

analysis like rotate, reflect, subset, layer addition; Pre-processing of satellite data like image registration, geo-correction, filtering, image enhancements, math operations; Image ratios and other remote sensing and geological indices like SAVI; Lithologic, land use/land cover feature identification Familiarization with GIS software systems.

Books recommended:

Burrough, P.A., 2003: Principles of Geographic Information Systems. Oxford University Press.

Campbell, J., 2002: Introduction to Remote Sensing. Guilford Press, New York.

Demers, M. N., 1999: Fundamentals of Geographic Information Systems. John Wiley.

Jensen, J. R., 2004: Remote Sensing of the Environment. Prentice Hall, New Jersey.

John, A. Richards, 1993: Remote Sensing Digital Image Analysis. Springer-Verlag.

John, R. Jensen, 2000: Introductory Digital Image Processing, A Remote Sensing Perspective.

Lillesand, T. M. and Kiefer, R. W., 1987: Remote Sensing in Geology. John Wiley. Prentice Hall, New Jersey. Lillesand, T. M. and Kiefer, R. W., 2002: Remote Sensing and Image Interpretation, J.

Wiley Rees, W. G., 2001: Physical Principles of Remote sensing. Cambridge University Press.

Sabbins, F. F., 1985: Remote Sensing - Principles and Applications. Freeman.

GL17304DCE: Term work (Compulsory)

Term work shall be discipline centric, and each candidate (of Applied Geology) has to complete term work on his own with an advisory support by the concerned teacher. The objective of term work is that the students shall learn how to apply knowledge in solving /studying /exploring difficult scientific problem in a creative way.

GL17305DCE: Glaciology

Unit-I

Glaciers: Glacier Formation, glacier features and types. Movement of glaciers. Glacial deposits. Glacial and interglacial periods. Glacial landform. Last Glacial Maximum, Little Ice Age, Younger Dryas. Climate change and glaciers. Glaciers resources of Kashmir

Unit-II

Glacier dynamics: ELA, AAR, velocity; Mass balance studies of glaciers; geological, photogrammetric, GPS/GPR mass balance. Use of remote sensing for snow and glacier studies; glacier (snow cover, snow depth, snow water equivalence, snow density). Snow depletion curves, Snow hydrology, snowmelt runoff modeling. Black carbon deposition on glaciers and its impacts on melting, and other feedbacks.

Books recommended

Bennett, M. R. and Glasser, N. F., 2000. Glacial Geology Ice Sheets and Landforms. Wiley Sharp,

M., Richards, K. S. and Tranter M., 1998. Glacier Hyrology and Hydrochemistry. Wiley Allan, T. D.:

Satellite microwave remote sensing. Chichester, Ellis Hardwood.

BennD.I. and EvansJ A D., 1997. Glaciers and Glaciation. Woody's Books USA

Hubbard, B. and Glasser N. F. 2005. Field Techniques in Glaciology and Glacial Geomorphology. Wiley

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Hubbard, B. and Glasser N. F. 2005. Field Techniques in Glaciology and Glacial Geomorphology. Wiley

GL17306DCE: Himalayan Geology

Unit-I

Major litho-tectonic divisions of India. Formation of Tethys, its paleogeography. Origin and evolution of Himalaya, Phases of upheaval of Himalaya. Longitudinal, latitudinal and geotectonic division of Himalaya. Brief introduction about the geology and regional framework of different tectonic units of Himalaya: Outer Himalaya, Lesser Himalaya, Tethys Himalaya, Higher Himalayan Crystalline and Trans-Himalaya.

Unit-II

Brief introduction about the geology and regional framework of different tectonic units of Indus Suture Zone with special reference to NW Ladakh Himalaya. Mineral resources of Himalaya. Major environmental issues in Himalaya: earthquakes, landslides, GLOFs, snow avalanches, floods, cloudburst. Glaciation in Himalaya

Books recommended

Gass I.G. et al 1982: Understanding the Earth. Artemis Press (Pvt.) Ltd. U.K.
Windley B. 1973: The Evolving continents. John Wiley & Sons, New York.
Condie, Kent. C. 1982. Plate Tectonics and Crystal Evolution Pergamon Press Inc.
Gansser, A. Geology Of Himlayas,
Cox, Plate Tectonics and Geotectonic reversal,
Heim and Gansser, Central Himalaya,
Sinha, A.K., 1989. Geology of Higher Central Himalaya,
Sinha, A. K., Sassi, F. P. and Papinikolaou, D., 1997. Geodynamic domains in the Alpine-Himalayan
Tethys, Sinha, A.K., 1992. Himalayan Orogen and Global Tectonics.
Thakur, V. C., 1992. .Geology of Western Himalaya,
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GL17307DCE: Geophysics

Unit-I

Introduction to Geophysics: Geophysics; Energetics; geomagnetism and Paleomagnetism; Gravitation: Law of Universal Gravitation; gravitational acceleration; Equipotential Surface; centripetal and centrifugal acceleration; Figure of the earth; Gravitational potential of the spheroid earth; Normal gravity; Geoid

Unit-II

Techniques of Seismology; origin and form of seismic waves; Earthquakes: Focus epicenter and depth of earthquakes, locating earthquakes; Seismic reflection and refraction. Gravity: Principles and interpretation; Satellite geodesy; Geoelectrics and electromagnetic (GPR) Methods. Gravity anomalies

Books recommended

GL17308DCE: Geotectonics

Unit I

Interior of the Earth: Mechanical and compositional layering of the Earth; Crust, mantle and Core; Lithosphere and asthenosphere; Brittle and ductile deformations; Isostasy- Airy's

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Interior of the Earth: Mechanical and compositional layering of the Earth; Crust, mantle and Core; Lithosphere and asthenosphere; Brittle and ductile deformations; Isostasy- Airy's

Hypothesis and Pratt's hypothesis, Isostatic Rebound; Continental Drift; Sea floor spreading; Geomagnetism; Palaeomagnetism; Polar Wandering; Magnetic reversals; Geomagnetic time scale.

UNIT II

Plate Tectonics: Plates and Plate Margins; Active and Passive margins; Geometry and Mechanism of Plate Motion; Plate boundaries; Mid-oceanic ridges, subduction zone, Strike slip; Andean; Pacific and other types of orogenies; Benioff zone, Fore-arc and back arc basins; Hotspots, Mantle plumes and Triple Junction;

GL17309GE: Environmental Geology

Unit-I

Concept and definition of Environmental Geology. Processes of soil formation, types of soils, soil degradation and changing land use pattern. Environmental changes due to influence of human-dominated environment over nature-dominated system. Mobility of elements. Impact assessment of water availability, quality and contamination of surface water and groundwater.

Unit-II

Health Geochemistry: essential and toxic elements & radon emission; impacts of aerosols including black carbon on environment. Distribution, magnitude and intensity of earthquakes. Neotectonics and seismic hazard assessment. Preparation of seismic hazard maps. Causes of major floods, cyclones and storms. Deforestation and land degradation.

Books recommended

Lanen, F., Environmental Geology.
Lawrence, L. Environmental Geology.
Lundgren, L., 1986, Environmental Geology. Prentice Hall.
Michael, A., Basic of Environmental Science.
Parasnis, D. S., 1975: Principles of Applied Geophysics. Chapman Hall.
Pipkin, B. W. & Trent, D. D., 1997: Geology and the Environment. West wardsworth.
Singh, A., Modern Geo-Technical Engineering.
Smith, K., 1992: Environmental Hazards. Rutledge, London.
Valdiya, K. S., 1987: Environmental Geology -Indian Context. Tata McGraw Hill.
Venkat, R. D., Engineering Geology for Civil Engineers.
Waltham, A. C., 1997: Foundations of Engineering Geology. Blackie Academic & Professional.
Subramaniam, V., 2001: Textbook in Environmental Science-Narosa International

GL17310GE: Frontiers in Earth Sciences

Unit-I

Introduction: Origin of Earth, Structure of earth; Crust, Mantle & Core;
Outer spheres: Atmosphere, hydrosphere, biosphere of the earth, Exogenous and endogenous process.

Unit-II

Biogeochemical cycles - nitrogen cycle, carbon cycle and phosphorous cycle.
Geological Time Scale: Lithostratigraphic Units, Chronostratigraphic Unit and Biostratigraphic Unit
Geology as the history of Earth: (a) Fossils (b) Mineralogy and the texture; (c) Structures; (d) Palaeogeography (e) Paleoclimate.

Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.

Levarson, 1985: Geology of Petroleum. CBS Pub.

Prasad, U., 1996: Economic Geology. CBS Pub. N. Delhi.

Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press.

Sinha, R. K. and Sharma, N. L. 1993: Mineral Economics. Oxford & IBH Pub. Co. Pvt. Ltd. Stach,

E. and Others, 1982: Stach's Text Book of Coal Petrology. Gebruder Borntraeger Stanton, R. L, 1972: Ore Petrology. Mc-Graw Hill.

Tissot, B. P. and Welte, D. H, 1984: Petroleum Formation and Occurrence. Springer-Verlag.

GL17403CR: Project work

Project work shall be discipline centric, and every student shall do the project work under the supervision of a teacher. The Dissertation must be typed and be limited to 50-75 pages of A4 size. The project work must be evaluated by one external and one internal examiner followed by presentation of work and viva voce

GL17404DCE: Sedimentary Environment and Sedimentary Basins

UNIT I

Kinds of sedimentary particles: Morphology of clastic, nonclastic and pyroclastic particles and their use in provenance studies. Study of laboratory techniques in sedimentological studies. Processes of dolomitization and phosphatization. Origin of various types of cements.

UNIT II

Use of trace fossils, stromatolites, thrombolites and related structure in palaeo-environmental analysis. Methods of palaeocurrent determination and basin analysis. Tectonic evolution of the sedimentary basins.

UNIT III

Sedimentary cycles, rhythemes and cyclothems. Analysis of sedimentary facies. Sedimentation pattern and depositional environment of selected sedimentary basins with special reference to Karewas, Indo-Gangetic plain and Siwaliks.

Books recommended

Bhattacharya, A. and Chakraborti, C., 2000: Analysis of Sedimentary Successions. Oxford Blatt, H.,

Murray, G. V. and Middleton, R. C., 1980: Origin of Sedimentary Rocks. CBS, N. Delhi.

Davis, R. A. Jr., 1992: Depositional Systems. Prentice Hall.

Einsele, G., 1992: Sedimentary Basins. Springer Verlag.

Friedman, G. M. and Sander, J. E., 1978: Principles of Sedimentology John Wiley.

Miall, A. D., 2000: Principles of sedimentary Basin Analysis. Springer-Verlag.

Prothero, D. R. Schwab, F., 1996: Sedimentary Geology. Freeman.

Reading, J. G. 1996: Sedimentary Environment and Facies. Black well.

Reineck, H. E. & Singh, I. B., 1975: Deposition Sedimentary Environment. Springer-Verlag.

Tucker, M. 1988: Techniques in Sedimentology. Blackwell.

GL17405DCE: Himalayan Tectonics

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Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.

Levarson, 1985: Geology of Petroleum. CBS Pub.

Prasad, U., 1996: Economic Geology. CBS Pub. N. Delhi.

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Unit-III

Petrology and geochemical characterization of Ladakh & Karakoram Batholiths and Drass & Shyok Volcanic of Ladakh Trans-Himalaya. Tectonic framework and geological features of Shyok Suture Zone and accreted Karakoram micro-continent.

