



SOMAIYA
VIDYAVIHAR

K J Somaiya College of Science And Commerce



K.J. SOMAIYA COLLEGE OF SCIENCE AND COMMERCE

AUTONOMOUS – Affiliated to University of Mumbai

Re-accredited “A’ Grade by NAAC

Vidyanagar, Vidyavihar, Mumbai 400077

Syllabus for F.Y.B.Sc.

Program: B.Sc.

Course: Geology (Major and Minor)

Learning Outcomes based

Curriculum Framework (LOCF)

From the academic year 2023–2024

As Per NEP 2020

Structure of Syllabus - Semester I

Course Number	Course Title	Course Code	Credits	Hours	Periods (60 mins)	No. of Unit / Module	Lectures per Module
CC-1	Earth System Science	23US1GECC1ESS	2	30	30	2	15
CC-2	Geomorphology	23US1GECC2GMP	2	30	30	2	15
CP-1	Earth System Science Practical	23US1GECC1P	1	30	15	1	30
CP-2	Geomorphology Practical	23US1GECC2P	1	30	15	1	30

Structure of Syllabus - Semester II

Course Number	Course Title	Course Code	Credits	Hours	Periods (60 mins)	Unit / Module	Lectures (60 mins)
CC-1	Structural Geology and Plate Tectonics	23US2GECC1SPT	2	30	30	2	15
CC-2	Economic Geology	23US2GECC2EGE	2	30	30	2	15
CP-1	Structural Geology and Plate Tectonics Practical	23US2GECC1P	1	30	15	1	30
CP-2	Economic Geology Practical	23US2GECC2P	1	30	15	1	30

Semester I - Theory

Course Number	Course Code	Course Name	Number of Lectures
CC-1	23US1GECC1ESS	Earth System Science	15 L / Module

Course Learning Outcome:

After the successful completion of the Course, the learner will be able to:

1. Identify the basic processes involved within the Earth
2. List various methods for calculation of the age of the Earth
3. Understand the basics of plate tectonics and mantle convection
4. Comprehend interactivity between the hydrosphere, atmosphere, biosphere and lithosphere
5. Understand Ocean and atmospheric circulation
6. Explain the process of soil formation and soil types

Module 1 - Solid Earth	
Learning Objective	<ol style="list-style-type: none"> 1. State perspectives of geology 2. Infer Earth's internal structure and formation of solar system 3. Analyse the age of the Earth
Learning Outcome	<ol style="list-style-type: none"> 1. Define geology and its branches 2. Paraphrase the origin of earth 3. Illustrate the interior of Earth 4. Explain the plate tectonics model 5. Comprehend the concept of radioactivity
1.1	Geology and its perspectives. Solar System, Age of the Earth, Origin of Solar system. Meteors and Meteorites; Internal structure: core, mantle, and crust. Continental and Oceanic Crust.
1.2	Introduction to Plate Tectonics and Mantle Convection Convection in the Earth's core and production of its magnetic field Radioactivity

Module 2 - Interaction between the three Spheres	
Learning Objective	1. Describe elements of Hydrosphere and Atmosphere circulation of Earth 2. Explain the ocean circulation 3. Emphasize on the interrelation of atmospheric and oceanic circulation
Learning Outcome	1. Illustrate the Hydrological cycle 2. Identify the ocean relief features 3. Relate the elements of Oceanic and Atmospheric Circulation
2.1	Interaction between Atmosphere, Hydrosphere, Biosphere. General relief features of Ocean floor, Ocean Currents.
2.2	Climate and Weather associated hazards Structure of Atmospheric circulation, Ocean currents. Soil and Soil Profile.

Recommended books for References

1. Skinner, B. J., Porter, S. C., & Botkin, D. B. (1994). Blue Planet: An Introduction to Earth System Science. Laboratory Manual. John Wiley & Sons.
2. Siddhartha, K. (2016). Oceanography A Brief Introduction. Kisalaya Publications Pvt. Limited.
3. Selby M.J. (1985), Earth's Changing Surface - An Introduction to Geomorphology, Oxford University Press
4. Grotzinger, J., & Jordan, T. H. (2010). Understanding earth. Macmillan.
5. Duff, P. M. D., & Duff, D. (Eds.). (1993). Holmes' principles of physical geology. Taylor & Francis.



