Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: M. Sc. (Geology)

PROGRAMME OUTCOMES (POs)

At the end of the two-year M. Sc. Geology programme, the student would be able to

PO1	Deep subject Knowledge and intellectual breadth	Develop extensive subject knowledge in various field of Geology.
PO2	Professional Ethics	Apply ethical principles and commit to professional ethics are dedicated to the highest standards of personal integrity and professional conduct.
PO3	Creative & Critical Thinking	Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO4	Innovation, Research and Problem Solving	Identify, create and review research materials to solve complex problems that lead to concentrate and innovative conclusion. Apply the knowledge to solve problems associated with Geology Design solutions for complex problems with appropriate consideration for the environmental pollution, waste management, urbanization and natural hazards, such as floods, Landslides and Earthquake etc.
PO5	Team work and Communication Skills	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings Present/communicate research at national/international level, write effective articles, reports and design documentation, make effective presentations, and give and receive clear instructions. Communicate disciplinary knowledge to the community and broader public.
PO6	Professionalism and Leadership Readiness	Demonstrate personal accountability and effective work habits, e.g., time and work planning as well as punctuality and working productively with different components. Use the strengths of others to achieve common goals.
PO7	Lifelong learning	think at a higher level and act locally as individual and as citizens, be aware of the nature around as well as to make the right decisions about the environment and the important elements of nature.
PO8	Competence for Digital World	Prepare well for living, learning and working in a Digital Society; Create, select, and apply appropriate techniques, resources, and modern ICT tools to complex activities with an understanding of the limitations. Use existing digital technologies ethically and efficiently to solve problems, complete tasks, and accomplish goals.
PO9	Global Citizenship	Act with an informed awareness of global issues. Engage in initiatives that encourage equity and growth for all.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

At the end of the two-year M. Sc. Geology programme, the student would be able to

PSO 1: Demonstrate their proficiency in basic geological problem-solving abilities by completing assignments, participating in seminars, and working on projects, identify different minerals and rocks from hand specimens and think critically. Develop a culture of research work, and improve understanding of geological maps, topography, satellite data interpretation, and field and lab data collection.

PSO 2: solve problems, share advanced information on subjects related to many aspects of geology, such as geology in the sectors of engineering, mining, hydrogeology, and other areas.

PSO 3: Collaborate in various geological services with demonstration of true values of leadership, co-operation, hard work, teamwork etc. during the field works, surveys and field visits.

PSO 4: be prepared for competitive tests, such as NET, SET, GATE, GSI, and GSDA, and give them individual guidance on how to conduct fieldwork.

Employability Potential of the Programme:

Master of Science in Geology is a postgraduate degree course of two year duration, divided into four semesters. This course basically teaches students about the surrounding environment and focuses on the scientific study of the workings and design of the earth and its layers.

M.Sc. Geology Programme is developed to create the awareness about issues related to the planet Earth which include natural resource management, environmental protection, mineral and oil exploration. The Programme would also develop the problem solving ability of the student in the area of natural hazards like landslides, earthquakes, floods etc.

After completing the PG course, the students of M.Sc. Geology can work for private industries, government organization, museum, college and universities etc. and they can get jobs as a Geological Technologist, Engineering Geologist, Geochemist, Geoscientist, Hydrogeologist, seismologist, researcher, meteorologist, geophysicist, oceanographer, onshore well-site geologist, development geologist, technical sales manager, and small business leader etc. The students can also start own consulting firm form ground water exploration, rain water harvesting, minor minerals and building materials. The students also have the opportunity to carry out research works in their field like mineralogy, structural geology and geotechnical engineering. There are a lot of research labs in India that appoints MSc Geology students for carrying out their research. If one wishes to continue in the same field of education, the first program of choice is a PhD in Geology. It is a three to five year duration course and the eligibility criteria include a M.Sc. degree in Geology with NET/SET/GATE or MPET.

Nowadays water scarcity is one of the major problems in the society and only geologist can find the solution on this issue. Geology contributes a lot of innovation in fields like mining, petroleum, remote sensing and GIS, civil engineering, ores, oil and gas, water, marine geology, petrology, geochemistry, mineralogy, structural geology, and palaeontology. Due to climate change and increasing demand for minerals and natural resources, many jobs have been created in geology. Almost everything depends on natural resources; the company needs graduates in this field.

Job opportunities

1) **Central government companies and PSUs**
   Geological Survey of India **(GSI),** *Mineral Exploration Corporation Ltd*. **(MECL)**, Coal India Ltd. **(CIL),** Kudremukh Iron Ore Company Limited **(KIOCL)**, *Steel Authority of India Limited* **(SAIL)**, Hindustan Copper Limited **(HCL)**, National Mineral Development Corporation Pvt Ltd **(NMDC)**, Atomic Minerals Directorate for Exploration and Research **(AMD)**, Oil and Natural Gas Corporation Ltd. **(ONGC)**, Indian Bureau of Mines **(IBM)**, Central Ground Water Board **(CGWB)**, Regional Remote Sensing Centre **(RRSC)**, National Remote Sensing Centre **(NRSC)**, Bhabha Atomic Research Centre **(BARC),** National Environmental Engineering Research Institute **(NEERI)**, Central Institute of Mining and Fuel Research **(CIMFR).**

2) **State government**
   Groundwater Surveys & Development Agency **(GSDA)**, Directorate of *Geology* and Mining **(DGM),** Maharashtra Remote Sensing Application Centre **(MRSAC).**

3) **Private sector metals and commodities companies**
   1. Reliance Industries, 2. Essar, 3. Tata Steel, 4. JSPL, 5. JSW, 6. JSL, 7. Essel Mining, 8. HINDACLO, 9. Vedanta, 10. Rungta, 11. Baldota Ramgarh Minerals, 12. Wolkem, 13. LANCO, 14. Geomysore, 15. Deccan Gold, 16. Drilling companies, 17. Shyam Steel, 18. Adhunik, 19. Golcha Group.