Books recommended

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GL17406 DCE: Rock Deformation and Structural Analysis

UNIT I

Deformation behavior of rocks, Stress and strain in rocks, principles and methods of stress and strain analysis. Different mechanism of deformation in rocks. Classification and characteristic structure and textures of different types of fault rocks. Ductile shear zones: types, criteria for sense of shear and mechanism of development.

UNIT II

Fault related folding: geometry and mechanism of development of different types of fault related folds and other structures in compressional regimes, extensional regimes and strike slip regimes. Exercises on stress and strain analysis and balanced cross-sections. Interpretation of different types of deformation mechanism in thin sections.

Books recommended

Davis, G.R., 1984: Structural Geology of Rocks and Region. John Wiley.
Ghosh. S. K., 1995: Structural Geology Fundamentals of Modern Developments. Pergamon Press.
Hobbs, B. E., Means, W. D. and Williams, P.F., 1976: An Outline of Structural Geology. John Wiley.

Tectonic framework and geological features of Molasse Zone of Siwalik foothills. Tectonic framework and geological features of Lesser Himalaya with special reference to biostratigraphy of Kashmir Himalaya.

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Ramsay, J. G. and Huber, M. I., 1987: Modern Structural Geology, Vol. 1&1. Academic Press.
Ramsay, J. G., 1967: Folding and fracturing of Rocks. McGraw Hill. ,
Turner, F. J. and Weiss, L. E., 1963: Structural Analysis of Metamorphic Tectonites. McGraw Hill.

GL17407DCE: Advanced Hydrology

UNIT I

Hydrographic analysis: Annual, seasonal and storm hydrographs; Water balance studies, determination of recharge by stream hydrograph and base flow separation; Water level maps; groundwater-surface water interaction; Application of Darcy's law case study, estimation of aquifer parameters with the help of pumping tests.

UNIT II

Groundwater modeling and management: Groundwater budgets, artificial recharge, conjunctive use of surface and groundwater; Mathematical modeling: concept, boundary conditions, analytical and numerical methods of solution, MODFLOW- introduction, Indian case studies; Environmental isotopes in hydrogeology: stable isotopes (oxygen and deuterium), radioisotopes (tritium and carbon14)

Books recommended:

Chow, V. T., 1988: Advances in Hydrosiences, McGraw Hill.
Fetter, C. W., 1990: Applied Hydrogeology, Merrill Publishing.
Freeze, R. A. & Cherry, J. A., 1979: Ground Water. Prentice Hall.
Karanth, K. R., 1987: Groundwater Assessment-Development and Management. Tata McGraw Hill.
Raghunath, N. M., 1982: Ground Water. Wiley Eastern.
Todd, D. K., 1980: Ground water Hydrogeology. John Wiley.
Walton, W. C., 1988: Ground Water Resources Evaluation. McGraw Hill.

GL17408DCE: Advanced Remote Sensing & GIS

UNIT I

Space borne remote sensing system and platforms: IRS, LANDSAT, SPOT, and IKONOS. Multispectral and hyper-spectral remote sensing, Geophysical Remote Sensing, Active Microwave remote sensing. Multivariate image statistics, Optical remote sensing data filters, radar speckle/noise removal techniques, image data formats (BSQ, BIP and BIL), image ratios, Georeferencing and mosaicing of satellite data, Image classification and accuracy estimation

UNIT II

Remote Sensing application: Geological mapping (lithology, structural mapping of faults, folds). Use of remote sensing data for snow and glacier mapping, change detection studies (deforestation), Remote sensing for crustal deformation and hydrological analysis.

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Books recommended:

Chow, V. T., 1988: Advances in Hydrosiences, McGraw Hill.
Fetter, C. W., 1990: Applied Hydrogeology, Merrill Publishing.
Freeze, R. A. & Cherry, J. A., 1979: Ground Water. Prentice Hall.
Karanth, K. R., 1987: Groundwater Assessment-Development and Management. Tata McGraw Hill.
Raghunath, N. M., 1982: Ground Water. Wiley Eastern.
Todd, D. K., 1980: Ground water Hydrogeology. John Wiley.
Walton, W. C., 1988: Ground Water Resources Evaluation. McGraw Hill.

GL17408DCE: Advanced Remote Sensing & GIS

UNIT I

Space borne remote sensing system and platforms: IRS, LANDSAT, SPOT, and IKONOS. Multispectral and hyper-spectral remote sensing, Geophysical Remote Sensing, Active Microwave remote sensing. Multivariate image statistics, Optical remote sensing data filters, radar speckle/noise removal techniques, image data formats (BSQ, BIP and BIL), image ratios, Georeferencing and mosaicing of satellite data, Image classification and accuracy estimation

UNIT II

Remote Sensing application: Geological mapping (lithology, structural mapping of faults, folds). Use of remote sensing data for snow and glacier mapping, change detection studies (deforestation), Remote sensing for crustal deformation and hydrological analysis.

Books recommended:

Lisle, R. J., 1988: Geological Strain Analysis. Pergamon.
 Price, N. J. and Cosgrove, J. W., 1990: Analysis of Geological Structure. Cambridge Univ. Press.
 Ramsay, J. G. and Huber, M. I., 1987: Modern Structural Geology, Vol. 1&1. Academic Press.
 Ramsay, J. G., 1967: Folding and fracturing of Rocks. McGraw Hill. ,
 Turner, F. J. and Weiss, L. E., 1963: Structural Analysis of Metamorphic Tectonites. McGraw Hill.

GL17407DCE: Advanced Hydrology

UNIT I

Hydrographic analysis: Annual, seasonal and storm hydrographs; Water balance studies, determination of recharge by stream hydrograph and base flow separation; Water level maps; groundwater-surface water interaction; Application of Darcy's law case study, estimation of aquifer parameters with the help of pumping tests.

UNIT II

Groundwater modeling and management: Groundwater budgets, artificial recharge, conjunctive use of surface and groundwater; Mathematical modeling: concept, boundary conditions, analytical and numerical methods of solution, MODFLOW- introduction, Indian case studies; Environmental isotopes in hydrogeology: stable isotopes (oxygen and deuterium), radioisotopes (tritium and carbon14)

Books recommended:

Chow, V. T., 1988: Advances in Hydrosiences, McGraw Hill.
 Fetter, C. W., 1990: Applied Hydrogeology, Merrill Publishing.
 Freeze, R. A. & Cherry, J. A., 1979: Ground Water. Prentice Hall.
 Karanth, K. R., 1987: Groundwater Assessment-Development and Management. Tata McGraw Hill.
 Raghunath, N. M., 1982: Ground Water. Wiley Eastern.
 Todd, D. K., 1980: Ground water Hydrogeology. John Wiley.
 Walton, W. C., 1988: Ground Water Resources Evaluation. McGraw Hill.

GL17408DCE: Advanced Remote Sensing & GIS

UNIT I

Space borne remote sensing system and platforms: IRS, LANDSAT, SPOT, and IKONOS. Multispectral and hyper-spectral remote sensing, Geophysical Remote Sensing, Active Microwave remote sensing. Multivariate image statistics, Optical remote sensing data filters, radar speckle/noise removal techniques, image data formats (BSQ, BIP and BIL), image ratios, Georeferencing and mosaicing of satellite data, Image classification and accuracy estimation

UNIT II

Remote Sensing application: Geological mapping (lithology, structural mapping of faults, folds). Use of remote sensing data for snow and glacier mapping, change detection studies (deforestation), Remote sensing for crustal deformation and hydrological analysis.

Books recommended:

Burrough, P. A., 2003: Principles of Geographic Information Systems. Oxford University Press.

Campbell, J., 2002: Introduction to Remote Sensing. Guilford Press, New York.

Demers, M. N., 1999: Fundamentals of Geographic Information Systems. John Wiley.

Jensen, J. R., 2004: Remote Sensing of the Environment. Prentice Hall, New Jersey.

John, A., Richards, 1993: Remote Sensing Digital Image Analysis. Springer-Verlag.

John, R., Jensen, 2000: Introductory Digital Image Processing, A Remote Sensing Perspective.

Lillesand, T. M. and Kiefer, R W., 1987: Remote Sensing in Geology. John Wiley. Prentice Hall,

Lillesand, T. M. and Kiefer, RW, 2002: Remote Sensing and Image Interpretation, John Wiley.

Rees, W. G., 2001: Physical Principles of Remote sensing. Cambridge University Press.

Sabbins, F. F., 1985: Remote Sensing - Principles and Applications. Freeman.

Skidmore, A., 2002. Environmental modeling with GIS and Remote Sensing. Taylor& Francis,

London. Longley, D. A., Gordchild, M. F., Maguire, D. J. and Rhind, D. W., 2001: Geographic Information Systems and Science. John Wiley & Sons.

GL17409DCE: Quaternary Geology and Paleoclimate

Unit-I

Definition of Quaternary. The Character of Quaternary. Quaternary stratigraphy- Oxygen isotope stratigraphy, biostratigraphy and magnetostratigraphy. Response of geomorphic, neotectonic, active tectonics during Quaternary. Quaternary dating methods: Radiocarbon, cosmogenic radionuclide, Luminescence, and Relative dating methods. Quaternary deposits of Kashmir.

Unit-II

Introduction to climate and climate systems, Global climate pattern, Climate controlling factors. Plate tectonics and climate change Milankovitch cycles, Atmosphere and Ocean interaction and its effect on climate. An Overview of Paleoclimatic reconstruction; Application of loess and phytoliths and other proxies in paleoclimatic studies.

Suggested Readings

Bigg, G., 1999 Ocean and Climate. Springer- Verlag

Bradley, F., 2000. Paleoclimatology: Reconstructing Climates of the Quaternary. Springer-Verlag

Maher and Thompson, 2000. Quaternary Climates, Environments and Magnetism. Cambridge University Press.

Williams, Durnkerley, Decker, Kershaw and Chhappell, 1998. Quaternary Environments. Wiley and Sons.

GL17410GE: Fundamentals of Geo-tectonics

Unit-I

Introduction to geotectonics; Continental drift, seafloor spreading and convection current hypotheses; Paleomagnetism, polar wandering and reversal of earth's magnetic field; Principal Geotectonic features: Features of the Ocean, Continent and Continental margins

Unit-II

GLP17103CR: Practical Igneous Petrology

Igneous Petrology: Megascopic and microscopic study of igneous lithotypes. Modal analysis. Chemographic diagrams (ACF & AFM ternary diagrams)

Books recommended:

Albert, J., 1967: Descriptive petrology of the Igneous Rocks. Mc-Graw Hill, New York.
Alexander, Mc. B., 1987: Igneous Petrology. Prentice Hall.
Barth, T. F. W., 1956: Theoretical Petrology. Mc-Graw Hill, New York.
Best, M. G., 1986: Igneous Petrology, CBS Pub.
Bose, M. K., 1997: Igneous Petrology. World Press.
Hall, A., 1988: Igneous petrology. ELBS Longman.
Harker, A., 1944: Natural History of Igneous Rocks. McMillan Press.
Hatch & Wells, Text Book of Petrology. CBS Pub.
McBirney, A. R., 1993: Igneous Petrology. John Wiley.
Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.
Turner & Verhoogen, 1999: Igneous and Metamorphic Petrology. CBS Pub.
Shelley, D., 1995: Descriptive Petrology of the Igneous Rocks. Chapman & Hall.
Winter, J.D. 2010. Igneous and Metamorphic Petrology.
Blatt H. & Tracy R.J. 1995. Petrology: Igneous, Sedimentary & Metamorphic. WHF & Co, New York.

GL17104DCE: Field Training

Geological Field Training shall be conducted on every alternate week in the valley.

