| IV | Cataclastic metamorphism and its products, thermal and dynamothermal metamorphism on QuartzoFelspathic, argillaceous, calcareous and basic igneous rocks. | 12 | CO4 |
| V | Plutonic metamorphism on Quartzo-felspathic, argillaceous, calcareous and basic igneous rocks – Charnockites – Metasomatism – A brief account of migmatites – Anatexis and palingenesis and retrogressive metamorphism. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basic Petrology | PO1 |
| **CO2** | Know the macro and micro-structures  | PO1, PO2 |
| **CO3** | Know various agents of sedimentary and metamorphic petrology | PO4, PO6 |
| **CO4** | Understand the Petrographical characters of rocks | PO4, PO5, PO6 |
| **CO5** | Analyse Origin of various rock types  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Principles of Petrology , G.W. Tyrrel, (1985), C.B.S Publishers and Distributors, Delhi |
| 2. | Petrology for sediments, S.R. Nockolds, R.W.O.Knott& G.A Chinner, (1979), Cambridge University Press, London. |
| 3. | Green smith J.T, Petrology of the Sedimentary Rocks, CBS.Delhi(1976).  |
| 4. | WiIIiams,H. et al, Petrography, CBS.New Delhi(1982) |
| 5. | Haung,W.T, Petrology,McGraw Hill. New York(1962)  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Metamorphism, B. Baskar Rao, (1986), Oxford I.B.D., New Delhi. |
| 2. | Petrography, H.William, F.J. Turner & C.M. Gilbert, (1954) San Francisco. |
| 3. | Introduction to Sedimentology, Sengupta.S.M, (2007), CBS Publishers & Distributors, New Delhi. |
| 4. | TyreII,G.W,Principles of Petrology, B.I.Publications. NewDelhi(1958)  |
| 5. | FoIk,R.L, Petrology of the Sedimentary Rocks. Hemphill.Texas.USA(1974)  |
| **Web Resources** |
| 1. | https://www.britannica.com/science/geology/sedimentary-petrology  |
| 2. | https://limk.springer.com/chapter/10 |
| 3. | https://www.geo.mtu.edu/UPSeis/hazards.html |
| 4. | https://www.omafra.gov.on.ca/english/engineer/facts/ |
| 5. | https://geology.com/rocks/rock-salt.shtml |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | Internship /Industrial Visit / Field Visit | NME | Y | - | - | - | 2 | 2 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | The students will enhance their writing skills. |
| CO2 | They will acquire knowledge about writing their assignments. |
| CO3 | They will delve into unchartered territory with regard to Scientific/Technical writing of research papers/reports. |
| CO4 | The students will understand what is Bibliography, how to cite references and how to quote them in the text. |
| CO5 | They will be trained in how to avoid redundancies, which constitute a major problem while writing a Scientific Paper/Technical Report. |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Students will be taken to various mines and mineral exploration industries across the country to gain first hand field experience on various mining methods, R&D activities in mineral exploration, interaction with subject experts in various industries and organizations involved in mineral exploration activities. | 12 | CO1 |
|  | **Total** |  |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | The students will enhance their writing skills. | PO1 |
| **CO2** | They will acquire knowledge about writing their assignments. | PO1, PO2 |
| **CO3** | They will delve into unchartered territory with regard to Scientific/Technical writing of research papers/reports. | PO4, PO6 |
| **CO4** | The students will understand what is Bibliography, how to cite references and how to quote them in the text. | PO4, PO5, PO6 |
| **CO5** | They will be trained in how to avoid redundancies, which constitute a major problem while writing a Scientific Paper/Technical Report. | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Best,M.G,Igneous and Metamorphic Petrology, Wiley.New Delhi(2003)  |
| 2. | McbirneyA.R,Igneous Petrology, CBSNew Delhi(1993)  |
| 3. | Best M.G,Igneous Petrology.Wiley.NewDelhi(2005) |
| 4. | Hatch,F.H. et al,Petrology of the Igneous Rooks, CBSDelhi.  |