4) **IT companies, looking to provide product and services in the field of mining**
   1. WIPRO, 2. Infosys, 3. TCS, 4. Accenture, 5. SAP

Part B

Syllabus Prescribed for First Year 2022-23 PG Programme

Programme: M. Sc. (Geology)

Semester I

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
1GOG 1	MINERALOGY	60
1GOG 2	STRUCUTRAL GEOLOGY AND TECTONICS	60
1GOG 3	GEOCHEMISTRY AND ANALYTICAL TECHNIQUES	60
1GOG 4	PALAEOBIOLOGY	60
1GOG 5	LAB-1	60
1GOG 6	LAB-2	60

COs (1GOG 1: MINERALOGY)

1. Students would be able to explain the basics of mineral chemistry and megascopic properties of minerals.
2. Students would be able to explain the optical properties of minerals.
3. Students would be able to describe the silicate mineral groups
4. Students would be able to describe the carbonates, sulphates and oxides minerals.
5. Students would be able to explain the native elements, gems & semiprecious minerals and radioactive minerals.

Unit	Content
Unit I	Chemistry of Minerals: Atom, Elements, Molecule, Compound and Mixture. Atomic Structure, Atomic Number, Atomic Weight, Atomic Bonding, Co-ordination Number. Physical, electrical, magnetic and radioactive properties of minerals; Silicate structures, Polymorphism & its types, Pseudomorphism. **(12)**
Unit II	Optical properties of minerals: birefringence, pleochroism, isotropism, interference figure, order of colours, extinction angle, twinning and its law, optic axis, uniaxial and biaxial minerals, optic orientation, dispersion and optical anomalies; optical accessories and its uses. **(12)**
Unit III	Mineralogy, atomic structure, mineral chemistry, physical & optical properties, and mode of occurrences of Olivine, Pyroxene, Amphibole, Mica, Feldspar, Garnet and Epidote groups. **(12)**
Unit IV	Mineralogy, atomic structure, mineral chemistry, physical & optical properties, and mode of occurrences of Feldspathoid, Quartz family, Alumino silicate groups and Carbonates, Sulphates, Oxides minerals etc. **(12)**
Unit V	Mineralogy, atomic structure, mineral chemistry, physical & optical properties, and mode of occurrences of Native elements, Sulphosalts, Phosphates, and Hydroxides; Gems and Semiprecious minerals; radioactive minerals. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work

4. Visit to the various organization

(30)

Course Material/Learning Resources
Essential Reading:

1. Gribble C. D. Rutley's Elements of Mineralogy 27 edition
2. Dexter Perkins - Mineralogy 2nd Edn PHI New Delhi
3. Dana E.S., Text book of Mineralogy 4th Ed 2005
4. Alexander P. O. (2009): **Handbook of Rocks, Minerals, Crystals & Ores.** New India Pub.
5. Babu, S. K. (1987): **Practical Manual of Crystal Optics**, CBS Pub. & Dist.
6. Phillips, W. R. and Griffen, D. T. (1986): **Optical Mineralogy,** Etd. CBS Pub & Dist.
7. Ray, S. (1958): **Optical Mineralogy**.
8. Kerr, P. (1977): **Optical Mineralogy**, McGraw- Hill Book Co.

Suggested Reading:

1. Deer, W. A., Howie, R. A. & Zussman, J. (1966): **An Introduction to Rock Forming Minerals.**
2. Deer, W. A., Howie, R. A. & Zussman, J. (1996): **The Rock Forming Minerals**, Longman
3. Winchell, A. N. (1939): **Elements of Optical Mineralogy**, Lincoln Pub. Co., New York.
4. Naidu, P. R. J. (1918): **Optical Mineralogy**, Allied Pub., Kolkata
5. Klein, C. and Hurlbut, Jr., C.S., 1993 : Manual of Mineralogy, John Wiley.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.swayam2.ac.in/cec21_ce01/preview
https://www.classcentral.com/course/swayam-crystallography-and-mineralogy-22942
https://www.careers360.com/university/dr-harisingh-gour-vishwavidyalaya-sagar/crystallography-and-mineralogy-certification-course

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://www.youtube.com/watch?v=i-CDVqhcEcE&list=PLpk11CHBpb6sDDa_ooZuKb7dm_LKWvBNl
https://www.youtube.com/watch?v=8Jf4z8sE6N0
https://www.youtube.com/watch?v=lhx1nvZFPS4&list=PLrb2lGnLJld_E7C0wVAqU4JGabm2IiT38

COs (1GOG 2): STRUCUTRAL GEOLOGY AND TECTONICS)

1. Students would be able to explain the mechanisms of rock deformation
2. Students would be able to distinguish between Faults, Fractures and Joints.
3. Students would be able to describe the Fold, Foliation, Lineation and Fabrics
4. Students would be able to distinguish between different igneous bodies and its significance in structural geology.
5. Students would be able to understand concept of plate tectonics.

Unit	Content
Unit I	Deformation: Mechanisms of rock deformation, Theories of rock failure, Behaviour of minerals and rocks under deformation conditions; Stress - Concept of stress, forces and stress, normal and shear stress, stress components, principal stresses, stress trajectories. Strain - Concept of strain, measurement of strain, techniques of strain analysis, progressive strain, principal strain axes and strain ellipsoid, Mohr Circle and their use, volume changes during deformation, relationship between stress and strain; Behaviour of rock with depth: Effect of confining Pressure, Temperature, Pore-fluid pressure, and strain rate in rocks. **(12)**
Unit II	Faults and fractures: Rock fractures, Fault geometry and nomenclature, Classification, Mechanism of Faulting, Features associated with fault planes, Fault associations, Thrust system, Extensional fault system, Strike-slip fault system, Shear zones, Kinematic significance of different shear zone structures. Joints and its classification, Cleavage & its types. **(12)**
Unit III	Folds: Fold geometry and nomenclature, Fold orientation, Classification of

	folds, Mechanism of folding, Relationship between faults, folds and ductile shears. Superimposed folding: Outcrop patterns of superimposed structures, comprising two fold systems. Ramsay's Classification of fold, Buckling, Oblique shear or flow folding, Kinking and formation of chevron folds, Foliation, Lineation and fabrics. **(12)**
Unit IV	Igneous bodies - Significance of igneous bodies in structural geology, Structural classification of igneous bodies, igneous pluton, diapirs and salt domes. Emplacement of igneous intrusions – Dilational emplacement of dikes and sills, emplacement of cone sheets and radial dikes, mode of emplacement of large intrusions, **(12)**
Unit V	Tectonics: Major structures of earth, continents and oceans, mountain ranges; Plate tectonics - Concept of plates, lithosphere, asthenosphere, nature of plate boundaries - constructive and destructive, subduction zone, oceanic ridges and trenches, geometry of plate motion, driving mechanism for plate motion. Seafloor spreading and plate tectonics; Island arcs, Oceanic islands and volcanic arcs; Triple junctions, Isostasy, orogeny and epeirogeny; Seismicity and plate movements. Stable and unstable tectonic zones, Present day tectonic activity. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work **(30)**