GL17105DCE: Crystallography

Unit-I

Nature of crystals: distinction between crystalline and amorphous material. Parallel growth, crystal form, crystal habit. Twinning-types, causes and laws. External & Internal symmetry in crystals; Symmetry elements; Improper axis; Combination of symmetry elements.

Unit-II

Crystal Systems: Normal classes of crystals, spherical and stereographic projections. Crystal structure of minerals: dimorphism, polymorphism, pseudomorphism, isomorphism, solid solution and exsolution.

Books recommended

Berry & Mason, 1988: Mineralogy. CBS Pub.
Kerr, P. F., 1977: Optical Mineralogy. McGraw Hill.
Nesse, 1987: Optical Mineralogy.
Phillips, Wm, R. and Griffen, D.T., 1986: Optical Mineralogy. CBS Edition.
Putnis, A., 2001: Introduction to mineral Science. Cambridge University Press. Putnis, A., 1992: Introduction to mineral Science. Cambridge University Press.
Richard, V. G., 1997: Dana's new Mineralogy. John Wiley.
Spear, F. S. 1993: Mineralogical Phase Equilibria and Pressure-Temperature Paths. Mineralogical Society of America Pub.
Read, H. H., 1986: Rutleys Elements of Mineralogy.
Winchell, A. N., 1968: Elements of optical mineralogy. Wiley Eastern Pvt Ltd.

GL17106DCE: Economic Geology

Unit-I

Ore Geology: Space-time distribution of mineral deposits and global metallogeny with special reference to India. Processes of formation of different mineral deposits. Weathering and Placer deposits. Different types of ore reserves, Mineral economics and its significance. National Mineral Policy

Fluid inclusions: types, assumptions, techniques and limitations.

Unit-II

GLP17103CR: Practical Igneous Petrology

Igneous Petrology: Megascopic and microscopic study of igneous lithotypes. Modal analysis. Chemographic diagrams (ACF & AFM ternary diagrams)

Books recommended:

Albert, J., 1967: Descriptive petrology of the Igneous Rocks. Mc-Graw Hill, New York.
Alexander, Mc. B., 1987: Igneous Petrology. Prentice Hall.
Barth, T. F. W., 1956: Theoretical Petrology. Mc-Graw Hill, New York.
Best, M. G., 1986: Igneous Petrology, CBS Pub.
Bose, M. K., 1997: Igneous Petrology. World Press.
Hall, A., 1988: Igneous petrology. ELBS Longman.
Harker, A., 1944: Natural History of Igneous Rocks. McMillan Press.
Hatch & Wells, Text Book of Petrology. CBS Pub.
McBirney, A. R., 1993: Igneous Petrology. John Wiley.
Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.
Turner & Verhoogen, 1999: Igneous and Metamorphic Petrology. CBS Pub.
Shelley, D., 1995: Descriptive Petrology of the Igneous Rocks. Chapman & Hall.
Winter, J.D. 2010. Igneous and Metamorphic Petrology.
Blatt H. & Tracy R.J. 1995. Petrology: Igneous, Sedimentary & Metamorphic. WHF & Co, New York.

GL17104DCE: Field Training

Geological Field Training shall be conducted on every alternate week in the valley.

GL17105DCE: Crystallography

Unit-I

Nature of crystals: distinction between crystalline and amorphous material. Parallel growth, crystal form, crystal habit. Twinning-types, causes and laws. External & Internal symmetry in crystals; Symmetry elements; Improper axis; Combination of symmetry elements.

Unit-II

Crystal Systems: Normal classes of crystals, spherical and stereographic projections. Crystal structure of minerals: dimorphism, polymorphism, pseudomorphism, isomorphism, solid solution and exsolution.

Books recommended

Berry & Mason, 1988: Mineralogy. CBS Pub.
Kerr, P. F., 1977: Optical Mineralogy. McGraw Hill.
Nesse, 1987: Optical Mineralogy.
Phillips, Wm, R. and Griffen, D.T., 1986: Optical Mineralogy. CBS Edition.
Putnis, A., 2001: Introduction to mineral Science. Cambridge University Press. Putnis, A., 1992: Introduction to mineral Science. Cambridge University Press.
Richard, V. G., 1997: Dana's new Mineralogy. John Wiley.
Spear, F. S. 1993: Mineralogical Phase Equilibria and Pressure-Temperature Paths. Mineralogical Society of America Pub.
Read, H. H., 1986: Rutleys Elements of Mineralogy.
Winchell, A. N., 1968: Elements of optical mineralogy. Wiley Eastern Pvt Ltd.

GL17106DCE: Economic Geology

Unit-I

Ore Geology: Space-time distribution of mineral deposits and global metallogeny with special reference to India. Processes of formation of different mineral deposits. Weathering and Placer deposits. Different types of ore reserves, Mineral economics and its significance. National Mineral Policy

Fluid inclusions: types, assumptions, techniques and limitations.

Unit-II

Fuel Geology: Coal: origin and classification of coal. Macroscopic and microscopic constituents of coal. Geological and geographical distribution of coal deposits in India with emphasis on Gondwana coal fields of India.

Books recommended

Evan, A. M., 1983: Ore Geology and industrial Minerals. Blackwell.
Holson, G. D. and Tiratsoo, E. N., 1985: Introduction Petroleum Geology. Gulf Pub. Houston, Jensen, M. L. and Bateman, A. M., 1981: Economic Mineral Deposits, John Wiley.
Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.
Levarson, 1985: Geology of Petroleum. CBS Pub.
Prasad, U., 1996: Economic Geology. CBS Pub. N. Delhi.
Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press.
Sinha, R. K. and Sharma, N. L. 1993: Mineral Economics. Oxford & IBH Pub. Co. Pvt. Ltd. Stach, E. and Others, 1982: Stach's Text Book of Coal Petrology. Gebruder Borntraeger Stanton, R. L, 1972: Ore Petrology. Mc-Graw Hill.
Tissot, B. P. and Welte, D. H, 1984: Petroleum Formation and Occurrence. Springer-Verlag.
Outlines of Geophysical Prospecting - A manual for geologists by Ramachandra Rao, M.B., Prasaranga, University of Mysore Mysore 1975.
Exploration Geophysics - An Outline by Bhimasarikaram Y.L.S., Association of Exploration Geophysicists, Osmania University, Hyderabad, 1990.
An introduction to Geophysical Prospecting by Oobrin, M.B. and Savit, C.H., McGraw Hill, New Delhi, 1988.
Applied Geophysics by Telford W.M. Geldart L.P., Sheriff, R.E. and Keys D.A. Oxford and IBH Publishing Co. Pvt., Ltd. New Delhi, 1976.

GL17107DCE: Petroleum Exploration

Unit-I

Source rocks, reservoir rocks and different types of traps. Amount, type and maturation of organic matter. Petroleum and source rock correlation. Locating petroleum prospects based on principles of petroleum generation and migration (geological modeling).

Geophysical methods of Hydrocarbon exploration.

Unit-II

Petroleum basins:Basin studies and basin analysis. Basin classification in plate tectonics. Fundamental types of petroliferous basin; relation between basin type and hydrocarbon richness. Factors favoring hydrocarbon abundance. Petroleum provinces of India and world Case studies of some giant oil fields

Unit-III

Elements of well drilling: Cable-tool drilling, rotary drilling, various types of drilling units. Elements of logging. Electric, radioactive and sonic logs. Nuclear magnetic resonance and dielectric logging Application of logs in petro-physical analysis and facies analysis

Books recommended

Guillemot, J., 1986: Oil and Gas Exploration Techniques. Additions Technip.
Glennie, K. W., 1998: Petroleum Geology of the North Sea. Blackwell Science.
Holson, G. D. and Tiratsoo, E.N., 1985: Introduction Petroleum Geology. Gulf Pub. Houston, Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.
Levarson, 1985: Geology of Petroleum. CBS Pub.
Landon, R. C., 1996: Principles of Petroleum Development Geology. Printice Hall.
North, F. K., 1985: Petroleum Geology. Allen &Unwin
Salley, R. C., 1988. Elements of Petroleum Geology. Academic Press.
Tedesco, S. A., 1995: Surface Geochemistry in Petroleum Exploration. Chapman Hall.
Tissot, B. P. &Welte, D. H., 1984: Petroleum Formation and Occurrence, Springer Verlag.

GL17108GE: Earth and Climate

Fuel Geology: Coal: origin and classification of coal. Macroscopic and microscopic constituents of coal. Geological and geographical distribution of coal deposits in India with emphasis on Gondwana coal fields of India.

Books recommended

Evan, A. M., 1983: Ore Geology and industrial Minerals. Blackwell.
Holson, G. D. and Tiratsoo, E. N., 1985: Introduction Petroleum Geology. Gulf Pub. Houston, Jensen, M. L. and Bateman, A. M., 1981: Economic Mineral Deposits, John Wiley.
Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.
Levarson, 1985: Geology of Petroleum. CBS Pub.
Prasad, U., 1996: Economic Geology. CBS Pub. N. Delhi.
Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press.
Sinha, R. K. and Sharma, N. L. 1993: Mineral Economics. Oxford & IBH Pub. Co. Pvt. Ltd. Stach, E. and Others, 1982: Stach's Text Book of Coal Petrology. Gebruder Borntraeger Stanton, R. L, 1972: Ore Petrology. Mc-Graw Hill.
Tissot, B. P. and Welte, D. H, 1984: Petroleum Formation and Occurrence. Springer-Verlag.
Outlines of Geophysical Prospecting - A manual for geologists by Ramachandra Rao, M.B., Prasaranga, University of Mysore Mysore 1975.
Exploration Geophysics - An Outline by Bhimasarikaram Y.L.S., Association of Exploration Geophysicists, Osmania University, Hyderabad, 1990.
An introduction to Geophysical Prospecting by Oobrin, M.B. and Savit, C.H., McGraw Hill, New Delhi, 1988.
Applied Geophysics by Telford W.M. Geldart L.P., Sheriff, R.E. and Keys D.A. Oxford and IBH Publishing Co. Pvt., Ltd. New Delhi, 1976.

GL17107DCE: Petroleum Exploration

Unit-I

Source rocks, reservoir rocks and different types of traps. Amount, type and maturation of organic matter. Petroleum and source rock correlation. Locating petroleum prospects based on principles of petroleum generation and migration (geological modeling).

Geophysical methods of Hydrocarbon exploration.

Unit-II

Petroleum basins:Basin studies and basin analysis. Basin classification in plate tectonics. Fundamental types of petroliferous basin; relation between basin type and hydrocarbon richness. Factors favoring hydrocarbon abundance. Petroleum provinces of India and world Case studies of some giant oil fields

Unit-III

Elements of well drilling: Cable-tool drilling, rotary drilling, various types of drilling units. Elements of logging. Electric, radioactive and sonic logs. Nuclear magnetic resonance and dielectric logging Application of logs in petro-physical analysis and facies analysis

Books recommended

Guillemot, J., 1986: Oil and Gas Exploration Techniques. Additions Technip.
Glennie, K. W., 1998: Petroleum Geology of the North Sea. Blackwell Science.
Holson, G. D. and Tiratsoo, E.N., 1985: Introduction Petroleum Geology. Gulf Pub. Houston, Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.
Levarson, 1985: Geology of Petroleum. CBS Pub.
Landon, R. C., 1996: Principles of Petroleum Development Geology. Printice Hall.
North, F. K., 1985: Petroleum Geology. Allen &Unwin
Salley, R. C., 1988. Elements of Petroleum Geology. Academic Press.
Tedesco, S. A., 1995: Surface Geochemistry in Petroleum Exploration. Chapman Hall.
Tissot, B. P. &Welte, D. H., 1984: Petroleum Formation and Occurrence, Springer Verlag.