| 5. | Hyndman D.W, Petrology of the Igneous and Metamorphic Rocks McGrawHill.NewYork(1985) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | TyreII,G.W,Principles of Petrology, B.I.Publications New Delhi(1958) |
| 2. | Haung,W.T, Petrology, McGrawHill. New York (1962) |
| 3. | Winter,J.D,Principles of Igneous and Metamorphic Petrology, PHI.New |
| 4. | Middlemost E.A.K,Magmas and Magmatic Rocks.Longman UK(1985) |
| 5. | Winkler,H.G.F, Petrology of the Metamorphic Rocks. Springer,New Delhi(1970) |
| **Web Resources** |
| 1. | https://minerva.union.edu/hollochk/c-petrology/resources.html |
| 2. | https://topex.ucsd.edu/es10/lecture/lecture10/lecture10.html |
| 3. | https://geology.com/rocks/igneous-rocks.shtml |
| 4. | https://course.lumenlearning.com/wmopen-geology/chapter/outcome-metamorphic-rocks/ |
| 5. | https://serc.carleton.edu/NAGTWorkshops/coursedesign/goalsdb/10875.html |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**SEMESTER - VI**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | 1. **REGIONAL GEOLOGY**
 | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand various Geological formations at Regional Scale |
| CO2 | Know the Important Stratigraphic landforms |
| CO3 | Know various economic importance of regional geology |
| CO4 | Know the mode of occurrence and uses of minerals  |
| CO5 | To predict mineral formations in an unknown region. |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Geomorphology: Tectonic and Shear Zones of Tamil Nadu -Physiography – The Western and Eastern Ghats of Tamilnadu and their structural aspects. The Cauvery and Tambraparani Rivers – Soil types of Tamil Nadu.. | 12 | CO1 |
| II | Archaean Group – Anorthosites of Sittampundi, Kadavur and Oddanchatram – Alkali Rocks of Sivanmalai, Cordierite Sillimanite rocks of Trichy and Madurai, Charnockites of Pallavaram-Thiruttani Dyke swarms. | 12 | CO2 |
| III | GondwanaSupergroup – Sriperumbudur beds and Therany clay beds - Cretaceous of Trichy District – Cenomanian Marine transgression –Tertiary group of Cauvery basins. Distribution of petroleum and natural gas in Tamil Nadu. | 12 | CO3 |
| IV | Cuddalore Sandstone, Neyveli Lignite Deposits - Mode of occurrence & distribution of precious and Semi - precious stones in Tamil Nadu. Distribution of commercial granites, Heavy mineral sands (Zircon, Rutile, Ilmenite and Garnet ) and Thorium deposits of Manavalakurichi in Tamil Nadu. | 12 | CO4 |
| V | Mode of occurrence, uses, origin, and distribution in Tamil Nadu of the followings mineral deposit: Iron ores of Kanjamalai, Gauthimalai; Magnesite deposits of Chalk hills; Bauxite deposits of Shaveroy hill; Graphite beds of Sivaganga- Silica Sands of coastal areas in Kanchipuram, Thiruvallur, Cuddalore and Nagapattinam districts- River sand deposits of TamilNadu.  | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basic of Historical Geology | PO1 |
| **CO2** | Know the Important group of Stratigraphic systems  | PO1, PO2 |
| **CO3** | Know various economic importance of various periods | PO4, PO6 |
| **CO4** | Understand the various rocks of different periods from the formation of Earth | PO4, PO5, PO6 |
| **CO5** | Present is the Key to the Past – Critical Analyse  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Geology of India and Burma M.S. Krishnan, (2010), 6th Edi., C.B.S publishers and Distributors, Delhi |
| 2. | Geology of India, D.N. Wadia, (1966), McMillan company, London |
| 3. | Vaidyanadhan.R&M.Ramakrishnan, Geology of India. Geological Society of India. Bangalore(2008)  |
| 4. | Geology& Mineral Resources of the States of India. Misc Pub.No.30.Geological Survey of India. Kolkota. (Several individual volumes available online at GSI portal) GSI(2005).  |
| 5. | Kumar R,Fundamentals of Historical Geology and Stratigraphy of India,WiIey.New Delhi (1988).  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Fundamentals of Historical Geology and Stratigraphy of India, Ravindrakumar (1985), Wiley Eastern ltd, New Delhi. |