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F.Y.B.Sc. Syllabus

Question Paper Template

F.Y. B. Sc. (Geology) SEMESTER 1

Core Course- I

COURSE TITLE: Earth System Science

COURSE CODE: 23US1GECC1ESS [CREDITS - 02]

Module	Remebering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total Marks
I	11	8	5	3	3		30
II	13	9	3	3	2		30
Total Marks per Objective	24	17	8	6	5		60
% Weightage	40	28	13	10	9		100

Course Number	Course Code	Course Name	Number of Lectures
CC-2	23US1GECC2GMP	Geomorphology	15 L / Module

Course Learning Outcome:

After the successful completion of the Course, the learner will be able to:

1. Analyze geomorphological systems in terms of resisting and driving forces
2. Evaluate the creation of landforms by different surface processes
3. Describe the exogenous and endogenous processes in the landscape, their importance in landform development, and distinguish the mechanisms that control these processes
4. Analyse how variations in climate, tectonics and environment affect the development of landforms

Assess how different scales of time and space affect geomorphological processes

Module 1 - Geomorphic System	
Learning Objective	<ol style="list-style-type: none"> 1. Distinguish between the endogenic and exogenic sources of energy 2. Evaluate the evolution of the geomorphic theory over time 3. Identify landforms created by various weathering processes 4. Identify the geomorphic landforms created by aeolian processes and evaluate the role of various aeolian parameters in their formation 5. Assess the role of anthropogenic activities on a landscape
Learning Outcome	<ol style="list-style-type: none"> 1. Identify the interactions that result in formation of different landscapes and predict the outcome given a set of geomorphic conditions 2. Judge the applicability of an isotopic dating method in a given situation to solve a geomorphic problem 3. Distinguish between the different types of deserts based on their causative mechanisms and generate a list of common factors that lead to formation of deserts
1.1	Interaction of rock cycle and water cycle. Denudation and Deposition: Weathering, Erosion and Mass wasting, Factors controlling Weathering, Types of Weathering, Sediment transportation, Sediment deposition. Classification of Mass movement.

1.2	Introduction to Plate Tectonics and Mantle Convection Convection in the Earth's core and production of its magnetic field Radioactivity Age of the earth
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Module 2 - Geomorphic Process

Learning Objective	<ol style="list-style-type: none"> 1. Identify the geomorphic landforms created by fluvial processes. 2. Estimate the scale of a flood and determine its severity based on a time-dependent change in the hydrographs 3. Differentiate between consequent and transverse drainage patterns. 4. Identify geomorphic landforms created by glacial processes and evaluate the role of various glacial parameters in their formation 5. Identify the geomorphic landforms created by coastal processes 6. Assemble a list of factors that affect the formation of karst landforms
Learning Outcome	<ol style="list-style-type: none"> 1. Evaluate the role of various fluvial parameters in their formation 2. Evaluate the tectonic changes in the landscape 3. Classify and distinguish between the different types of glaciers, their formation and the mechanisms of their movement 4. Evaluate the effect of epeirogeny in a region and determine its effect on isostatic rebalance of the tectonic plate 5. Analyze the formation of waves and determine the areas of high-energy and low-energy wave action that may lead to coastal erosion or coastal deposition respectively 6. Evaluate the role of relative tectonic uplift or subsidence in generating coastal landforms
2.1	Fluvial Processes and Landforms: W.M. Davis Cycle of erosion, Fluvial Transport and Deposition: Alluvial Fans, Floodplains and Terraces, Alluvial Bars, Braided Channels, Straight and Meandering Channels.
2.2	Glaciers and Glaciated landforms: Ice movement, flow patterns, forms of glacier surfaces, Glaciated erosional landforms and glaciated depositional landforms. Aeolian Processes and Landforms: Aeolian erosion, transport and deposition.



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F.Y.B.Sc. Syllabus

Department: Geology

Recommended books for References

- 1.Shuttleworth, E., Huggett, R. J. (2023). Fundamentals of Geomorphology. United Kingdom: Routledge.
- 2.Huggett, R. (2016). Fundamentals of Geomorphology. United Kingdom: Taylor & Francis.
- 3.Selby M.J. (1985), Earth's Changing Surface - An Introduction to Geomorphology, Oxford University Press
- 4.Gupta, A., Kale, V. S. (2001). Introduction to Geomorphology. India: Orient Longman.
- 5.Summerfield, M. A. (2014). Global Geomorphology. United Kingdom: Taylor & Francis.
- 6.Bloom, A. L. (2004). Geomorphology: A Systematic Analysis of Late Cenozoic Landforms. United States: Waveland Press.