GL17108GE: Earth and Climate

Micropaleontology: Introduction to various groups of microfossils, their importance in geology and hydrocarbon exploration. Important plant fossils from Indian stratigraphic horizons.

Vertebrate paleontology: Vertebrate fossils of Siwalik Group and their stratigraphic significance

Unit-III

Stratigraphy: Introduction to sequence stratigraphy. Outline idea about Seismic Stratigraphy, Magnetostratigraphy. Boundary problems: Boundary problems in stratigraphy with reference to Precambrian - Cambrian, Permian -Triassic, KT boundary, Pliocene - Pleistocene boundaries.

GLP17203CR: PracticalPalaeontology& Stratigraphy

Palaeontology& Stratigraphy: Identification, classification and morphological study of selected invertebrate fossils with labelled diagrams. Taxonomic study of selected Gondwana plant fossils. Study of selected important rocks & fossils from Indian stratigraphic horizons and preparation of stratigraphic column.

Books recommended

Arnold, C. A., 1947: An introduction to Paleobotany. McGraw - Hill Book Co.

Bignot, G., 1985: *Elements of Micropaleontology*. Graham andTrotman.

Brasier, M. D., 1980: *Microfossils*. George Allen &Unwin.

Clerkson, E. N. K., 1998: *Invertebrate Paleontology and evolution*. Black Well Colbert, E. H, 1955: *Evolution of Vertibrate*. Jhon Wiley & sons, London.

Dunbar, C. O, Rodger, J., 1957: *Principles of stratigraphy*. Wiley International.

Glassner, M. F., 1945: *Principles of Micropaleontology*. Hafner Pub.

Krishanan, M. S., 1968: *Geology of India and Burma*. Higginbothams Pvt. Ltd., Madras.

Kumar, R, 1998: *Fundamentals of Historical Geology and Stratigraphy*. Wiley Eastern Limited.

Shork & Twenholf, 1987: *Principles of invertibrate Paleontology*. CBS Pub., N. Delhi.

Wadia, D. N., 1957: *Geology of India*. Mcmillan, London.

Weller, J. M., 1960: *Stratigraphy Principles &Practice*. Harper & Row Pub.

Wood, H., 1968: Paleontology invertebrate. CBS Pub., N. Delhi.

GL17204DCE: Field Training

Geological Field Training of 4 to 6 weeks shall be conducted at different parts of India.

GL17205DCE: Engineering Geology

Unit-I

Principles of engineering geology: Engineering properties and classification of rocks. Factors affecting engineering properties of rocks. Rock stability tests. Engineering properties of soils. Soil liquefaction and creep. Stress distribution in soils and foundation failures.

Unit-II

Geological considerations for construction of dams, reservoirs, and tunnels Tunnel alignment and transportation routes. Methods of tunneling and various types of tunnel support.

Geological consideration for construction of roads, buildings and bridges

Unit-III

Mass movements with special emphasis on landslides and slope stability. Earthquakes and seismic zones of India. Case history of engineering projects and geological causes for failures of engineering structures and remedial measures

Books recommended:

Arms, K., 1990: Environmental Science. Saunders College Pub.

Bell, F. G., Engineering Properties of Soils and Rocks.

Bell, F. G., 1999: Geological Hazards their assessment, Avoidance & Mitigation. E&FN S. London.

Bell, F. G., 1999: Geological Hazards. Routledge, London.

Bryant, E., 1985: Natural Hazards. Cambridge University Press.

Micropaleontology: Introduction to various groups of microfossils, their importance in geology and hydrocarbon exploration. Important plant fossils from Indian stratigraphic horizons.

Vertebrate paleontology: Vertebrate fossils of Siwalik Group and their stratigraphic significance

Unit-III

Stratigraphy: Introduction to sequence stratigraphy. Outline idea about Seismic Stratigraphy, Magnetostratigraphy. Boundary problems: Boundary problems in stratigraphy with reference to Precambrian - Cambrian, Permian -Triassic, KT boundary, Pliocene - Pleistocene boundaries.

GLP17203CR: Practical Palaeontology & Stratigraphy

Palaeontology & Stratigraphy: Identification, classification and morphological study of selected invertebrate fossils with labelled diagrams. Taxonomic study of selected Gondwana plant fossils. Study of selected important rocks & fossils from Indian stratigraphic horizons and preparation of stratigraphic column.

Books recommended

Arnold, C. A., 1947: An introduction to Paleobotany. McGraw - Hill Book Co.

Bignot, G., 1985: *Elements of Micropaleontology*. Graham and Trotman.

Brasier, M. D., 1980: *Microfossils*. George Allen & Unwin.

Clerkson, E. N. K., 1998: *Invertebrate Paleontology and evolution*. Black Well Colbert, E. H, 1955: *Evolution of Vertebrate*. Jhon Wiley & sons, London.

Dunbar, C. O, Rodger, J., 1957: *Principles of stratigraphy*. Wiley International.

Glassner, M. F., 1945: *Principles of Micropaleontology*. Hafner Pub.

Krishanan, M. S., 1968: *Geology of India and Burma*. Higginbothams Pvt. Ltd., Madras.

Kumar, R, 1998: *Fundamentals of Historical Geology and Stratigraphy*. Wiley Eastern Limited.

Shork & Twenholf, 1987: *Principles of invertebrate Paleontology*. CBS Pub., N. Delhi.

Wadia, D. N., 1957: *Geology of India*. Mcmillan, London.

Weller, J. M., 1960: *Stratigraphy Principles & Practice*. Harper & Row Pub.

Wood, H., 1968: Paleontology invertebrate. CBS Pub., N. Delhi.

GL17204DCE: Field Training

Geological Field Training of 4 to 6 weeks shall be conducted at different parts of India.

GL17205DCE: Engineering Geology

Unit-I

Principles of engineering geology: Engineering properties and classification of rocks. Factors affecting engineering properties of rocks. Rock stability tests. Engineering properties of soils. Soil liquefaction and creep. Stress distribution in soils and foundation failures.

Unit-II

Geological considerations for construction of dams, reservoirs, and tunnels Tunnel alignment and transportation routes. Methods of tunneling and various types of tunnel support.

Geological consideration for construction of roads, buildings and bridges

Unit-III

Mass movements with special emphasis on landslides and slope stability. Earthquakes and seismic zones of India. Case history of engineering projects and geological causes for failures of engineering structures and remedial measures

Books recommended:

Arms, K., 1990: Environmental Science. Saunders College Pub.

Bell, F. G., Engineering Properties of Soils and Rocks.

Bell, F. G., 1999: Geological Hazards their assessment, Avoidance & Mitigation. E&FN S. London.

Bell, F. G., 1999: Geological Hazards. Routledge, London.

Bryant, E., 1985: Natural Hazards. Cambridge University Press.

Goodman, R. E., Engineering Geology.

Keller, E. A., 1978: Environmental Geology. Bell and Howell, USA.

Krynine, D. H. and Judd, W.R., 1998: Principles of Engineering Geology. CBS Pub.

GL17206DCE: Disaster, Risk & Hazard Assessment

Unit-I

Principles of Disaster Management: Natural disasters (earthquakes, floods, landslides, GLOFS, avalanches), anthropogenic disasters; hazards, risks and vulnerabilities. Assessment of disaster vulnerability of a location and vulnerable groups. Preparedness and mitigation measures for various disasters. Disaster management with respect to earthquakes, flood and landslides

Unit-II

Remote sensing for disaster management: Satellite remote sensing for disaster management, real time disaster analysis and management, identification of flood prone areas using remote sensing and other ancillary data, post disaster analysis of inundated areas, area estimations, crop loss estimates etc. Forest fire identification and zonation using remote sensing data. Seismic microzonation.

Unit-III

Geoinformatics for disaster assessment: Flood control, drought management, cyclones, avalanches, land use planning,. GPS for early warning system for disasters. GIS for Risk assessment, Recent trends in Geoinformatics for disaster management.

Books recommended:

Aki, K. and P.G. Richards (2002) Quantitative Seismology, University Science Books, Sausalito, CA.

Bolt, B.A. (1992). Inside the Earth, W.H. Freeman, San Francisco.

Building safer cities, 2003. Alcira Kreime, Margaret Arnold, Anee Carlin, New York United Nations Press. Collaborative Decision Making: Perspectives and Challenges, 2008, Pascale Zarate, James and James science Publisher.

Iyer, H.M. and K. Hirahara (Eds.) (1993) Seismic Tomography Theory and Practice, Chapman & Hall, New York.

Landslides-Risk reduction. Kyoji Sassa, Paolo Canuti.. 2008, Kluwer Academic Publishers.

Lay, T. and T.C. Wallace (1995) Modern Global Seismology, Academic Press, San Diego.

Natural Hazards and Human-Exacerbated disasters, Edgardo Latrubesse. National University of Colombia. Risk management and Society-Eve Coles, Denis Smith, Steve Tombs, 2000

GL17207DCE: Geophysical Exploration

Unit-I

General and Exploration geophysics- Different types of geophysical methods; Gravity, magnetic, Electrical, Seismic, radioactive- their principles and applications. Concepts and Usage of corrections in geophysical data. Role of geophysical data in explaining geodynamical features of the earth.

Unit-II

Geophysical field operations: Different types of surveys, grid and route surveys, profiling and sounding techniques, scales of survey, presentation of geophysical data. Application of Geophysical methods - Regional geophysics, oil and gas geophysics, ore geophysics, groundwater geophysics, engineering geophysics.

Unit-III

Geophysical anomalies: Correction to measured quantities, geophysical, anomaly, regional and residual (local) anomalies, factors controlling anomaly, depth of exploration.

Integrated geophysical methods - Ambiguities in geophysical interpretation, Planning and execution of geophysical surveys.

Books recommended:

Goodman, R. E., Engineering Geology.

Keller, E. A., 1978: Environmental Geology. Bell and Howell, USA.

Krynine, D. H. and Judd, W.R., 1998: Principles of Engineering Geology. CBS Pub.

GL17206DCE: Disaster, Risk & Hazard Assessment

Unit-I

Principles of Disaster Management: Natural disasters (earthquakes, floods, landslides, GLOFS, avalanches), anthropogenic disasters; hazards, risks and vulnerabilities. Assessment of disaster vulnerability of a location and vulnerable groups. Preparedness and mitigation measures for various disasters. Disaster management with respect to earthquakes, flood and landslides

Unit-II

Remote sensing for disaster management: Satellite remote sensing for disaster management, real time disaster analysis and management, identification of flood prone areas using remote sensing and other ancillary data, post disaster analysis of inundated areas, area estimations, crop loss estimates etc. Forest fire identification and zonation using remote sensing data. Seismic microzonation.

Unit-III

Geoinformatics for disaster assessment: Flood control, drought management, cyclones, avalanches, land use planning,. GPS for early warning system for disasters. GIS for Risk assessment, Recent trends in Geoinformatics for disaster management.

Books recommended:

Aki, K. and P.G. Richards (2002) Quantitative Seismology, University Science Books, Sausalito, CA.

Bolt, B.A. (1992). Inside the Earth, W.H. Freeman, San Francisco.

Building safer cities, 2003. Alcira Kreime, Margaret Arnold, Anee Carlin, New York United Nations Press. Collaborative Decision Making: Perspectives and Challenges, 2008, Pascale Zarate, James and James science Publisher.

Iyer, H.M. and K. Hirahara (Eds.) (1993) Seismic Tomography Theory and Practice, Chapman & Hall, New York.