Course Material/Learning Resources

Essential Reading

1. Park, R. G. (1997): **Fundamentals of Structural Geology**.
2. Ghosh, S. K. (1985): **Structural Geology- Fundamental & Modern Development**.
3. Ramsay, J. G. (1967): **Folding & Fracturing of Rocks**, Pergamon Press, Mc Graw Hill, New Delhi.
4. Ramsay, J. G. (1983): **Strain Analysis & Deformation**, Academic Press.
5. Saklani, P. S. (1983): **Structural & Tectonics of Himalaya**, Today & Tomorrow Pub. New Delhi
6. Hills, S. E. (1950): **Structural Geology**.
7. Billings, M.P. (1974): **Principle of Structural Geology**, III Edi. Prentice Hall Int. Inc.
8. Park, R. G. (1988):**Geological Structures and Moving Plates**

Suggested Reading:

1. Ramsay, J. G. and Huber, M. I. (1993): **The Techniques of Modern Structural Geology**, V. I & II, Academic Press.
2. Seyfert, C. K. (1987): **Encyclopedia of Structural Geology**, Vay Norstand Reinhold, New York.
3. Valdiya, K. S. (1980): **Geology Kumaun Himalaya**, WIHG, H.T. Press, Dehradon
4. Jain, A. K. (2014): **Structural Geology**, Geol. Soc. of India, Bangalore.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://www.classcentral.com/course/swayam-structural-geology-14312
https://www.classcentral.com/course/swayam-introductory-field-structural-geology-91695
https://www.careers360.com/university/indian-institute-of-technology-kanpur/structural-geology-certification-course
https://onlinecourses.nptel.ac.in/noc19_ce47/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://www.youtube.com/watch?v=-dK9byeDZgM
https://www.youtube.com/watch?v=1WsbBNRzc7g

COs (1GOG 3): GEOCHEMISTRY AND ANALYTICAL TECHNIQUES)

1. Students would be familiar with the main aspects of the Geochemistry.
2. Students would be able to understand the Cosmochemistry
3. Students would be able to describe the different types of Isotopes and radiometric dating methods
4. Students would be able to illustrate the Thermodynamics and crystal chemistry
5. Students would be familiar with the analytical instruments and its techniques used in geosciences.

Unit	**Content**
Unit I	Geochemistry: Introduction, history, scope and present status. Atomic structure and properties of elements in the periodic table. Special properties

	of transition and rare earth elements. Origin and abundance of elements in the Earth and its constituents. Distribution coefficients. **(12)**
Unit II	Cosmochemistry: Principles of distribution of elements in the cosmos, composition of planets; classification, mineralogy, origin and significance of Meteorites. Geochemical composition of the Earth. Geochemical classification of elements. Weathering indices. **(12)**
Unit III	Isotopes: Stable isotopes, its nature and abundance. Radiogenic isotopes, Growth of daughter isotopes, U-Pb, Sm-Nd, Rb-Sr, K-Ar methods of radiometric dating of rocks. Geochemical cycle and concepts of Geochemical prospecting & exploration; Geochemical association and pathfinder elements. **(12)**
Unit IV	Thermodynamics and crystal chemistry: Principles of ionic substitution in minerals, elements partitioning in mineral and rock formation. Nucleation & diffusion processes in Igneous, Sedimentary and Metamorphic environments, Redox reactions and Eh-pH diagram & their applications. **(12)**
Unit V	Dissolution procedure in Geological and environmental samples; Instrumentation Technique used in geosciences, Principles and geological applications of UV-VIS Spectrophotometry, Atomic absorption spectrometry (AAS), Inductively coupled plasma mass spectrophotometry (ICP-MS), X-Ray diffraction (XRD), Scanning Electron Microscopy (SEM), Electron Microprobe analysis. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization

(30)

Course Material/Learning Resources

Essential Reading:

1. Albarede, F. (2009):**Geochemistry an Introduction,** Cambridge Univ. press, (II Ed) 330p
2. Beus, A. A. and Grigorian, S. V. (1977): **Geochemical Exploration Methods for Mineral Deposits**, Applied Publication, University of California, 287p.
3. Brownlow, A. H. (1979): **Geochemistry,** Englewood Cliffs and London Prentice Hall, 498p.
4. Deckin, A. P.(2005): **Radiogenic Isotope Geology,** Cambridge University press, 492p (II Ed)
5. Hawkes, H. E. & Webb, J. S. (1962): **Geochemistry in Mineral Exploration,** Harper & Row.
6. Krauskopf, K. B. and Bird, D. K.(1995): **Geochemistry,** McGraw Hill, New York,640p
7. Nordstorm, D.K. and Munoz, J.L. (1986): **Geochemical Thermodynamics**, Blackwell.
8. Robin Gill, (1997): **Modern Analytical Geochemistry,** Addison Wesley Longman.
9. Hota, R. N. (2011): **Geochemical Analysis**, CBS Publication, Delhi.
10. M. W. Rowe and M. Hyman, (1993): **Advances in Analytical Geochemistry**, Volume 1, JAI Press Inc., Greenwich, Connecticut, U.S.A.

Suggested Reading:

1. Levinson, A.A. (1980): **Introduction to Exploration Geochemistry**, (2nd Ed) App. Pub., 924p.
2. Mason, B. and Moore, C. B. (1982): **Principles of Geochemistry,** Wiley Eastern Ltd., 344p.
3. Fairbridge, R. W. (1972): **Encyclopedia of Geochemistry and Environmental Sciences,** Von Nostrond Reinhold Co, 1321p.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://onlinecourses.swayam2.ac.in/cec19_mm01/preview

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://www.youtube.com/watch?v=pHj7ytPirEI
https://www.youtube.com/watch?v=93O0PXba0hI&list=PLdZcCa6mtW23cvplUz2IoqBDvI24pK82b
https://www.youtube.com/watch?v=pHj7ytPirEI
https://www.youtube.com/watch?v=bl_pzBdvbns
https://www.youtube.com/watch?v=Lng0hVDvsu0&list=PLOzRYVm0a65dtbpo_DP7acjsLYdmWT99r

COs (1GOG4): PALAEOBIOLOGY

1. Students would be able to understand the concept of palaeobiolgy.

2. Students would be able to explain the process of fossilization and Classification of organisms.

3. Students would be able to describe the phylum- Mollusca, Brachiopoda, Echinodermata and Arthropoda.

4. Students would be able to understand the micropaleontology and its significance

5. Students would be able to explain Evolutionary histories of man, elephant and horse and also discuss geological distribution and extinction of Dinosaur.