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Department: Geology



F.Y.B.Sc. Syllabus

Question Paper Template

F.Y. B. Sc. (Geology) SEMESTER 1

Core Course- II

COURSE TITLE: Geomorphology

COURSE CODE: 23US1GECC2GMP [CREDITS - 02]

Module	Remebering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total Marks
I	11	8	5	3	3		30
II	13	9	3	3	2		30
Total Marks per Objective	24	17	8	6	5		60
% Weightage	40	28	13	10	9		100

Semester 1 - Practical

Course Number	Course Code	Course Name
CP-1	23US1GECC1P	Earth System Science Practical

Learning Objective	Familiarise with Interior Structure of the earth, Ocean morphology, atmospheric circulation and soil profiles in the earth with age
Learning Outcome	1. Learn about the various Ocean floor morphological features 2. Learn about the Interior of the earth and its layered structure 3. Understand the Ocean and Atmospheric Circulation and its relationships 4. Understand Soil Profiles and its variations in the earth's crust
1	Ocean Floor Morphology.
2	Preparation of diagram showing layered structure of Earth's interior.
3	Problems related to absolute and relative dating methods.
4	Study of Soil Profile.
5	Exercise related to Ocean current and Circulation.
6	Exercise related to Atmospheric Circulation.

Course Number	Course Code	Course Name
CP-2	23US1GECC2P	Geomorphology Practical

Learning Objective	Familiarise with the geomorphic landforms formed by different endogenic and exogenic processes and compute the rate of processes bringing about the change
Learning Outcome	<ol style="list-style-type: none"> 1. Identify the individual landforms and the overall landscape on a toposheet or map and determine their causative mechanisms and processes 2. Compute the change in exogenic processes with respect to time and their effect on the geomorphic landscape
1	Toposheet reading
2	Measurement of areas enclosed within curves
3	Topographic Profiles, Projected Profiles,
4	Superimposed Profiles and Spur Profiles
5	Longitudinal and cross valley profiles.
6	Drainage basin analysis – Linear aspects Hypsometric analysis, watershed delineation Types of drainage.
7	Identification of geomorphic features on different types of maps and toposheets.

Semester II - Theory

Course Number	Course Code	Course Name	Number of Lectures
CC-1	23US2GECC1SPT	Structural Geology and Plate Tectonics	15 L / Module

Course Learning Outcome:

After the successful completion of the Course, the learner will be able to:

1. Comprehend, assess, analyse different structures and develop core competencies to apply this knowledge in field and practical problems
2. Enhance their skills in structural mapping
3. Identify the basic processes involved within the Earth
4. Do Topographic Analysis and solve Structural Maps

Module 1 - Topography and Geological Structures	
Learning Objective	<ol style="list-style-type: none"> 1. Recognize the basics of geologic structure and its types 2. Explain the different types of geological structures that are observed in rocks and methods of their classification
Learning Outcome	<ol style="list-style-type: none"> 1. Define structural geology and understand its significance 2. Distinguish between different types of folds, faults and dipping strata and measure the strike and dip of structural entities 3. Analyse the topographic, structural features and understand structural maps
1.1	Effects of topography on structural features, topographic and structural maps, important representative factors of a topographic map. Planar and linear structures: Concept of dip and strike, outcrop pattern of different structures.
1.2	Geological structures: Geometric description and classification of folds, terminology and anatomy of faults, geometry and kinematics of faults.

Module 2 - Plate Tectonics	
Learning Objective	1. Familiarize the concept of Plate tectonics 2. Recognize and assemble the continents of the supercontinent, Pangea. 3. Describe the interaction between plate boundaries 4. Describe Volcanism and plate motion
Learning Outcome	1. Demonstrate a knowledge and understanding of the theory of tectonic plates with evidence 2. Demonstrate a knowledge and understanding of the three main types of plate boundary 3. Explain the process of the motion of the tectonic plates
2.1	Concept of plate tectonics, sea-floor spreading, and continental drift
2.2	Geodynamic element of the earth - Mid-oceanic ridges, trenches, transform faults, island arcs
2.3	Earthquakes and volcanoes associated with plate tectonics

Recommended books for References

1. Condie, K. C. (2013). Plate Tectonics & Crustal Evolution. United Kingdom: Elsevier Science.
2. Kluth, C. F., Reynolds, S. J., Davis, G. H., Kluth, C. (2012). Structural Geology of Rocks and Regions. United Kingdom: Wiley.
3. Park, R. G. (2004). Foundations of Structural Geology. United Kingdom: Routledge.
4. Ragan, D. M. (2009). Structural Geology: An Introduction to Geometrical Techniques. (n.p.): Cambridge University Press.
5. Billings, M. P. (1954). Structural Geology. United Kingdom: Prentice-Hall.
6. Fossen, H. (2016). Structural Geology. United Kingdom: Cambridge University Press.