Landslides-Risk reduction. Kyoji Sassa, Paolo Canuti.. 2008, Kluwer Academic Publishers.

Lay, T. and T.C. Wallace (1995) Modern Global Seismology, Academic Press, San Diego.

Natural Hazards and Human-Exacerbated disasters, Edgardo Latrubesse. National University of Colombia. Risk management and Society-Eve Coles, Denis Smith, Steve Tombs, 2000

GL17207DCE: Geophysical Exploration

Unit-I

General and Exploration geophysics- Different types of geophysical methods; Gravity, magnetic, Electrical, Seismic, radioactive- their principles and applications. Concepts and Usage of corrections in geophysical data. Role of geophysical data in explaining geodynamical features of the earth.

Unit-II

Geophysical field operations: Different types of surveys, grid and route surveys, profiling and sounding techniques, scales of survey, presentation of geophysical data. Application of Geophysical methods - Regional geophysics, oil and gas geophysics, ore geophysics, groundwater geophysics, engineering geophysics.

Unit-III

Geophysical anomalies: Correction to measured quantities, geophysical, anomaly, regional and residual (local) anomalies, factors controlling anomaly, depth of exploration.

Integrated geophysical methods - Ambiguities in geophysical interpretation, Planning and execution of geophysical surveys.

Books recommended:

Goodman, R. E., Engineering Geology.

Keller, E. A., 1978: Environmental Geology. Bell and Howell, USA.

Krynine, D. H. and Judd, W.R., 1998: Principles of Engineering Geology. CBS Pub.

GL17206DCE: Disaster, Risk & Hazard Assessment

Unit-I

Principles of Disaster Management: Natural disasters (earthquakes, floods, landslides, GLOFS, avalanches), anthropogenic disasters; hazards, risks and vulnerabilities. Assessment of disaster vulnerability of a location and vulnerable groups. Preparedness and mitigation measures for various disasters. Disaster management with respect to earthquakes, flood and landslides

Unit-II

Remote sensing for disaster management: Satellite remote sensing for disaster management, real time disaster analysis and management, identification of flood prone areas using remote sensing and other ancillary data, post disaster analysis of inundated areas, area estimations, crop loss estimates etc. Forest fire identification and zonation using remote sensing data. Seismic microzonation.

Unit-III

Geoinformatics for disaster assessment: Flood control, drought management, cyclones, avalanches, land use planning,. GPS for early warning system for disasters. GIS for Risk assessment, Recent trends in Geoinformatics for disaster management.

Books recommended:

Aki, K. and P.G. Richards (2002) Quantitative Seismology, University Science Books, Sausalito, CA.

Bolt, B.A. (1992). Inside the Earth, W.H. Freeman, San Francisco.

Building safer cities, 2003. Alcira Kreime, Margaret Arnold, Anee Carlin, New York United Nations Press. Collaborative Decision Making: Perspectives and Challenges, 2008, Pascale Zarate, James and James science Publisher.

Iyer, H.M. and K. Hirahara (Eds.) (1993) Seismic Tomography Theory and Practice, Chapman & Hall, New York.

Landslides-Risk reduction. Kyoji Sassa, Paolo Canuti.. 2008, Kluwer Academic Publishers.

Lay, T. and T.C. Wallace (1995) Modern Global Seismology, Academic Press, San Diego.

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GL17208GE: Oceanography

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Kennett, J. P., 1982: Marine Geology. Prentice Hall.

Pinet, P. R., 1992: Oceanography, An Introduction to the Planet Oceanus. West Pub. Co.

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Chenicoff, S 1995: Geology (An introduction to physical geology)

GL17210OE: Introduction to stratigraphy and fossils

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Unit-II

Fossils, their characters, conditions necessary for fossilization; types of preservation and occurrence. Importance of fossils in stratigraphy.

Books recommended

Fuel Geology: Coal: origin and classification of coal. Macroscopic and microscopic constituents of coal. Geological and geographical distribution of coal deposits in India with emphasis on Gondwana coal fields of India.

Books recommended

Evan, A. M., 1983: Ore Geology and industrial Minerals. Blackwell.
Holson, G. D. and Tiratsoo, E. N., 1985: Introduction Petroleum Geology. Gulf Pub. Houston, Jensen, M. L. and Bateman, A. M., 1981: Economic Mineral Deposits, John Wiley.
Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.
Levarson, 1985: Geology of Petroleum. CBS Pub.
Prasad, U., 1996: Economic Geology. CBS Pub. N. Delhi.
Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press.
Sinha, R. K. and Sharma, N. L. 1993: Mineral Economics. Oxford & IBH Pub. Co. Pvt. Ltd. Stach, E. and Others, 1982: Stach's Text Book of Coal Petrology. Gebruder Borntraeger Stanton, R. L, 1972: Ore Petrology. Mc-Graw Hill.
Tissot, B. P. and Welte, D. H, 1984: Petroleum Formation and Occurrence. Springer-Verlag.
Outlines of Geophysical Prospecting - A manual for geologists by Ramachandra Rao, M.B., Prasaranga, University of Mysore Mysore 1975.
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Applied Geophysics by Telford W.M. Geldart L.P., Sheriff, R.E. and Keys D.A. Oxford and IBH Publishing Co. Pvt., Ltd. New Delhi, 1976.

GL17107DCE: Petroleum Exploration

Unit-I

Source rocks, reservoir rocks and different types of traps. Amount, type and maturation of organic matter. Petroleum and source rock correlation. Locating petroleum prospects based on principles of petroleum generation and migration (geological modeling).

Geophysical methods of Hydrocarbon exploration.

Unit-II

Petroleum basins:Basin studies and basin analysis. Basin classification in plate tectonics. Fundamental types of petroliferous basin; relation between basin type and hydrocarbon richness. Factors favoring hydrocarbon abundance. Petroleum provinces of India and world Case studies of some giant oil fields

Unit-III

Elements of well drilling: Cable-tool drilling, rotary drilling, various types of drilling units. Elements of logging. Electric, radioactive and sonic logs. Nuclear magnetic resonance and dielectric logging Application of logs in petro-physical analysis and facies analysis

Books recommended

Guillemot, J., 1986: Oil and Gas Exploration Techniques. Additions Technip.
Glennie, K. W., 1998: Petroleum Geology of the North Sea. Blackwell Science.
Holson, G. D. and Tiratsoo, E.N., 1985: Introduction Petroleum Geology. Gulf Pub. Houston, Keller, S. E., 1994: Mineral Resources, Economic and the Environment. McMillan College Pub.
Levarson, 1985: Geology of Petroleum. CBS Pub.
Landon, R. C., 1996: Principles of Petroleum Development Geology. Printice Hall.
North, F. K., 1985: Petroleum Geology. Allen &Unwin
Salley, R. C., 1988. Elements of Petroleum Geology. Academic Press.
Tedesco, S. A., 1995: Surface Geochemistry in Petroleum Exploration. Chapman Hall.
Tissot, B. P. &Welte, D. H., 1984: Petroleum Formation and Occurrence, Springer Verlag.

GL17108GE: Earth and Climate

Unit-I

Components of the climate system, climate forcing, Climate system response, -response rates and interactions within the climate system. Incoming solar radiation, receipt and storage of heat, heat transformation, earth's heat budget. Layering of Atmosphere. Conveyor belt and its control on earth's climate.

Unit-II

Climate Change: natural vs Anthropogenic effects. Response of cryosphere to earth's climate. Brief introduction to archives of climate change. Milankovitch cycles. Glacial interglacial stages. The Last Glacial maximum (LGM), Younger Dryas and LIA.

Books recommended

Ahren, C.D., 2012: Meteorology Today, 10th edition, Cengage Learning.
Anthes, R. 1997: Meteorology, 7th edition, Prentice-Hall Inc., Upper Saddle River.
Barry, R.G. & Chorley, R.T. 1992: Atmosphere, Weather & Climate, 6th edition, Routledge, London.
Brigg, G.R. 1996: The Ocean and Climate, Cambridge University Press, Cambridge..
16 Critchfield, H.J. 1983: General Climatology, 4th edition, Prentice Hall India Ltd., New Delhi.
Das, P.K. 1995: Monsoons, 2nd edition, National Book Trust, New Delhi.
Elsom, D.M. 1992: Atmospheric Pollution: A Global Problem, 2nd edition, B. Well Pub. Co., London.
Lal, D.S. 1993: Climatology, 3rd edition, Chaitanya Pub. House, New Delhi.
Linacre, E. and Geerts, B. 1997: Climates and Weather Explained, Routledge, London.
Lutgens, F.K. and Tarbuck, E.J. 1998 : The Atmosphere: An Introduction to Meteorology, P. Hall
McIlveen R., 2010: Fundamentals of Weather and Climate, 2nd edition, Oxford University Press,
Oliver, J.E, Hidore, J.J., et al., 2009: Climatology, 3rd Edition, Prentice Hall.
Pant, G.B. and Kumar, R.K. 1997: Climates of South Asia, John Wiley and Sons Ltd., Chichester.
Roger G.B. and Richard, J.C., 2009: Atmosphere, Weather and Climate, 9th edition, Routledge.
Rohli, R.V. and Vega, A.J., 2011: Climatology, 2nd edition, Jones and Bartlett Publishers, Inc.
Smith, K. 1996: Environmental Hazards: Assessing Risk & Reducing Disaster, 2nd ed. R. London.
Taylor, J.A. (editor) 1974: Climatic Resources and Economic Activity, David & Charles, London.
A.G. Pimente, J. D. (editor) 1993: World Soil Erosion and Conservation, CU Press, Cambridge.

GL17109GE: Environmental Geosciences

Unit-I

Environmental Geology: Introduction to environmental geology, Fundamental concepts of environmental geosciences, Earth processes; endogenic and exogenic, Cenozoic climate extremes, their impact on evolution of life.

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Soils, Soil profiles, land use and environmental problem of soils, soil pollution. Health Geochemistry: essential and toxic elements & radon emission; impacts of aerosols including black carbon on environment. Rock water interactions

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Lundgren, L, 1986, Environmental Geology. Prentice Hall.
Michael, A., Basic of Environmental Science.
Parasnis, D. S., 1975: Principles of Applied Geophysics. Chapman Hall.
Pipkin, B. W. & Trent, D. D., 1997: Geology and the Environment. West wardsworth.
Singh, A., Modern Geo-Technical Engineering.
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Valdiya, K. S., 1987: Environmental Geology -Indian Context. Tata McGraw Hill.
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Waltham, A. C., 1997: Foundations of Engineering Geology. Blackie Academic & Professional. Subramaniam, V., 2001: Textbook in Environmental Science-Narosa International

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Chenicoff, S 1995: Geology (An introduction to physical geology)

GL17210OE: Introduction to stratigraphy and fossils

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Stratigraphy-definition and principles. Geological timescale. Stratigraphic correlation. Order of superposition. Karewas of Kashmir.

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Fossils, their characters, conditions necessary for fossilization; types of preservation and occurrence. Importance of fossils in stratigraphy.

Books recommended

Hypothesis and Pratt's hypothesis, Isostatic Rebound; Continental Drift; Sea floor spreading; Geomagnetism; Palaeomagnetism; Polar Wandering; Magnetic reversals; Geomagnetic time scale.

UNIT II

Plate Tectonics: Plates and Plate Margins; Active and Passive margins; Geometry and Mechanism of Plate Motion; Plate boundaries; Mid-oceanic ridges, subduction zone, Strike slip; Andean; Pacific and other types of orogenies; Benioff zone, Fore-arc and back arc basins; Hotspots, Mantle plumes and Triple Junction;

GL17309GE: Environmental Geology

Unit-I

Concept and definition of Environmental Geology. Processes of soil formation, types of soils, soil degradation and changing land use pattern. Environmental changes due to influence of human-dominated environment over nature-dominated system. Mobility of elements. Impact assessment of water availability, quality and contamination of surface water and groundwater.