Unit	**Content**
Unit I	Modern concepts of origin of life, Chemical and biological evolution, Mechanism of evolution - mutation, adaptation, isolation, variation; Species concept and speciation; Paleontological evidence of evolution. Fossil record and geological time scale. **(12)**
Unit II	Fossil: Mode of preservation, Introduction to Taphonomy, Limiting environmental factors, physico-chemical condition for Fossilization, types of fossils, significance of fossils;, Preparation and nomenclature of fossils, Classification of organisms **(12)**
Unit III	Morphology, classification, geological history and evolution of mollusca-bivalve, gastropad, cephalopod; Brachiopoda, Echinodermata. Morphology, classification, geological distribution and significance of Arthropoda **(12)**
Unit IV	Significance of micropaleontology, Methods & technique of microfossil study. Foraminifers: Morphology, Classification, evolution, geological history, and palaeoecology. Ostracods: Morphology, Classification, Palaeoecology, and geological history. Conodonts, Morphology and geological range of Radiolarians and Diatoms **(12)**
Unit V	Vertebrates of Siwalik. Evolutionary histories of man, elephant and horse. Geological distribution and extinction of Dinosaur. Gondwana Flora and its significance. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization

(30)

Course Material/Learning Resources
Essential Reading:

1. Jain P. C., Anantharaman M. S. (2016) **Paelontology**
2. Dasgupta Amal: **An introduction to Palaeontology**
3. Clarkson, E.N.K., 1998 : **Invertebrate Palaeontology and Evolution**. IV Ed. Blackwell.
4. Kathal, P.K., Nigam, R. & Talib, A., (2017) **Micropaelontology, and its Applications**. Scientific publishers, New Delhi, Jodhpur 342 p.
5. Saraswati, P. K. & Srinivasan, M. S. (2016): **Micropaelontology, Principles & Applications**
6. ***Henry Woods (1958): Palaeontology*** **Invertebrate** CBS; 8th edition

Suggested Reading:

1. Prothero, D.R., 1998 : Bringing Fossils to Life- An Introduction to Palaeobiology, McGraw Hill.
2. Smith, A.B., 1994 : Systematics and the Fossils, Record-Documenting Evolutionary Patterns. Blackwell.
3. Stearn, C.W. & Carrol. R.I., 1989 Palaeontology; The Record of Life, John Wiley.

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:
https://www.youtube.com/watch?v=ehoEid0Pneo&list=PLb1flP7NCA7KcIWABW_lu7PAVXqWIih_1
https://www.youtube.com/watch?v=ZDKtS21RruQ

1GOG 7 Open elective/ GIC/Open skill course/MOOC*

GIC 1 Fundamentals of Geology **(15)hrs**

After successfully completing the course, the student will be able to

1. Understand basic idea about Geology
2. Understand origin and interior of Earth

Unit-1 Definition of geology, Earth in the solar system Origin of the earth **(7)hrs**

Unit-2: Constitution of earth: crust, mantle and core. Lithosphere, hydrosphere, atmosphere and biosphere. **(8)hrs**

Part B

Syllabus Prescribed for First Year 2022-23 PG Programme

Programme: M. Sc. (Geology)

Semester II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
2GOG 1	**IGENEOUS PETROLOGY**	**60**
2GOG 2	**METAMORPHIC PETROLOGY**	**60**
2GOG 3	**SEDIMENTOLOGY**	**60**
2GOG 4	**GEOMORPHOLOGY AND FIELD GEOLOGY**	**60**
2GOG 5	**LAB-3**	**60**
2GOG 6	**LAB-4**	**60**

COs (2GOG1: IGENEOUS PETROLOGY)

After completion of this course successfully, students would be able to

1. understand the genesis of magma and also study the texture and structures of igneous rock.
2. explain the different types of igneous rock classification.
3. describe the process of magmatic evolution and differentiation.
4. explain the phase rule and phase equilibrium of single, binary and ternary system.
5. describe Petrogenesis of major igneous rock.

Unit	Content
Unit I	Magma: Origin, nature, factors affecting magma and its evolution; Introduction to mantle petrology and mantle metasomatism, Plate tectonics and generation of different magmas in various tectonic settings. Study of textures, structures and their genetic significance of Igneous rocks. **(12)**
Unit II	Criteria for classification of the Igneous rocks. Mode, CIPW norms, IUGS, Chemical, mineralogical and other standard classification. Bowen's reaction principle: Reactions series and their applications to petrogenesis. **(12)**
Unit III	Magmatic evolution and differentiation: Fractional crystallization, gravitational differentiation, gas streaming, liquid immiscibility, and assimilation. Mantle, onset and process of partial melting in mantle, mantel-magmas in relation to degree and depth level of partial melting. **(12)**
Unit IV	Phase equilibrium of single systems. Binary systems: Eutectic, Solid solution series, Peritectic, Exsolution Systems. Ternary systems, Partial melting, Crystal fractionation and Crustal contamination. **(12)**
Unit V	Petrogenesis of major igneous rock types such as ultramafic komatiite, basaltic, granitic and alkaline rocks, ophiolites, carbonatite, lamprophyre, and Kimberlites. Petrographic Provinces and associations. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization

(30)

Course Material/Learning Resources

Essential Reading:

1. Best, Myron G. (2002): **Igneous and Metamorphic Petrology**. Wiley-Blackwell Science

2. Bose, Mihir K., (1997): **Igneous Petrology**, The World Press Pvt. Ltd., Calcutta, p.568.
3. Carmichael, I. S. E., Turner, F. J. & Verhoogen, J. (1971) **Igneous Petrology**, Mc Graw Hill
4. Ehlers, E.G. & Blatt, H. (1982): **Igneous, Sedimentary, and Metamorphic Petrology**, CBS Pub. Dist., New Delhi
5. Winter, J. D. (2012): **Principles of Igneous and Metamorphic Petrology** 2nd Edition, PHI Learning Pvt. Ltd., New Delhi
6. Philpotts Anthony R. (1992): **Principles of Igneous & Metamorphic Petrology**, Prentice Hall
7. S. C. Chatterjee (1974): **Igneous and Metamorphic Petrology**
8. Tyrell, G. W. (1963): **Principles of Petrology**, Metheun