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F.Y.B.Sc. Syllabus

Question Paper Template

F.Y. B. Sc. (Geology) SEMESTER 2

Core Course- I

COURSE TITLE: Structural Geology and Plate Tectonics

COURSE CODE: 23US2GECC1SPT [CREDITS - 02]

Module	Remebering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total Marks
I	11	8	5	3	3		30
II	13	9	3	3	2		30
Total Marks per Objective	24	17	8	6	5		60
% Weightage	40	28	13	10	9		100

Course Number	Course Code	Course Name	Number of Lectures
CC-2	23US2GECC2EGE	Economic Geology	15 L / Module

Course Learning Outcome:

After the successful completion of the Course, the learner will be able to:

1. Discuss the basic terminology used in economic geology
2. Explain the various endogenous processes of formation of ore minerals
3. Describe the exogenous processes of formation of ore minerals
4. Enumerate the different geographical and geological distribution of various economic minerals in India and the important metallogenic epochs

Module 1 - Introduction and Endogenous processes of formation of ore Minerals	
Learning Objective	<ol style="list-style-type: none"> 1. Become acquainted with the basic terminology used in economic geology 2. Explain the various endogenous processes of formation of ore minerals
Learning Outcome	<ol style="list-style-type: none"> 1. Evaluate the various factors that control ore formation 2. Identify the processes of ore mineral formation by Magmatic concentration, Hydrothermal processes, sublimation and Contact Metasomatic processes 3. Differentiate between various endogenous processes
1.1	Ores, gangue minerals, tenor, grade and lodes Resources and reserves- Economic and Academic definitions Metallic, industrial and strategic minerals.
1.2	Mineral deposits and classical concepts of ore formation. Endogenous processes: Magmatic concentration, skarns, greisen and hydrothermal deposits.

Module 2 - Exogenous processes and distribution of Economic minerals in India

Learning Objective	1. Explain the various exogenous processes of formation of ore minerals 2. Understand metallogenic epochs and provinces 3. Learn the formation, association and Indian distribution of major metallic ore minerals 4. Learn the formation, association and Indian distribution of major nonmetallic ore minerals
Learning Outcome	1. Explain the various exogenous processes of formation of ore minerals 2. Learn the factors that affect the formation of ore minerals by exogenous processes 3. Enumerate the different geographical and geological distribution of major metallic ore minerals and non-metallic ore minerals in India
2.1	Exogenous processes: weathering products and residual deposits, oxidation and supergene Enrichment, placer deposits. Distribution of ores and minerals Metallogenic provinces and epochs
2.2	Important deposits of India including atomic minerals Non- metallic and industrial rocks and minerals, in India.

Recommended books for References

1. Misra, K. (2012). Understanding Mineral Deposits. Germany: Springer Netherlands.
2. Deb, M., Sarkar, S. C. (2017). Minerals and Allied Natural Resources and Their Sustainable Development: Principles, Perspectives with Emphasis on the Indian Scenario. Singapore: Springer Nature Singapore.
3. Bateman, A.M. and Jensen, M.L. (1990) Economic Mineral Deposits. John Wiley.
4. Evans, A. M. (2013). Ore Geology and Industrial Minerals: An Introduction. Germany: Wiley.
5. Robb, L. (2020). Introduction to Ore-Forming Processes. United Kingdom: Wiley.
6. Gokhale, K.V.G.K. and Rao, T.C. (1978) Ore deposits of India their distribution and processing, Tata-McGraw Hill, New Delhi.
7. Prasad, U. (2005). Economic Geology : Economic Mineral Deposits, 2e. India: CBS Publishers & Distributors.



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F.Y.B.Sc. Syllabus

Question Paper Template

F.Y. B. Sc. (Geology) SEMESTER 2

Core Course- II

COURSE TITLE: Economic Geology

COURSE CODE: 23US2GECC2EGE [CREDITS - 02]

Module	Remebering / Knowledge	Understanding	Applying	Analysing	Evaluating	Creating	Total Marks
I	11	8	5	3	3		30
II	13	9	3	3	2		30
Total Marks per Objective	24	17	8	6	5		60
% Weightage	40	28	13	10	9		100

Semester II - Practical

Course Number	Course Code	Course Name
CP-1	23US2GECC1P	Structural Geology and Plate Tectonics Practical

Learning Objective	To provide practical tools for different structural techniques used in industry / exploration organisations.
Learning Outcome	1. Learn about Structural Geological problems 2. Learn interpretation of geological maps 3. Learn projection of structural data in stereographic plots
1	Basic idea of topographic maps
2	Three point problems
3	Understanding topographic maps of different scales
4	Interpretation of geological maps with unconformities, fold, faults, igneous intrusions and construction of geological cross sections
5	Stereographic projection of lines and planes