Unit-II

Health Geochemistry: essential and toxic elements & radon emission; impacts of aerosols including black carbon on environment. Distribution, magnitude and intensity of earthquakes. Neotectonics and seismic hazard assessment. Preparation of seismic hazard maps. Causes of major floods, cyclones and storms. Deforestation and land degradation.

Books recommended

Lanen, F., Environmental Geology.
Lawrence, L. Environmental Geology.
Lundgren, L., 1986, Environmental Geology. Prentice Hall.
Michael, A., Basic of Environmental Science.
Parasnis, D. S., 1975: Principles of Applied Geophysics. Chapman Hall.
Pipkin, B. W. & Trent, D. D., 1997: Geology and the Environment. West wardsworth.
Singh, A., Modern Geo-Technical Engineering.
Smith, K., 1992: Environmental Hazards. Rutledge, London.
Valdiya, K. S., 1987: Environmental Geology -Indian Context. Tata McGraw Hill.
Venkat, R. D., Engineering Geology for Civil Engineers.
Waltham, A. C., 1997: Foundations of Engineering Geology. Blackie Academic & Professional.
Subramaniam, V., 2001: Textbook in Environmental Science-Narosa International

GL17310GE: Frontiers in Earth Sciences

Unit-I

Introduction: Origin of Earth, Structure of earth; Crust, Mantle & Core;
Outer spheres: Atmosphere, hydrosphere, biosphere of the earth, Exogenous and endogenous process.

Unit-II

Biogeochemical cycles - nitrogen cycle, carbon cycle and phosphorous cycle.
Geological Time Scale: Lithostratigraphic Units, Chronostratigraphic Unit and Biostratigraphic Unit
Geology as the history of Earth: (a) Fossils (b) Mineralogy and the texture; (c) Structures; (d) Palaeogeography (e) Paleoclimate.

Burrough, P. A., 2003: Principles of Geographic Information Systems. Oxford University Press.

Campbell, J., 2002: Introduction to Remote Sensing. Guilford Press, New York.

Demers, M. N., 1999: Fundamentals of Geographic Information Systems. John Wiley.

Jensen, J. R., 2004: Remote Sensing of the Environment. Prentice Hall, New Jersey.

John, A., Richards, 1993: Remote Sensing Digital Image Analysis. Springer-Verlag.

John, R., Jensen, 2000: Introductory Digital Image Processing, A Remote Sensing Perspective.

Lillesand, T. M. and Kiefer, R W., 1987: Remote Sensing in Geology. John Wiley. Prentice Hall,

Lillesand, T. M. and Kiefer, RW, 2002: Remote Sensing and Image Interpretation, John Wiley.

Rees, W. G., 2001: Physical Principles of Remote sensing. Cambridge University Press.

Sabbins, F. F., 1985: Remote Sensing - Principles and Applications. Freeman.

Skidmore, A., 2002. Environmental modeling with GIS and Remote Sensing. Taylor& Francis,

London. Longley, D. A., Gordchild, M. F., Maguire, D. J. and Rhind, D. W., 2001: Geographic Information Systems and Science. John Wiley & Sons.

GL17409DCE: Quaternary Geology and Paleoclimate

Unit-I

Definition of Quaternary. The Character of Quaternary. Quaternary stratigraphy- Oxygen isotope stratigraphy, biostratigraphy and magnetostratigraphy. Response of geomorphic, neotectonic, active tectonics during Quaternary. Quaternary dating methods: Radiocarbon, cosmogenic radionuclide, Luminescence, and Relative dating methods. Quaternary deposits of Kashmir.

Unit-II

Introduction to climate and climate systems, Global climate pattern, Climate controlling factors. Plate tectonics and climate change Milankovitch cycles, Atmosphere and Ocean interaction and its effect on climate. An Overview of Paleoclimatic reconstruction; Application of loess and phytoliths and other proxies in paleoclimatic studies.

Suggested Readings

Bigg, G., 1999 Ocean and Climate. Springer- Verlag

Bradley, F., 2000. Paleoclimatology: Reconstructing Climates of the Quaternary. Springer-Verlag

Maher and Thompson, 2000. Quaternary Climates, Environments and Magnetism. Cambridge University Press.

Williams, Durnkerley, Decker, Kershaw and Chhappell, 1998. Quaternary Environments. Wiley and Sons.

GL17410GE: Fundamentals of Geo-tectonics

Unit-I

Introduction to geotectonics; Continental drift, seafloor spreading and convection current hypotheses; Paleomagnetism, polar wandering and reversal of earth's magnetic field; Principal Geotectonic features: Features of the Ocean, Continent and Continental margins

Unit-II

Unit-I

Components of the climate system, climate forcing, Climate system response, -response rates and interactions within the climate system. Incoming solar radiation, receipt and storage of heat, heat transformation, earth's heat budget. Layering of Atmosphere. Conveyor belt and its control on earth's climate.

Unit-II

Climate Change: natural vs Anthropogenic effects. Response of cryosphere to earth's climate. Brief introduction to archives of climate change. Milankovitch cycles. Glacial interglacial stages. The Last Glacial maximum (LGM), Younger Dryas and LIA.

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GL17309GE: Environmental Geology

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Concept and definition of Environmental Geology. Processes of soil formation, types of soils, soil degradation and changing land use pattern. Environmental changes due to influence of human-dominated environment over nature-dominated system. Mobility of elements. Impact assessment of water availability, quality and contamination of surface water and groundwater.

Unit-II

Health Geochemistry: essential and toxic elements & radon emission; impacts of aerosols including black carbon on environment. Distribution, magnitude and intensity of earthquakes. Neotectonics and seismic hazard assessment. Preparation of seismic hazard maps. Causes of major floods, cyclones and storms. Deforestation and land degradation.

Books recommended

Lanen, F., Environmental Geology.
Lawrence, L. Environmental Geology.
Lundgren, L., 1986, Environmental Geology. Prentice Hall.
Michael, A., Basic of Environmental Science.
Parasnis, D. S., 1975: Principles of Applied Geophysics. Chapman Hall.
Pipkin, B. W. & Trent, D. D., 1997: Geology and the Environment. West wardsworth.
Singh, A., Modern Geo-Technical Engineering.
Smith, K., 1992: Environmental Hazards. Rutledge, London.
Valdiya, K. S., 1987: Environmental Geology -Indian Context. Tata McGraw Hill.
Venkat, R. D., Engineering Geology for Civil Engineers.
Waltham, A. C., 1997: Foundations of Engineering Geology. Blackie Academic & Professional.
Subramaniam, V., 2001: Textbook in Environmental Science-Narosa International

GL17310GE: Frontiers in Earth Sciences

Unit-I

Introduction: Origin of Earth, Structure of earth; Crust, Mantle & Core;
Outer spheres: Atmosphere, hydrosphere, biosphere of the earth, Exogenous and endogenous process.

Unit-II

Biogeochemical cycles - nitrogen cycle, carbon cycle and phosphorous cycle.
Geological Time Scale: Lithostartigraphic Units, Chronostratigraphic Unit and Biostratigraphic Unit
Geology as the history of Earth: (a) Fossils (b) Mineralogy and the texture; (c) Structures; (d) Palaeogeography (e) Paleoclimate.

Books recommended

Holmes, A., 1996: Principles of Physical Geology, EUBS, Chapman.
Judson, S. and Kaufman, M. E., 1990: Physical Geology, Prentice Hall.
Press, F. and Seiver, R., 1989: The Earth, W. H. Freeman

GL17311GE: Mapping in GIS**Unit-I**

National Mapping standards - NNRMS and its importance. Levels of classification from earth observation data. NNRMS standards from land cover and vegetation mapping. Basic components of a map and concept of scale in mapping. Data sources for mapping: remote sensing, field observations, GPS, maps and other ancillary data. Hands-on GIS: Creation of point, line and polygon theme).

Unit-II

Elements of image interpretation. Web-portals for data download: Bhuvan and Earth Explorer. Delineating land use land cover from earth observation data: Opportunities and challenges. Ground truth procedure and ground data collection pertaining to land cover and vegetation. Hands-on GIS: Land cover mapping, Map making and Accuracy assessment.

Books recommended

Burrough, P. A. 1996. Principles of Geographic Information Systems for land resources assessment, Oxford: Clarendon Press.
De Mers, M. N. 2002. Fundamentals of Geographic Information Systems. John Wiley and Sons, New York.
Ormeling, F., & Kraak, M. J. 2010. Cartography: Visualization of Geospatial Data. Prentice Hall.
Robinson, Arthur H., Joel L. Morrison, Phillip C. Muehrcke, A. Jon Kimerling, and Stephen C. Gupill 1995. Elements of Cartography, John Wiley and Sons, New York.

GL17312OE: Land resources of Kashmir**Unit-I**

Renewable resources Definition. Soil: definition, classification, formation and soil types of Kashmir. Economic mineral resources: Origin of petroleum. Reservoir and Source rocks – definition and types.

Unit-II

Coal: definition, formation and classification of coal. Petroleum prospecting in Kashmir. Ore minerals and gangue. Mineral deposit of Jammu and Kashmir. Distribution and uses of Marble, Granite, Basalt, Limestone and Slate in Kashmir.

Books Recommended

Bamzai, P. N. K (1994), Culture And Political History Of Kashmir (3 Vols. Set), M.D. Publications, ISBN 97881-85880-31-0.
Sir Walter Roper Lawrence (1895). The Valley of Kashmir. Asian Educational Services, 1895.
Raina A. N. (2002) Geography of Jammu & Kashmir State . Radha Krishan Anand & Co.
Qazi S.A. (2005). Systematic Geography Of Jammu And Kashmir. APH Publishing, 2005.

Unit-I

Components of the climate system, climate forcing, Climate system response, -response rates and interactions within the climate system. Incoming solar radiation, receipt and storage of heat, heat transformation, earth's heat budget. Layering of Atmosphere. Conveyor belt and its control on earth's climate.

Unit-II

Climate Change: natural vs Anthropogenic effects. Response of cryosphere to earth's climate. Brief introduction to archives of climate change. Milankovitch cycles. Glacial interglacial stages. The Last Glacial maximum (LGM), Younger Dryas and LIA.

Books recommended

Ahren, C.D., 2012: Meteorology Today, 10th edition, Cengage Learning.
Anthes, R. 1997: Meteorology, 7th edition, Prentice-Hall Inc., Upper Saddle River.
Barry, R.G. & Chorley, R.T. 1992: Atmosphere, Weather & Climate, 6th edition, Routledge, London.
Brigg, G.R. 1996: The Ocean and Climate, Cambridge University Press, Cambridge..
16 Critchfield, H.J. 1983: General Climatology, 4th edition, Prentice Hall India Ltd., New Delhi.
Das, P.K. 1995: Monsoons, 2nd edition, National Book Trust, New Delhi.
Elsom, D.M. 1992: Atmospheric Pollution: A Global Problem, 2nd edition, B. Well Pub. Co., London.
Lal, D.S. 1993: Climatology, 3rd edition, Chaitanya Pub. House, New Delhi.
Linacre, E. and Geerts, B. 1997: Climates and Weather Explained, Routledge, London.
Lutgens, F.K. and Tarbuck, E.J. 1998 : The Atmosphere: An Introduction to Meteorology, P. Hall
McIlveen R., 2010: Fundamentals of Weather and Climate, 2nd edition, Oxford University Press,
Oliver, J.E, Hidore, J.J., et al., 2009: Climatology, 3rd Edition, Prentice Hall.
Pant, G.B. and Kumar, R.K. 1997: Climates of South Asia, John Wiley and Sons Ltd., Chichester.
Roger G.B. and Richard, J.C., 2009: Atmosphere, Weather and Climate, 9th edition, Routledge.
Rohli, R.V. and Vega, A.J., 2011: Climatology, 2nd edition, Jones and Bartlett Publishers, Inc.
Smith, K. 1996: Environmental Hazards: Assessing Risk & Reducing Disaster, 2nd ed. R. London.
Taylor, J.A. (editor) 1974: Climatic Resources and Economic Activity, David & Charles, London.
A.G. Pimente, J. D. (editor) 1993: World Soil Erosion and Conservation, CU Press, Cambridge.