Suggested Reading:

1. A.K. Gupta (1998): **Igneous Petrology**
2. Alexander, P. O. (2008): **Handbook of Minerals, Crystals, Rocks & Ores**, New India Pub.
3. Blatt, H. and Tracy, R. J. (1996): **Petrology (Igneous, Sedimentary &, Metamorphic)**, W.H. Freeman and Co., New York
4. Moorhouse W. W. (1959): **The Study of Rocks in Thin Section**, Harper

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://www.careers360.com/university/dr-harisingh-gour-vishwavidyalaya-sagar/geology-petrology-certification-course

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:
https://www.youtube.com/watch?v=wpKbv2mJwDc&list=PLI3yxxPdnJaYSSN0526DSnLmfkV26dJ82
https://www.youtube.com/watch?v=NhrNJB-43bo
https://www.youtube.com/watch?v=cd_nNahP9H4

COs (2GOG 2: METAMORPHIC PETROLOGY)

After completion of this course successfully, students would be able to

1. understand basic concept of Metamorphic Petrology
2. explain the classification of metamorphic facies and how the mineral content of metamorphic rocks indicates the pressure and temperature conditions of metamorphism.
3. describe nature of metamorphic reactions
4. describe metamorphic process
5. Compare and contrast the plate tectonic settings where metamorphism takes place and the variable conditions of metamorphism that the different settings produce.

Unit	Content
Unit I	Metamorphic Petrology: Scope, definition, Concepts and theory: Types/kinds of metamorphism and their controlling factors/variables, Types of metamorphic agents and classification based on metamorphic agent. Metamorphic zones and metamorphic grade. Structure and texture of metamorphic rocks **(12)**
Unit II	The concept of classification of metamorphic facies and facies series with special reference to characteristic mineral assemblages; subdivision into zones/subfacies, Pressure-temperature conditions of metamorphism, Pressure- temperature, time paths (P-T-t path). **(12)**
Unit III	Nature of metamorphic reactions, Isoreaction grid, Schreinmake's rule and construction of petrogenetic grids; Mineralogical phase rule of closed and open systems. Metamorphic differentiation, Metasomatism. **(12)**
Unit IV	Metamorphism of Granitoides, Charnockites and Migmatites. Regional and thermal metamorphism of pelitic rocks. Ultra High Pressure & Ultra High Temperature metamorphism. Regional and thermal metamorphism of basic and ultrabasic rocks. **(12)**
Unit V	Classification based on Plate tectonics and metamorphic facies series. Paired metamorphic belts. Ocean floor metamorphism & its types. Extraterrestrial metamorphism (impact and shock metamorphism), poly-metamorphism. **(12)**
**Activities	1. Assignment/ Seminar 2.Class test

3. Field work
4. Visit to the various organization

(30)

Course Material/Learning Resources
Essential Reading

1. Best, M. G. (2002): **Igneous and Metamorphic Petrology**, Wiley-Blackwell Science
2. Blatt, H. and Tracy, R. J. (1996): **Petrology (Igneous, Sedimentary &, Metamorphic)**, W.H. Freeman and Co., New York.
3. Winter, J. D. (2012): **Principles of Igneous & Metamorphic Petrology** (2nd Ed.)' PHI Learn.
4. Winkler, H. G. F. (1967): **Petrogenesis of Metamorphic Rocks**, Springer–Verlag./Narosa.
5. Thomas, H. (2005): **Metamorphism and Crustal Evolution** (Edited)
6. *Bhaskar Rao B. (*1986*): Metamorphic Petrology*. Publisher, Taylor & Francis

Suggested Reading:

1. Kretz, R. (1994): **Metamorphic Petrology**
2. Mason, R. (1978): **Petrology of Metamorphic Rocks,** CBS Pub. & Dist., New D

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://www.careers360.com/university/dr-harisingh-gour-vishwavidyalaya-sagar/metamorphic-petrology-and-thermodynamics-certification-course
https://www.classcentral.com/course/swayam-metamorphic-petrology-thermodynamics-14197

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:
https://www.youtube.com/watch?v=SXNmV4-ZDF8&list=PLT1sIl3JtKm_AeEOvIqlfDzUlFgbuN6w0
https://www.youtube.com/watch?v=qd5GdLUDQi4
https://www.youtube.com/watch?v=_81Imh52OI8

COs (2GOG3: SEDIMENTOLOGY)

After completion of this course successfully, students would be able to

1. explain the basics concept of sedimentary petrology.
2. recognize, describe, and classify sedimentary rocks.
3. describe Sedimentary environment and facies.
4. analyse the sedimentary petrology. .
5. Compare and contrast the tectonics and sedimentation of sedimentary basin.

Unit	**Content**
Unit I	Process of sedimentation - surface processes and rock weathering, mineral stability and source of sediments; Grain size analysis- phi scale, grain size measurement, sieving technique, settling technique; Graphic presentation of grain size data - histogram, frequency curve, cumulative curve; statistical parameter of grain size - mode, mean, standard deviation, skewness, kurtosis. **(12)**
Unit II	Classification and composition of sandstone, limestone, mud rock and conglomerate. Diagenesis of sandstone and limestone. Classification and significance of sedimentary structures. Origin and significance of trace fossils - preservational and behavioral classifications. **(12)**
Unit III	Sedimentary environment and facies: alluvial-fluvial, desert, aeolian, glacial, shallow marine and deep marine. Evaporite, Phosphorite, Chert, Iron and Manganese rich sediments, volcanogenic sediments. **(12)**
Unit IV	Palaeocurrent and basin analysis, Stromatolite origin and significance, Heavy mineral analysis, Preparation of litho logs, Rock and thin section staining, Cathodoluminescence, X-ray identification of clay minerals. **(12)**
Unit V	Tectonics and sedimentation of sedimentary basin - down warp basin, rift basin, interior basin, foreland basin, sub-duction basin, pull apart basin, delta type of basin, composite basin. **(12)**
**Activities	1. Assignment/ Seminar