Course Number	Course Code	Course Name
CP-2	23US2GECC2P	Economic Geology Practical

Learning Objective	Learn to identify different metallic and non-metallic ores from their megascopic properties and apply the knowledge to identify in the field
Learning Outcome	1. Learn identification of ore minerals in hand specimen 2. Identification of gangue constituents and associated minerals to understand the depositional setting 3. Learn the Indian distribution and deposit types.
1	Identification with the help of physical properties, chemical composition and origin
2	Indian occurrences and geographical distribution of the following Metallic and Non-Metallic economic minerals: Limestone, Baryte, Bauxite, Magnesite, Mica, Coal, Biotite, Calcite, Dolomite, Fluorite, Garnet, Kyanite, Magnesite, Muscovite, Serpentine, Talc, Tourmaline, Barytes, Bauxite, Chalcopryrite, Chromite, Cuprite, Galena, Graphite, Gypsum, Hematite, Ilmenite, Limonite, Magnetite, Malachite, Psilomelane, Pyrite, Pyrolusite, Sphalerite, Stibnite.
3	Geographic distribution of important mines of India.
4	Geographic distribution of important minerals of Maharashtra.

Teaching learning process:

The pedagogic methods adopted, involve direct lectures, tutorial discussions, as well as technology-supported presentations. We believe that education is interactive and all sessions between students and teachers are based upon reciprocity and respect. 1) The lectures (of fifty minutes duration) delivered to one whole class at a time systematically deal with the themes of the syllabus. This constitutes the core of the teaching-learning process. The students are provided with bibliographic references and encouraged to go through at least some readings so that they could be more interactive and ask more relevant questions in the class. This also helps obtain knowledge beyond the boundaries of the syllabi.

2) Wherever needed, teachers use audio-video based technology devices (e. g. power point, YouTube videos) to make their presentations more effective. Some courses require that students see a documentary or feature film and course themes are structured so that discussions of these will further nuance the critical engagement of students with ideas introduced in their textual materials. 3) Remedial coaching, bridge courses are adopted to enhance the scope of learning for the learners. Remedial sessions are conducted to offer assistance on certain advanced topics. Bridge courses facilitate the development of a concrete basis for the topics to be learnt in the coming academic year.

Assessment Methods:

Evaluation Pattern: Theory

- Assessments are divided into two parts: Continuous Internal Assessment (CIA) & Semester End Examination.
- The Semester End Examination shall be conducted by the College at the end of each semester.
- Semester End Examination (external) (30 M)- Duration: 1 hours Paper Pattern.

Question No	Module	Marks with Option	Marks without Option
1	1	15	25
2	2	15	25

- For Internal Evaluation (20 M)
- Mid Sem Examination 10 M
- Seminar/ Assignment/ Research paper review 10 M

Evaluation pattern: Practical

- Semester-end evaluation: 15 Marks practical examination for each Course at the end of semester.
- Continuous internal evaluation 10 marks as per the following rubrics

Experimental Work	Experimental Report	Quiz	Total
5	2	3	10

Programme and Course Code Format

The course is coded according to following criteria:

- First two numbers in each course code indicates year of implementation of syllabus (21- year of implementation is 2021-22)
- Third letter 'U' designates undergraduate
- Fourth letter 'S' designate Science discipline and the digit followed is for semester number (S1 – 1st Semester)
- Letter 'G' is for Geology discipline (G- Geology) This forms the programme code 21USGE. For the further course codes programme code is amended as follows
- To designate the semester, add the digit (1-6) after S in the programme code. (Eg: 21US1GE- for semester I) For the further course codes, addition to the programme code should be done as per the following instructions.
- To represent core courses (CC) followed by course number digit (1/2/3/4) and three lettered code representing the title of the course.
- For Ability enhancement course code, (AE) alphabets followed by a digit (1/2) followed by 'FOC'- Foundation course, 'EVS'-Environmental science are used.
- For Skill enhancement courses code (SE) followed by digits (1/2/3) followed by letters 'STP'- Sports training programme, 'BCE'-Basic communication in English, 'ICH'-Indian cultural heritage, followed by digits (1/2/3) representing the levels used. In case of subject related SEC, (SE) followed by digits (1/2/3) followed by a three lettered code representing the title of the course are used.
- For Discipline specific elective course (DS) of Semester V and VI, (DS) followed by digits (1/2/3/4) followed by a three lettered code representing the title of the course are used.
- 'P' followed by digit indicates practical course number (practical course number will be added for semesters only where there are more than one course).