GL17109GE: Environmental Geosciences

Unit-I

Environmental Geology: Introduction to environmental geology, Fundamental concepts of environmental geosciences, Earth processes; endogenic and exogenic, Cenozoic climate extremes, their impact on evolution of life.

Unit-II

Soils, Soil profiles, land use and environmental problem of soils, soil pollution. Health Geochemistry: essential and toxic elements & radon emission; impacts of aerosols including black carbon on environment. Rock water interactions

Books recommended

Lundgren, L, 1986, Environmental Geology. Prentice Hall.
Michael, A., Basic of Environmental Science.
Parasnis, D. S., 1975: Principles of Applied Geophysics. Chapman Hall.
Pipkin, B. W. & Trent, D. D., 1997: Geology and the Environment. West wardsworth.
Singh, A., Modern Geo-Technical Engineering.
Smith, K., 1992: Environmental Hazards. Rutledge, London.
Valdiya, K. S., 1987: Environmental Geology -Indian Context. Tata McGraw Hill.
Venkat, R. D., Engineering Geology for Civil Engineers.
Waltham, A. C., 1997: Foundations of Engineering Geology. Blackie Academic & Professional. Subramaniam, V., 2001: Textbook in Environmental Science-Narosa International

GL17110OE: Introduction to Geosciences

Unit-I

Introduction to Geology: Definition, branches and scope. Relationship of geology with other subjects, Interior of earth, Folds, faults and joints- definition and types.

Unit-II

Weathering: definition and types. Depositional and erosional features formed by rivers, glaciers, wind. Soils: formation and types

GL17111OE: Introduction to Rocks and Minerals

Unit-I

Rocks: Definition, Types. Description of common rock types: Basalt, Granite, Sandstone, Limestone, Shale, Conglomerate, Marble, Slate, Schist, Gneiss. Rock types of Kashmir

Unit-II

Minerals: Definition and Types, Physical and chemical properties. Mineral resources of Kashmir

Books recommended:

Holmes, A., 1996: Principles of Physical Geology, EUBS, Chapman.
Judson, S. and Kaufman, M. E., 1990: Physical Geology, Prentice Hall.
Press, F. and Seiver, R., 1989: The Earth,
Terry, G. W., 1958: Principles of Petrology.
Gribble, D. D., 1988: Rutley's Elements of Mineralogy, DBS Publications.
Tarbuck, E. J. and Lutgens, F. K., 1997: Earth Science, Prentice Hall.
Lutgens, F. K. and Tarbuck, E. J., 1998: Essentials of Geology, Prentice Hall.

General Instructions for the Candidates

1. The two year (4 semesters) PG programme is of 96 credit weightage i.e, 24 credits / semester (24x4=96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has to obtain a minimum of 8 credits (2-3 papers) from the Discipline Centric Electives (DCE) offered by his/her own Department.
4. A candidate has compulsorily to obtain a minimum of 4 credits (2 paper) from Generic Elective (GE) or Open Electives (OE) or a combination of both offered by the departments other than his/her own.
5. A candidate can earn more than the minimum required credits (i.e, more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.
6. Field Training (course code: **GL17104DCE**) is compulsory only for M.Sc. Applied Geology students. Every student of M.Sc. Applied Geology ought to opt for this course.

Outlines of Geophysical Prospecting - A manual for geologists by Ramachandra Rao, M.B., Prasaranga, University of Mysore Mysore 1975.

Exploration Geophysics - An Outline by Bhimasarikaram Y.L.S., Association of Exploration Geophysicists, Osmania University, Hyderabad, 1990.

An introduction to Geophysical Prospecting by Oobrin, M.B. and Savit, C.H., McGraw Hill, New Delhi, 1988. Applied Geophysics by Telford W.M. Geldart L.P., Sheriff, R.E. and Keys D.A. Oxford and IBH Publishing Co. Pvt., Ltd. New Delhi, 1976.

GL17208GE: Oceanography

Unit-I

Ocean circulation: Horizontal circulation, vertical circulation. Circulation in different Oceans. Coastal erosion and Wave study. Changing levels of the Shoreline. Ocean circulation and climate change

Unit-II

Waves: Characteristics, Wind-generated waves, Tsunami, Internal waves. Tides: Characteristics and origin, Tidal currents, Tides as a source of power.

Books recommended

Kennett, J. P., 1982: Marine Geology. Prentice Hall.

Pinet, P. R., 1992: Oceanography, An Introduction to the Planet Oceanus. West Pub. Co.

Seibold, E. and Berger, W. H., 1982: The Sea Floor. Springer-Verlag.

Smoot, N. C., Choi, D. R & Bhat, M. I., 2002. Marine Geomorphology. XLIBRIS Corp.

Smoot, N. C., Choi, D. R. & Bhat, M. I., 2002. Active Margin Geomorphology. XLIBRIS

Corporation Thurman, H. B., 1978: Introductory, Oceanography. Charles, E. Merrill Pub. Co.

GL17209GE: Marine Geology

Unit-I

Ocean floor morphology. Structure, composition and mechanism of the formation of oceanic crust. Ocean margins and their significance, Origin of ocean floor. Hydrothermal vents. Mineral resources.

Unit-II

Oceanic sediments: Factors controlling the deposition and distribution of oceanic sediments; geochronology of oceanic sediments. CCD. Paleooceanography, Approaches to paleoceanographic reconstructions; various proxy indicators for paleoceanographic interpretation.

Books recommended

Kennett, J. P., 1982: Marine Geology. Prentice Hall.

Pinet, P. R., 1992: Oceanography, An Introduction to the Planet Oceans. West Pub. Co.

Seibold, E. and Berger, W. H., 1982: The Sea Floor. Springer-Verlag.

Smoot, N. C., Choi, D. R & Bhat, M. I., 2002. Marine Geomorphology. XLIBRIS Corp.

Smoot, N. C., Choi, D. R. & Bhat, M. I., 2002. Active Margin Geomorphology. XLIBRIS Corporation

Thurman, H. B., 1978: Introductory, Oceanography. Charles, E. Merrill Pub. Co.

Chenicoff, S 1995: Geology (An introduction to physical geology)

GL17210OE: Introduction to stratigraphy and fossils

Unit-I

Stratigraphy-definition and principles. Geological timescale. Stratigraphic correlation. Order of superposition. Karewas of Kashmir.

Unit-II

Fossils, their characters, conditions necessary for fossilization; types of preservation and occurrence. Importance of fossils in stratigraphy.

Books recommended

Arnold, C. A., 1947: An introduction to Paleobotany. McGraw - Hill Book Co.
 Clerkson, E. N. K., 1998: Invertebrate Paleontology and evolution. Black Well
 Dunbar, C. O, Rodger, J., 1957: Principles of stratigraphy. Wiley International.
 Krishanan, M. S., 1968: Geology of India and Burma. Higginbothams Pvt. Ltd., Madras.
 Kumar, R, 1998: Fundamentals of Historical Geology and Stratigraphy. Wiley Eastern Limited.
 Wadia, D. N., 1957: Geology of India. Mcmillan, London.
 Weller, J. M., 1960: Stratigraphy Principles & Practice. Harper & Row Pub.

GL17211OE:Earth Observation

Unit-I

Fundamentals of Earth Observation:

Earth observation: History of earth observations; Ground-based, airborne and space-borne earth observation systems. Polar orbiting and geostationary satellites; Remote sensing data: Spatial, spectral and temporal resolution. Earth observation missions from NASA and ISRO.

Unit-II

Earth observation applications:

Earth observation for: forests, wetlands and agriculture. Utility of earth observation data for impact assessments and city master planning. Earth observation data for natural resource inventorying and disaster assessment.

Books recommended:

Understanding earth observation. Domenico Solimini. 2016. Springer Switzerland.
 Earth Observation of global change. Emilio Chuvieco (Ed). 2008. Springer
 Principles of Geographic Information Systems for land resources assessment: Burrough, P.A., 1996. Oxford: Clarendon Press.
 Remote Sensing & Image Interpretation, Lillesand, R. M. & R. W. Kiefer, 1994, 3rd Ed. NY: John Wiley and Sons, Inc.
 Introduction to GIS, Chang, K. 2004. 2nd Edition. McGraw-Hill, Dubuque,
 Introduction to remote sensing, Campbell, J.B., Taylor and Francis, London. Remote Sensing Digital Image Analysis, John A. Richards: Springer-Verlag, 1993.
 Manual of Remote Sensing Colwell, R.N. (ed), 1983, 2Ed. Falls, Church, V.A American society of Photogrammetry.

General Instructions for the Candidates

1. The two year (4 semesters) PG programme is of 96 credit weightage i.e, 24 credits / semester (24x4=96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has to obtain a minimum of 8 credits (2-3 papers) from the Discipline Centric Electives (DCE) offered by his/her own Department.
4. A candidate has compulsorily to obtain a minimum of 4 credits (2-3 paper) from Generic Elective (GE) or Open Electives (OE) or a combination of both offered by the departments other than his/her own.
5. A candidate can earn more than the minimum required credits (i.e, more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

Field Training (course code: **GL17204DCE**) is compulsory only for M.Sc. Applied Geology students. Every student of M.Sc. Applied Geology ought to opt for this course.

dehydration reactions, decarbonisation and oxidation-reduction reactions and their implications to geothermo-barometry. Metasomatism and anataxis. Metamafics. Regional metamorphism and paired metamorphic belts in reference to plate tectonics. Metamorphic Phase Equilibria & Pressure-Temperature-Time Paths

GLP17301CR: Practical Metamorphic Petrology

Metamorphic Petrology: Megascopic and microscopic study of metamorphic rocks of different facies. Interpretation of metamorphic textures. Modal analysis. Chemo-graphic diagram (ACF & AFM ternary diagrams).

Books recommended

Bucher, K. and Frey, M., 1994: Petrogenesis of Metamorphic rocks. Springer-Verlag.
Miyashiro, A., 1994: Metamorphic Petrology. UCL Press Ltd., London.
Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.
Turner, F. J., 1960: Igneous and Metamorphic Petrology. Mc-Graw Hill, New York.
Turner, F. J., 1980: Metamorphic Petrology. McGraw Hill, New York. ‘ Turner & Verhoogen, 1999: Igneous and Metamorphic Petrology. CBS Pub.
Tyrrell, G. W., 1987: Principles of Petrology. CBS Pub
Yardley, B. W., 1989: An Introduction to Metamorphic Petrology. Longman, New York.