| 2. | Principle of Stratigraphy, Dunbar and Roggers, (1964), John Wiley and co, New York |
| 3. | An Introduction in Stratigraphy, Stamp L.D, (1964), Thomas Murby, Museum St, WCI, London. |
| 4. | Stratigraphic Principles and Practices, Weller, J.M, (1962), Harper & Bros, New York |
| 5. | Wadia,D.N, Geology of India, McMillan India Delhi(1953)  |
| **Web Resources** |
| 1. | https://stratigraphy.org/  |
| 2. | https://www.sepm.org/ |
| 3. | https://www.geosocindia.org/ |
| 4. | https://www.moes.gov.in/ |
| 5. | . https://isegindia.org/ |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **ECONOMIC GEOLOGY AND MINERAL ECONOMICS**  | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand basics of Economic minerals |
| CO2 | Know the various process of mineral formation |
| CO3 | Know the various mode of mineral deposits |
| CO4 | Know the physical and chemical characters of minerals  |
| CO5 | To understand various uses of minerals  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Definition of ore, tenor, grade and metallic and non-metallic minerals.Geologic thermometry –– Classification of ore deposits, (Lindgren and Bateman). Process of mineral formations – magmatic concentration – sublimation, contact metasomatism- Hydrothermal process – sedimentation – evaporation. | 12 | CO1 |
| II | Processes of mineral formation: Residual and mechanical concentration – Oxidation and supergene sulphide enrichment – metamorphism. Coal deposits: Use, origin, Mode of Occurrence, distribution in India. Petroleum deposits: Origin and distribution in India.- Mineralogy, origin, mode of occurrence, uses and distribution in India of the following: - Gold Deposits, Iron deposits, and copper deposits. | 12 | CO2 |
| III | Mineralogy, origin, mode of occurrence, uses and distribution in India of the following: - manganese deposits, lead and zinc deposits, bauxite deposits and chromite deposits. Granite Industry I: Building stones – properties – cost, color, durability, crushing strength, transverse strength, absorption, density, frost and fire resistance, structural features, texture.Important building stones, physical and chemical properties and uses of granite, marble, limestone, sandstone, slate.Classification of commercial granites in pre-cambrian terrain of south India. | 12 | CO3 |
| IV | Physical properties, chemical composition, mode of occurrence and distribution in India of minerals required for the following industries: – Abrasives, fertilizers and refractory. Descriptive mineralogy, Mode of occurrence, uses, distribution in India of the following ores and industrial minerals: realgar, orpiment, cinnabar, fluorite, ilmenite, rutile, graphite, magnesite, asbestos and chrysotile. | 12 | CO4 |
| V | Granite Industry II: Granite blocks - quarrying techniques – pre quarrying phase – operational phase – quarrying in earlier and recent times – blasting methodology – primary and secondary cutting – supporting machineries – problems encountered in granite mining.Granite trade, marketability, Resource estimation | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basics of Minerals | PO1 |
| **CO2** | Understand the importance of Minerals in Geological studies | PO1, PO2 |
| **CO3** | Know different group of minerals systems | PO4, PO6 |
| **CO4** | Understand the descriptive mineralogy of different groups | PO4, PO5, PO6 |
| **CO5** | Understand the importance of Minerals and mineralogical studies  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi |
| 2. | Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. &Dist, New Delhi |
| 3. | KrishnasamyS,India’s MineralResources, Oxford &IBH. Delhi(1988) |
| 4. | SharmaN.L&R.K.Sinha. MineralEconomics, Oxford &IBH.Delhi(1985) |
| 5. | Prasad U, EconomicMineralDeposits, CBS.Delhi(2003) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | India’s Mineral Resoruces, Krishnaswamy.S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi |
| 2. | Introduction to Indian Economic minerals, Sharma, N.L and Ram, K.S.V.,(1970), Dhanbad publications, Dhanbad. |
| 3. | Industrial Minerals , Sinha,R.K,(1986), Oxford 7 IBH Pub. Co., New Delhi. |
| 4. | Craig,R.C& D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York.(1985) |
| 5. | Aiyengar, N.K.N, Minerals of Madras, Dept.of Industries &Commerce. Guindy, Madras, (1964). |
| **Web Resources** |
| 1. | https://www.britannica.com/topic/economic-geology  |
| 2. | https://en.m.wikipedia.org/wiki/supergene-(geology) |
| 3. | https://energymining.sa.gov.au/minerals/mineral-commodities |
| 4. | https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology |
| 5. | https://link.spring.com/ |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | **Applied Geology** | Core | Y | - | - | - | 4 | 4 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand basics of Hydrological Cycle |
| CO2 | Know the various hydrological parameters |
| CO3 | Know the various water bearing formations |
| CO4 | Know the application of Geological methods in groundwater investigations  |
| CO5 | To explore groundwater regime through various geophysical methods |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Engineering Geology: Dams, Reservoirs and Tunnels – Brief description of the types of dam, Reservoir, spillways, Tunnels, bridges and highways. Engineering properties of Rocks: Porosity – permeability – elasticity characteristics of rocks. | 12 | CO1 |
| II | Environmental Geology: Environmental science – Introduction; Environmental impacts due to mining and mineral process. A short account of renewable and non-renewable resources. Effects of urbanization on surface and subsurface water- causes for ground water pollution. | 12 | CO2 |
| III | Hydrologic cycle – origin of water – meteoric, juvenile, magmatic and seawaters;Hydrological parameters - Precipitation, evaporation, transpiration and infiltration.vertical distribution of ground water, Springs and its types; Porosity and permeability.specific yield, specific retention.Aquifer, aquitard, aquifuge and aquiclude– Classifications of aquifers.Ground water movements – Darcy’s law.Specific yield and specific retention.Water Level fluctuation and its causes.Ground water quality – Physical and chemical properties of water, quality criteria for different uses. | 12 | CO3 |
| IV | Concepts of drainage basin and ground water provinces of India.A short account of ground water basins in Tamil Nadu.-Ground water exploration- Dowsing- – Brief out line of various methods of groundwater exploration. | 12 | CO4 |
| V | Geological Method – Identification of formations and structure favorable for movement and storage of groundwater water. Geophysical Methods- Surface and Subsurface methods.Electrical resistivity method – Wenner Method – Schlumberger Method.Field Data interpretation – Curve matching and inverse slope method. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand basics of Hydrological Cycle | PO1 |
| **CO2** | Know the various hydrological parameters | PO1, PO2 |
| **CO3** | Know the various water bearing formations | PO4, PO6 |
| **CO4** | Know the application of Geological methods in groundwater investigations  | PO4, PO5, PO6 |
| **CO5** | To explore groundwater regime through various geophysical methods | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Outlines of Geophysical Prospecting - A manual for geologists by RamachandraRao, M.B.,Prasaranga, University of Mysore, Mysore, 1975. |
| 2. | Groundwater Hydrology, Todd.D.K. (1980) John Wiley Sons, Inc |
| 3. | Coppola D.P, Introduction to International Disaster Management, Butterworth Heinemann(2007)  |
| 4. | Pine,J.C, Natural Hazards Analysis: Reducing the Impact of Disasters, CRC Press, Taylor and Francis Group(2009) |
| 5. | Smith K, Environmental Hazards: Assessing Risk and Reducing Disaster Rout ledge Press(2001)  |

|  |