2.Class test
3. Field work
4. Visit to the various organization

(30)

Course Material/Learning Resources
Essential Reading

1. Babu, S. K. & Sinha, D. K. (1987): **Sedimentary Petrology Practical**, CBS Pub., N. Delhi.
2. Blatt, M. and Murray (1980): **Origin of sedimentary rocks**, Printice Hall Inc.
3. Blatt, H. E., (1972): **Sedimentary Petrology**, 2nd Ed. W. H. Freeman & Co. New York.
4. Collins, J. D. and. Thompson, D. B (1982): **Sedimentary Structures**, George Allen & Unwin,.
5. Pettijohn, F. J. (1975): **Sedimentary rocks**, Harper and Row Publ., New Delhi.
6. Reading, H. G. (1986): **Facies**. Blackwell Scientific Publication.
7. Reinbeck, H. E. & Singh, I. B. (1980): **Depositional Sedimentary Environments**. Springer.
8. Sengupta, S. M. (2007): **Introduction of Sedimentology**. 2nd Ed. CBS Pub., New Delhi.

Suggested Reading:

1. Boggs, Sam (Jr.) (1996): **Princiles of Stratigraphy and Sedimentology**. 2nd Ed. Prentice Hall.
2. Selly, R. C. (1976): **An Introduction of Sedimentology**. Academic Press London.
3. Sukhtankar, R. K. (2004): **Applied Sedimentology**. 1st Ed. CBS Pub. & Dist., New Delhi.
4. Tucker, M. E. (1981): **Sedimentary Petrology: an introduction**. John Willey & Sons, New York.

Weblink to Equivalent MOOC on SWAYAM if relevant:
https://www.careers360.com/university/dr-harisingh-gour-vishwavidyalaya-sagar/geology-petrology-certification-course

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:
https://www.youtube.com/watch?v=SzK2Ok4PNCA
https://www.youtube.com/watch?v=uozyWZ6XQzM
https://www.youtube.com/watch?v=F9KwNOcmMd4

COs (2GOG 4: GEOMORPHOLOGY AND FIELD GEOLOGY)

After completion of this course successfully, students would be able to

1. explain the basics concept and process of Geomorphology.

2. apply the Morphometric Analysis and Fluvial Landforms.

3. describe the Eolian, Glacier and other types of landform.

4. understand the **I**mportance and scope of field geology.

5. handle Geological surveying instruments.

Unit	**Content**
Unit I	Fundamental concepts of geomorphology; Geomorphic agents and processes: exogenetic, endogenetic and extraterrestrial; Rock weathering and mass wasting; Cycle of erosion, rejuvenation and peneplaination, Karst topography. **(12)**
Unit II	Fluvial Geomorphology: Drainage system and pattern; Morphometric analysis: basic principles and techniques of river basin analysis and its application; River terraces and their significance, Fluvial land forms. Delta and its classification. **(12)**
Unit III	Arid, eolian, glacial, volcanic and coastal landforms; Ocean floor topography. Geomorphic features of India. Application of geomorphology in hydrogeology, engineering geology, and environmental studies. **(12)**
Unit IV	**I**mportance and scope of field geology, Study of outcrops, Field observations, Topographic forms, Reconnaissance survey, Toposheets , Topographic maps, Interpretation of contour maps, Mapping and analysis of sedimentary, igneous & metamorphic terrains. **(12)**
Unit V	Geological surveying: Plane table survey, Use of Clinometer, Brunton

compass, Prismatic compass, Abney level, Dumpy level and Theodolites. Air reconnaissance. Aerial photography & elements of aerial photo interpretation, Stereoscope and stereoscopic vision. **(12)**

**Activities	1. Assignment/ Seminar 2.Class test 3. Field work 4. Visit to the various organization

(30)

Course Material/Learning Resources
Essential Reading:

1. Savindra Singh (2015): **Geomorphology**, Paravalika Publication
2. Jain, S. (2014): **Fundamentals of Physical Geology**, Springer
3. Summerfield, M. A. (1999): **Global geomorphology- an introduction to the study of landforms**, Longman
4. Barkbank, D. W. and Anderson, R. S, (2008): **Tectonic Geomorphology**. Blackwell Science.
5. Ford, D. and Williams, P. (2007): **Karst Hydrology and Geomorphology**. John Wiley & Sons.
6. Hugget, R. J. (2007): **Fundamentals of Geomorphology** (2nd Ed.), Routledge, London
7. Charlton, R. O. (2007): **Fundamentals of Fluvial geomorphology,** Routledge
8. Harvey, A. M., Mathar, A. E. and Stokes, M. (2005): **Alluvial fans- Geomophology, Sedimentology, Dynamics**, Geol. Soc. London, Sp Pub. 251.
9. Thornbury, W. D. (2004): **Principles of Geomorphology** – Reprint CBS Pub., New Delhi
10. Field Geology - Lahee 1987 CBS Pub New Delhi.

Suggested Reading:

1. Allison, R. J. (2002): **Applied geomorphology,** John Wiely & Sons. Inc.
2. Turk, G. R. and Thompson, J. (1997) **Introduction to Physical Geology** (2nd Ed.), Brooks Cole.
3. Holmes, A. (1978): **Principles of Physical Geology** (3rd Ed.), Wiley,730p (3rd Ed)

Cotton, C. A. (1952) **Geomorphology**, John Wiley & Sons Inc.

Weblink to Equivalent MOOC on SWAYAM if relevant:
https://onlinecourses.nptel.ac.in/noc22_ce04/preview
https://www.classcentral.com/course/swayam-introductory-field-structural-geology-91695

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:
https://www.youtube.com/watch?v=0QRKkiOa9Fw
https://www.youtube.com/watch?v=ZEmauGfPJOE

2GOG7 Open elective/ GIC/Open skill course/MOOC*

GIC 2 Mineralogy **and Petrology**

(15) hrs

After successfully completing the course, the student will be able to

1. Understand basic idea about Mineralogy

2. Understand basic idea about Petrology

Unit-1 Definition of Mineralogy, Physical properties of mineral and identification of mineral.

(7) hrs

Unit-2: Definition of Petrology, Types of rock and their characters and uses.