| --- |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | Groundwater Drilling, Handa.O.P (1984) Oxford & I.B.H. Publishing Co. |
| 2. | Groundwater, Raghunath.H.M. (1987) 2nd Edition, Wiley Eastern Ltd. |
| 3. | Groundwater Assessment Development and Management, Karanth.K.R. (1987) Tata McGraw Hill Publishing Company, Ltd. |
| 4. | Miller T.G. Environmental Science. Wadsworth Publishing.US(2004).  |
| 5. | Coates,D.R. Environmental Geology. McGraw Hill.NewYork(1984) |
| **Web Resources** |
| 1. | https://www.britannica.com/science/geology/sedimentary-petrology  |
| 2. | https://limk.springer.com/chapter/10 |
| 3. | https://www.geo.mtu.edu/UPSeis/hazards.html |
| 4. | https://www.omafra.gov.on.ca/english/engineer/facts/ |
| 5. | https://geology.com/rocks/rock-salt.shtml |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | **MINERALOGY AND ETROLOGY PRACTICAL** | Core | Y | - | - | - | 3 | 5 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basic Petrology |
| CO2 | Know the macro and micro-structures  |
| CO3 | Know various agents of sedimentary and metamorphic petrology |
| CO4 | Understand the Petrographical characters of rocks |
| CO5 | Analyse Origin of various rock types  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Megascopic identification and description of the following: quartz, chalcedony, opal, agate, flint, jasper, amethyst, rose quartz, orthoclase, microcline, albite, oligoclase, labradorite, adularia, sanidine, nepheline, sodalite, lapislazuli, hornblende, Actinolite, tremolite, enstatite, bronzite, hypersthene, augite, olivine, serpentine, muscovite, biotite, phlogopite, lepidolite, vermiculite, chlorite, epidote, garnet, apophyllite, stilbite, heulandite, talc, steatite, beryl, kaolin, cordierite, apatite, andalusite, staurolite, sillimanite, kyanite, tourmaline, topaz, calcite, dolomite and fluorspar. | 12 | CO1 |
| II | Microscopic identification and description of the following: quartz, orthoclase, albite, oligoclase, andesine, labradorite, anorthite, nepheline, leucite, sodalite, hypersthene, augite, diopside, aegerine, hornblende, tremolite, actinolite, glaucophane, riebeckite, muscovite, biotite, phlogopite, olivine, serpentine, chlorite, epidote, garnet, apatite, zircon, sphene, magnetite, tourmaline, calcite, dolomite, andalusite, staurolite, sillimanite and cordierite. | 12 | CO2 |
| III | Megascopic identification and description of the following rocks: granite, graphic granite, pegmatite, aplite, orbicular granite, schorl rock, tourmaline rock, granite porphyry, Syenite, dolerite, gabbro, anorthosite, olivine, gabbro, dunite, pyroxenite, norite, dolerite porphyry, basalt, trachyte, rhyolite, vitrophyre, obsidian, pumice, scoria, pitchstone, volcanic tuff and volcanic breccia. | 12 | CO3 |
| IV | Megascopic identification and description of the following: conglomerate, breccia, laterite, sandstone, arkose, greywacke, grit, shales, limestones, chert, flint, peat, bituminous coal, anthracite, lignite, chalk, gneisses, schist, phyllite, slates, quartzite, marble, ophicalcite, itabirite, jaspillite, quartz-magnetite rock, amphibolite, eclogite, leptynite, khondalite, kodurite, gondite, charnockite, calc granulite and basic granulite. | 12 | CO4 |
| V | Microscopic identification and description of the following: mica granite, hornblende granite, tourmaline granite, schorl rock, aplite, graphic granite, quartz syenite, mica syenite, hornblende syenite, nepheline syenite, quartz diorite, hornblende diorite, olivine gabbro, hypersthene gabbro, troctolite, dunite, peridotite granite porphyry; syenite porphyry, diorite porphyry, quartz porphyry, dolerite, minette, anorthosite, rhyolite, trachyte, andesite, basalt, leucite, phonolite, nosean, and volcanic breccia. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basic Petrology | PO1 |
| **CO2** | Know the macro and micro-structures  | PO1, PO2 |
| **CO3** | Know various agents of sedimentary and metamorphic petrology | PO4, PO6 |