(8)hrs

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for First Year 2022-23 PG Programme

Programme: M. Sc. (Geology)

Semester I

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
1 GOG 5	**LAB-1(Mineralogy and Structural Geology)**	**09**
1 GOG 6	**LAB-2(Geochemistry and Palaeobiology)**	**09**

COs (1 GOG 5- Mineralogy and Structural Geology)

After completion of this course successfully, students would be able to

1. Identify the megascopic properties of various Minerals
2. Identify the microscopic properties of various Minerals
3. Draw and interpret the geological section map and outcrop map
4. Present and interpret the structural data
5. Solve true and apparent dip problem

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Megascopic identification of minerals.
2. Microscopic identification of minerals.
3. Pleochroic colour scheme.
4. Extinction angle and its determination.
5. Presentation and interpretation of geological maps and sections.
6. Outcrop maps.
7. Stereographic projections of structural data.
8. Determination of true and apparent dip; Geometrical and Trigonometric method.

Reference Books:

9. Gribble C. D. **Rutley's Elements of Mineralogy** 27 edition
10. Rabindra Nath Hota (2017): Practical Approach to Crystallography and Mineralogy, CBS Publishers and Distributors PVT LTD
11. Billings, M.P. (1974): **Principle of Structural Geology**, III Edi. Prentice Hall Int. Inc.

COs (1 GOG 6- Geochemistry and Palaeobiology)

After completion of this course successfully, students would be able to

1. Calculate the mineral formulae from the concentration of various oxides in minerals.
2. Solve gain and loss problem in the weathering.

3. Calculate the weathering indices in soil and sediments and graphic presentation of analytical data.
4. Perform methods of quick analysis used in geochemistry
5. Identify and classify various fossils.

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Calculation of mineral formulae from the concentration of various oxides in minerals.
2. Calculation of gain and loss in weathering from the chemical analysis of rocks.
3. Calculation of weathering indices in soil and sediments, graphic presentation of analytical data.
4. Methods of quick analysis as used in geochemistry; spot test paper, colorimetry, chromatography.
5. Identification and classification of fossils belonging to major phylums.
6. Gondwana flora fossils.

Reference Books:

11. Robin Gill, (1997): **Modern Analytical Geochemistry,** Addison Wesley Longman.
12. Jain P. C., Anantharaman M. S. (2016) **Palaeontology**

Syllabus Prescribed for First Year 2022-23 PG Programme

Programme: M. Sc. (Geology)

Semester ll

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
2GOG 5	**LAB-3 (Igneous and Metamorphic Petrology)**	**09**
2 GOG 6	**LAB-4 (Sedimentalogy, Geomorphology and Field Geology)**	**09**

COs (2GOG5- Igneous and Metamorphic Petrology)

After completion of this course successfully, students would be able to

1. Identify the megascopic properties of various Igneous and Metamorphic Rocks.
2. Identify the microscopic properties of various Igneous and Metamorphic Rocks.
3. Draw and interpret the ACF, AKF and AFM diagrams

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Megascopic and microscopic study of various acidic, basic and ultrabasic igneous rocks with emphasis on crystallization history, occurrence and association.
2. Calculation of CIPW norms for various types of Igneous rocks.
3. Megascopic and microscopic study of metamorphic rocks.
4. Graphic construction of ACF, AKF and AFM diagrams and their interpretation

Reference Books:

5. Alexander, P. O. (2008): **Handbook of Minerals, Crystals, Rocks & Ores**, New India Pub.
6. Moorhouse W. W. (1959): **The Study of Rocks in Thin Section**, Harper
7. Rabindra Nath Hota (2020): Practical Approach to Petrology, CBS Publishers and Distributors PVT LTD

COs (2 GOG 6- Sedimentalogy, Geomorphology and Field Geology)

After completion of this course successfully, students would be able to

1. Identify the megascopic properties of various Sedimentary rocks.
2. Identify the microscopic properties of various Sedimentary rocks.
3. Perform Grain Size Analysis and its calculations.
4. Exercise morphometric analysis of river basins and its interpretation.
5. Understand Toposheet reading and handling of geological surveying equipments.

*** List of Practical/Laboratory Experiments/Activities etc.**

1. Megascopic and microscopic study of Sedimentary rocks.
2. Grain Size Analysis (Procedures, Cumulative curve, Histogram and Statistical calculation)
3. Exercise on morphometric analysis of river basins.
4. Toposheets reading
5. Exercise on clinometer, Bruton compass. Prismatic compass, Abney level, Dumpy level, Theodolite & Plane table,

Reference Books:

9. Sengupta, S. M. (2007): **Introduction of Sedimentology**. 2nd Ed. CBS Pub., New Delhi.
10. Field Geology - Lahee 1987 CBS Pub New Delhi.

*** Total number of Practical/Lab Experiments/Activities, etc. may be decided by the respective BOS**

BOS should meticulously choose the type of activity according to the need of their Course

APPENDIX – A-1, A-2

General Model Scheme

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Master of Science (Choice Based Credit System) (Two Years ... Four Semesters Degree Course- C.B.C.S)

(M.Sc. Part-I) Semester- I, Subject: Geology

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme								Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits					Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory L/T	Internal Ass.	Practical	Total		Theory + M.C.Q External	Theory Internal	Practical		Total Marks	Marks	Grade
														Internal	External			
1	DSC-I (Mineralogy)	1 GOG 1	04	--	--	04	04		--	04	03	80	20	--	--	100	40	P
2	DSC-II (Strucutral Geology and Tectonics)	1 GOG 2	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
3	DSC-III (Geochemistry and Analytical Techniques)	1 GOG 3	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
4	DSC-IV(Palaeobiology)	1 GOG 4	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
5	AEC-I	1 GOG 7			01	01	01			01	01		25		--	25	10	P
6	LAB-	1 GOG			09	09			4.5	4.5	04		--	--	100	10	50	p

	1(Mineralogy and Structural Geology)	**5**														**0**		
7	**LAB-2(Geochemistry and Palaeobiology)**	**1 GOG 6**			**0 9**	**09**			**4.5**	**4.5**	**04**				**--**	**100**	**10 0**	**50**	**p**
8	**#Internship/Field Work/Work Experience@ Open elective/GIC/Open skill/MOOC***																	
9																		
	Total		1 6	0 0	1 9	**35**	17		09	**26**						**625**		

- **L: Lecture, T: Tutorial, P: Practical**
- **# Students may complete their internship/field work/work experience in first or second or third semester of M.Sc. (Geology) according to their convenience; @denotes non-examination credit**
- **Note: Internship/Apprenticeship/field work/work experience (During vacations of semester I to semester III) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 credits for learning of 90 hours. Its credits and grades will be reflected in final semester IV credit grade report.**
- **OEC (optional) can be studied during semester I to IV.**

Suggested Activities for assessment for AEC:

Mini-project, internal evaluation: Class test or surprise test, Demonstration of task or activity assigned, assignment, seminar, or any other innovative pedagogical method.