| **CO4** | Understand the Petrographical characters of rocks | PO4, PO5, PO6 |
| **CO5** | Analyse Origin of various rock types  | PO3, PO8 |
| **Text Books** **(Latest Editions)** |
| 1. | Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi |
| 2. | Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. &Dist, New Delhi |
| 3. | KrishnasamyS,India’s MineralResources, Oxford &IBH. Delhi(1988) |
| 4. | SharmaN.L&R.K.Sinha. MineralEconomics, Oxford &IBH.Delhi(1985) |
| 5. | Prasad U, EconomicMineralDeposits, CBS.Delhi(2003) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | India’s Mineral Resoruces, Krishnaswamy.S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi |
| 2. | Introduction to Indian Economic minerals, Sharma, N.L and Ram, K.S.V.,(1970), Dhanbad publications, Dhanbad. |
| 3. | Industrial Minerals , Sinha,R.K,(1986), Oxford 7 IBH Pub. Co., New Delhi. |
| 4. | Craig,R.C& D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York.(1985) |
| 5. | Aiyengar, N.K.N, Minerals of Madras, Dept.of Industries &Commerce. Guindy, Madras, (1964). |
| **Web Resources** |
| 1. | https://www.britannica.com/topic/economic-geology  |
| 2. | https://en.m.wikipedia.org/wiki/supergene-(geology) |
| 3. | https://energymining.sa.gov.au/minerals/mineral-commodities |
| 4. | https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology |
| 5. | https://link.spring.com/ |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  |  **ECONOMIC GEOLOGY AND ORE ANALYSIS PRACTICAL** |  | Y | - | - | - | 3 | 5 | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 | Understand the basics of Minerals |
| CO2 | Understand the importance of Minerals in Geological studies |
| CO3 | Know different group of minerals systems |
| CO4 | Understand the descriptive mineralogy of different groups |
| CO5 | Understand the importance of Minerals and mineralogical studies  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Megascopic identification, description of visible characteristics, mode of occurrence and uses of the following ores: galena, anglesite, cerrusite, sphalerite, zincite, willemite, bornite, azurite, chalcopyrite, cuprite, malachite. | 12 | CO1 |
| II | Megascopic identification, description of visible characteristics, mode of occurrence and uses of the following ores: haematite, magnetite, siderite, goethite, pyrolusite, psilomelane, rhodochrosite, rhodonite, chromite, cinnabar, bauxite, realgar, orpiment, stibnite, molybdenite, pyrite, coal and its varieties. | 12 | CO2 |
| III | Megascopic identification and description of: monazite, samarskite, columbite, tantalite, beryl, zircon, Megascopic identification and description of the following minerals used for industrial purposes – magnesite, calcite, dolomite, gypsum, strontianite, celestite, fluorite,apatite. | 12 | CO3 |
| IV | Megascopic identification and description of the following minerals used for industrial purposes: barite, witherite, limonite, asbestos, quartz, feldspar, kaolin, garnet, rutile and ilmenite. | 12 | CO4 |
| V | Identification of the following mineral powders by blowpipe methods: galena, chalcopyrite, haematite, magnetite, celestite, strontianite, witherite, gypsum, bauxite, apatite, pyrite, siderite, orpiment, realgar, calcite, psilomelane, rhodochrosite, smithsonite and ilmenite. | 12 | CO5 |
|  | **Total** | **60** |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** | Understand the basics of Minerals |  |
| **CO2** | Understand the importance of Minerals in Geological studies |  |
| **CO3** | Know different group of minerals systems |  |
| **CO4** | Understand the descriptive mineralogy of different groups |  |
| **CO5** | Understand the importance of Minerals and mineralogical studies  |  |
| **Text Books** **(Latest Editions)** |
| 1. | Economic Mineral deposits, Bateman, A.N. (1981), Asian publishers House, New Delhi |
| 2. | Economic Geology – Economic Mineral Deposits, Umeshwar Prasad, (2010), CBS Pub. &Dist, New Delhi |