General Model Scheme

APPENDIX – A-1,A-2

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Master of Science (Choice Based Credit System) (Two Years ... Four Semesters Degree Course- C.B.C.S)

(M.Sc. Part-I) Semester- II , Subject : Geology

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme								Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits					Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory L/T	Internal Ass.	Practical	Total		Theory + M.C.Q External	Theory Internal	Practical		Total Marks	Marks	Grade
														Internal	External			
1	DSC-V (Igneous Petrology)	2GOG 1	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	P
2	DSC-VI (Metamorphic Petrology)	2GOG 2	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
3	DSC-VII (Sedimentology)	2GOG 3	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
4	DSC-VIII (Geomorphology and Field Geology)	2GOG 4	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
5	AEC- II	2GOG 7	--	--	01	01	01	--		01	01	--	25	--	--	25	10	P
6	LAB-III (Igneous and Metamorphic Petrology)	2GOG 5			09	09			4.5	4.5	04			--	100	100	50	p

7	**LAB-IV (Sedimentalogy, Geomorphology and Field Geology)**	**2GOG 6**			**0 9**	**09**			**4.5**	**4.5**	**04**			**--**	**100**	**10 0**	**50**	**p**
8	**#Internship/Field Work/Work Experience@**																	
9	**Open elective/GIC/OpenSkill/MO OC***																	
	Total		1 6	0 0	1 9	**35**	17		09	**26**						**62 5**		

- **L: Lecture, T: Tutorial, P: Practical**
- **# Students may complete their internship/field work/work experience in first or second or third semester of M.Sc. (Geology) according to their convenience; @denotes non-examination credit**
- **Note: Internship/Apprenticeship/field work/work experience (During vacations of semester I to semester III) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 credits for learning of 90 hours. Its credits and grades will be reflected in final semester IV credit grade report.**
- **OEC (optional) can be studied during semester I to IV.**

Suggested Activities for assessment for AEC:

Mini-project, internal evaluation: Class test or surprise test, Demonstration of task or activity assigned, assignment, seminar, or any other innovative pedagogical method.

APPENDIX – A-1, A-2

General Model Scheme

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Master of Science (Choice Based Credit System) (Two Years ... Four Semesters Degree Course- C.B.C.S)

(M.Sc. Part-II) Semester-III, Subject: Geology

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme								Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits					Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory L/T	Internal Ass.	Practical	Total		Theory + M.C.Q External	Theory Internal	Practical		Total Marks	Marks	Grade
														Internal	External			
1	DSC-IX	3 GOG 1	04	--	--	04	04		--	04	03	80	20	--	--	100	40	P
2	DSC-X	3 GOG 2	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
3	DSC-XI	3 GOG 3	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
4	DSC-XII	3 GOG 4	04	--	--	04	04		--	04	03	80	20	--	--	100	40	p
5	AEC-III	3 GOG 7			01	01	01			01	01		25		--	25	10	P
6	LAB-V	3 GOG 5			09	09			4.5	4.5	04		--	--	100	100	50	p
7	LAB-VI	3 GOG 6			0	09			4.5	4.5	04			--	100	100	50	p

					9													
8	**#Internship/Field Work/Work Experience@ Open elective/GIC/Open skill/MOOC***																	
9																		
	Total		16	00	19	**35**	17		09	**26**						**625**		

- **L: Lecture, T: Tutorial, P: Practical**
- **# Students may complete their internship/field work/work experience in first or second or third semester of M.Sc. (Geology) according to their convenience; @denotes non-examination credit**
- **Note: Internship/Apprenticeship/field work/work experience (During vacations of semester I to semester III) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 credits for learning of 90 hours. Its credits and grades will be reflected in final semester IV credit grade report.**
- **OEC (optional) can be studied during semester I to IV.**

Suggested Activities for assessment for AEC:

Mini-project, internal evaluation: Class test or surprise test, Demonstration of task or activity assigned, assignment, seminar, or any other innovative pedagogical method.

Sant Gadge Baba Amravati University, Amravati

General Model Scheme

APPENDIX – A-1,A-2

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Master of Science (Choice Based Credit System) (Two Years ... Four Semesters Degree Course- C.B.C.S)

(M.Sc. Part-II) Semester- IV , Subject : Geology

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme								Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits					Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory L/T	Internal Ass.	Practical	Total		Theory + M.C.Q External	Theory Internal	Practical		Total Marks	Marks	Grade
														Internal	External			
1	DSC-XIII	4GOG1	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	P
2	DSC-XIV	4GOG2	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
3	DSC-XV	4GOG3	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
4	DSC-XVI	4GOG4	04	--	--	04	04	--	--	04	03	80	20	--	--	100	40	p
5	AEC- IV	4GOG7	--	--	01	01	01	--		01	01	--	25	--	--	25	10	P
6	LAB-VII	4GOG5			09	09			4.5	4.5	04			--	100	100	50	p
7	LAB-VIII (Project)	4GOG6			09	09			4.5	4.5	04			--	100	100	50	p

8	**#Internship/Field Work/Work Experience@**																	
9	**Open elective/GIC/OpenSkill/MOOC***																	
	Total		16	00	19	**35**	17		09	**26**						**625**		

- **L: Lecture, T: Tutorial, P: Practical**
- **# Students may complete their internship/field work/work experience in first or second or third semester of M.Sc. (Geology) according to their convenience; @denotes non-examination credit**
- **Note: Internship/Apprenticeship/field work/work experience (During vacations of semester I to semester III) for duration of minimum 60 hours to maximum 90 hours mandatory to all the students, to be completed during vacations of semester I to III. This will carry 2 credits for learning of 60 hours or 3 credits for learning of 90 hours. Its credits and grades will be reflected in final semester IV credit grade report.**
- **OEC (optional) can be studied during semester I to IV.**

Suggested Activities for assessment for AEC:

Mini-project, internal evaluation: Class test or surprise test, Demonstration of task or activity assigned, assignment, seminar, or any other innovative pedagogical method.