| 3. | KrishnasamyS,India’s MineralResources, Oxford &IBH. Delhi(1988) |
| 4. | SharmaN.L&R.K.Sinha. MineralEconomics, Oxford &IBH.Delhi(1985) |
| 5. | Prasad U, EconomicMineralDeposits, CBS.Delhi(2003) |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. | India’s Mineral Resoruces, Krishnaswamy.S revised by Shina, R.K, (1986), III Edi., Oxford & IBH Pub., Co., Ltd., New Delhi |
| 2. | Introduction to Indian Economic minerals, Sharma, N.L and Ram, K.S.V.,(1970), Dhanbad publications, Dhanbad. |
| 3. | Industrial Minerals , Sinha,R.K,(1986), Oxford 7 IBH Pub. Co., New Delhi. |
| 4. | Craig,R.C& D.V. Vaughan. Ore Microscopy and Ore Petrography. Wiley. New York.(1985) |
| 5. | Aiyengar, N.K.N, Minerals of Madras, Dept.of Industries &Commerce. Guindy, Madras, (1964). |
| **Web Resources** |
| 1. | https://www.britannica.com/topic/economic-geology  |
| 2. | https://en.m.wikipedia.org/wiki/supergene-(geology) |
| 3. | https://energymining.sa.gov.au/minerals/mineral-commodities |

|  |  |
| --- | --- |
| 4. | https://www.slideshare.net/mobile/monokaonaBoruah/magmatic-deposits-economic-geology |
| 5. | https://link.spring.com/ |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 2 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** |
| **CIA** | **External** | **Total**  |
|  | EXTENSION ACTIVITY | NME | Y | - | - | - | 1 |  | 25 | 75 | 100 |
| **Course Objectives** |
| CO1 |  |
| CO2 |  |
| CO3 |  |
| CO4 |  |
| CO5 |  |
| **UNIT** | **Details** | **No. of Hours** | **Course Objectives** |
| I | Students will be taken to various mines and mineral exploration industries across the country to gain first hand field experience on various mining methods, R&D activities in mineral exploration, interaction with subject experts in various industries and organizations involved in mineral exploration activities. | 12 | CO1 |
|  | **Total** |  |  |
| **The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.****The blooms taxonomy verbs will be given as a separate annexure for your reference.****Each course outcome should be mapped with the POs.** **The mapping of each CO can be done with any number of POs.** **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will; |
| **CO1** |  |  |
| **CO2** |  |  |
| **CO3** |  |  |
| **CO4** |  |  |
| **CO5** |  |  |
| **Text Books** **(Latest Editions)** |
| 1. |  |
| 2. |  |
|  |  |
| **References Books** **(Latest editions, and the style as given below must be strictly adhered to)** |
| 1. |  |
| 2. |  |
| **Web Resources** |
| 1. |  |
| 2. |  |
| **Methods of Evaluation** |
| **Internal Evaluation** | Continuous Internal Assessment Test | 25 Marks |
| Assignments |
| Seminars |
| Attendance and Class Participation |
| **External Evaluation** | End Semester Examination | 75 Marks |
|  | Total | 100 Marks |
| **Methods of Assessment** |
| **Recall (K1)** | Simple definitions, MCQ, Recall steps, Concept definitions |
| **Understand/ Comprehend (K2)** | MCQ, True/False, Short essays, Concept explanations, Short summary or overview |
| **Application (K3)** | Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain |
| **Analyze (K4)** | Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge |
| **Evaluate (K5)** | Longer essay/ Evaluation essay, Critique or justify with pros and cons |
| **Create (K6)** | Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations |

**In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.**

**The S, M, L is based on the course outcome. The mapping is based on the revised Bloom’s Taxonomy Verbs used to describe your course outcome.**

* **Remember and Understanding – Lower level**
* **Apply and Analyze – Medium Level**
* **Evaluate and Create – Strong Level**

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** |  |  |  |  |  |  |  |  |
| **CO 2** |  |  |  |  |  |  |  |  |
| **CO 3** |  |  |  |  |  |  |  |  |
| **CO 4** |  |  |  |  |  |  |  |  |
| **CO 5** |  |  |  |  |  |  |  |  |

**S-Strong(3) M-Medium (2) L-Low (1)**

****