GL17302CR: Hydrogeology

Theory

Unit-I

Introduction: Groundwater in the hydrologic cycle. Groundwater table – Groundwater table fluctuations and controlling factors. Subsurface inflow and outflow, recharge and discharge, effluent and influent streams. Elementary theory of groundwater flow: Darcy's law and its range of validity. Steady and unsteady flow. Hydrological properties of aquifers: Porosity and permeability, transmissivity, storage coefficient, their definition and methods of determination. Water table maps and flow net analysis; differential equation for controlling groundwater flow. Well hydraulics: Steady, unsteady and radial flow into a well. Confined and leaky confined and unconfined aquifers. Determination of aquifer characteristics from pump-tests.

Unit-II

Groundwater development: Groundwater exploration methods – geological & geophysical (resistivity, magnetic and seismic) methods. Borehole geophysical logging – electrical, resistivity and SP; Radiation logging – gama, gama-gama, and neutron logging. Cliper and temperature logging. Preparation of strata charts, design of tube well assembly and water well design criteria. Water level development and yield tests, well completion reports. Groundwater modeling techniques, data requirement.

Unit-III

Groundwater basin management methods: Basic ideas of groundwater management. Water logging –causes and remedial measures; artificial recharge. Fresh and saltwater relationship in coastal areas. Quality and geochemistry of water: Groundwater quality analysis – sampling methods, bacteriological, chemical and physical quality. Quality criteria for drinking, irrigation and industrial purposes. Pollution of groundwater. Groundwater and hydro-chemical provinces of India.

GLP17302CR: Practical Hydrogeology

Delineation of hydrological boundaries on water-table contour maps and estimation of permeability. Preparation of isohyetal maps, Thiessen's polygonal method. Analysis of aquifer performance test data, Thieme's, Theis's and Jacob's method. Design of water well screen and gravel pack on the basis of mechanical analysis data of aquifer material. Analysis of hydrographs and estimation of infiltration capacity. Study of geophysical well logs. Estimation of TDS using resistivity and SP logs. Plotting of groundwater provinces of India.

Books recommended:

Chow, V. T, 1988: Advances in Hydrosociences, McGraw Hill.
Freeze, R. A. & Cherry, J. A., 1979: Ground Water. Prentice Hall.
Fetter, C. W., 1990: Applied Hydrogeology. Merrill Publishing.
Karanth, K. R., 1987: Groundwater Assessment-Development and Management. Tata McGraw Hill.
Todd, D. K., 1980: Groundwater Hydrogeology John Wiley.
Raghunath, N. M., 1982: Ground Water. Wiley Eastern.
Raghunath, H. M., 1997: Hydrology, Principles, Analysis, Design. New Age Pub. Roa, K. L., 1979:
India's Water Wealth, Orient Blackswan.

**GL17303CR: Remote Sensing in Geosciences
Theory****Unit-I**

Remote sensing: basic concepts, fundamentals, data sources, Types of scanners and image acquisition: History and scope of remote sensing, concepts of remote sensing, electromagnetic radiations, matter interactions with atmosphere and terrain atmospheric windows, spectral reflectance of vegetation, soils, minerals and rocks. Elements of visual image interpretation. Factors governing image interpretation, verification and validation of RS data (Ground Truthing).

Unit-II

Digital analysis of remote sensing data: Picture element and image statistics, Geometric and Radiometric Distortions, Pre-processing of satellite data (radiometric and geometrical corrections). Image enhancements techniques. Image filtering techniques. Spectral ratios and indices. Digital image classification: Supervised and unsupervised classification. Accuracy assessment: Sources of errors and measurement of map accuracy, kappa coefficient.

Unit-III

Remote sensing applications to geosciences: Earth sciences: Lithology and structure (faults, folds), Environmental: Land use and land cover changes, monitoring erosion, urbanization and deforestation. Survey: cadastral mapping, digital terrain models. Hydrology: hydrological modeling and ground water prospecting.

GLP17303CR: Practical Remote Sensing in Geosciences

Remote Sensing in Geosciences: Tutorial on different modules of image processing software; Import and export of satellite data; Different image and remote sensing data formats; Familiarization with the earth surface features on the images; Preparation of satellite data for

**Choice based Credit System (CBCS) Scheme and course structure for M.Sc. Applied
Geology 4th semester effective from academic session 2017 and onwards**

4th Semester

Course Code	Course Name	Paper Category	Hours per week			Credits
			L	T	P	
GL17401CR	Geomorphology	Core	2	2	0	2+1+0=3
GL17402CR	Mining & Exploration Geology	Elective (DCE)	2	2	0	2+1+0=3
GL17403CR	Project work	Core	0	12	0	0+6+0=6
GL17404 DCE	Sedimentary Environment and Sedimentary Basins	Elective (DCE)	2	2	0	2+1+0=3
GL17405 DCE	Himalayan Tectonics	Elective (DCE)	2	2	0	2+1+0=3
GL17406 DCE	Rock Deformation and Structural Analysis	Elective (DCE)	1	2	0	1+1+0=2
GL17407 DCE	Advanced Hydrogeology	Elective (DCE)	1	2	0	1+1+0=2
GL17408 DCE	Advanced Remote Sensing and GIS	Elective (DCE)	1	2	0	1+1+0=2
GL17409 DCE	Quaternary Geology and Paleoclimate	Elective (DCE)	1	2	0	1+1+0=2
GL17410 GE	Fundamentals of Geotectonics	Elective (GE)	2	0	0	2+0+0=2
GL17411 GE	Natural Disasters	Elective (GE)	2	0	0	2+0+0=2
GL17412 OE	Earth Surface Processes	Elective (OE)	1	2	0	1+1+0=2
GL17413 OE	Water Quality	Elective (OE)	1	2	0	1+1+0=2
24 Credits= 33 Contact Hours						
L= Lecture; T= Tutorial; P= Practical; * Compulsory for the Applied Geology Students						

Seminar: A candidate shall have to deliver one seminar lecture in the subject per semester in the 3rd and 4th semesters carrying weightage of 1 credit. The topic of the seminar lecture shall be allotted by the concerned teachers/Department to the candidate well in advance.

GL17401CR: Geomorphology

UNIT I

Overview of geomorphology: Geomorphic processes and resulting landforms. Geomorphological cycle. Geodesy, Soils: development and classification. Morphometric analysis of basins. Geomorphic evolution of Western Himalaya.

UNIT II

Introduction to Tectonic Geomorphology: Energetics. Controversies in tectonic geomorphology. Gravity tectonics. Landform dating techniques: Relative – Clast seismic velocity method, Weathering rinds, Obsidian hydration rinds, Soil development and Carbonate coating method, Lichenometry; Absolute – Tree rings, Luminescence dating. Geomorphic Expression of Faults.

UNIT III

Palaeoseismology. Field techniques in Paleoseismology: Principles and practice. Use of liquefaction-induced features for Palaeoseismic analysis. Quaternary geomorphology: Cycles of climatic change (glacial and interglacial) and their effect on landforms. Geomorphic Markers: Planar and linear geomorphic markers. Alluvial river response to active tectonics. Knickpoints, base level.

Books recommended:

Bloom, A. L., 2002: Geomorphology, A Systematic Analysis of Late Cenozoic Land Forms. Prentice Hall Pvt. Ltd., N. Delhi.

Burbank, D. W. and Anderson, R.S., 2001: Tectonic Geomorphology Blackwell Sciences

Easterbrook, Easterbrook, 1994: Surface Processes and Land Forms. Prentice Hall.

McCalpin, J., 1996: Paleoseismology Academic Press.

Pitty, A. F., 1982: Nature of Geo-Morphology. University Paper Backs. Ritter, D. F., 1978:

Process Geomorphology. Wm. C. Brown Publishers, Iowa Sharma, V. K., 1986:

Geomorphology. Tata McGraw Hill.

Thorrenberry, W. D., 1997: Principles of Geomorphology New Age International, Delhi.

Vishwas, S. K and Gupta, A., 2001: Introduction to Geomorphology Orient Longman.

GL17402CR: Mining & Exploration Geology

UNIT I

Classification of mining methods, introductory geological and economic aspects of mine planning, developmental works for underground mining, mode of entry in mines, drift, crosscuts, winz, raise, ore bin and ore chutes. Surface mining methods; placer mining methods and open pit methods, ground sluicing, hydraulic mining, dredging, drift mining, shovel mining and multi bench, lateral advance mining method, their advantages and disadvantages. Underground mining methods; open stopes mining methods, supported stopes mining methods, shrinkage, cut and fill and square set mining methods, caving methods- top slicing sublevel caving and block caving, their advantages and disadvantages.

UNIT II

Mining supports; support types with their merits and demerits. Stowing methods; subsidence –causes and prevention. Methods of breaking and blasting the rocks, types of explosives used; arrangements of drill holes for blasting in surface and underground mines. Mining atmosphere; ventilation in underground mines, types and arrangements of directing ventilations in underground mining.

UNIT III

Exploration Geology: Concept of Geochemical Prospecting: dispersion, pathfinder elements, geochemical sampling, and geochemical field techniques. Geophysical prospecting: Basic principles, scope and application of geophysical prospecting. Principle, procedure, equipment used and applicability of gravity, magnetic, electrical, seismic and radiometric methods. Aerial geophysical surveys.

Books recommended:

Evan, A. M., 1983: Ore Geology and industrial Minerals. Blackwell.

Holson, G. D. and Tiratsoo, E. N., 1985: Introduction Petroleum Geology. Gulf Pub. Houston,

Jensen, M. L. and Bateman, A. M., 1981: Economic Mineral Deposits, John Wiley.

**Choice based Credit System (CBCS) Scheme and course structure for M.Sc. Applied Geology
1st semester effective from academic session 2017 and onwards**

1st Semester

Course Code	Course Name	Paper Category	Hours per week			Credits
			L	T	P	
GL17101CR	Structural Geology & Global Tectonics	Core	3	0	0	3+0+0=3
GLP17101CR	Practical Structural Geology	Core	0	0	2	0+0+1=1
GL17102CR	Mineralogy	Core	3	0	0	3+0+0=3
GLP17102CR	Practical Mineralogy	Core	0	0	2	0+0+1=1
GL17103CR	Igneous Petrology	Core	3	0	0	3+0+0=3
GLP17103CR	Practical Igneous Petrology	Core	0	0	2	0+0+1=1
GL17104DCE	Field Training (compulsory)*	Elective (DCE)	0	2	0	0+1+0=1
GL17105DCE	Crystallography	Elective (DCE)	2	0	0	2+0+0=2
GL17106DCE	Economic Geology	Elective (DCE)	2	0	0	2+0+0=2
GL17307DCE	Petroleum Exploration	Elective (DCE)	2	2	0	2+1+0=3
GL17108GE	Earth and Climate	Elective (GE)	2	0	0	2+0+0=2
GL17109GE	Environmental Geosciences	Elective (GE)	2	0	0	2+0+0=2
GL17110OE	Introduction to Geosciences	Elective (OE)	1	1	0	1+1+0=2
GL17111OE	Introduction to Rocks& Minerals	Elective (OE)	1	1	0	1+1+0=2
24 Credit= 33 Contact Hours						
L= Lecture; T= Tutorial; P= Practical; * Compulsory for the Applied Geology Students						

GL17101CR: Structural Geology & Global Tectonics

Unit-I

Introduction: Mechanical properties of rocks and rock failure. Concepts of stress and strain, Different methods of stress and strain analyses in rocks. Concept and methods of structural analysis. Petro-fabric analysis and its significance.

Unit-II

Folds: Geometry and mechanics of folding. Fractures and joints: classification, origin and significance. Faults: classification and mechanism of development of faults. Different type of Planar and linear structures in rocks.

Unit-III

Global tectonics: Mechanical and compositional layering of earth. Isostasy and Paleomagnetism. Plate tectonics: concept, causes and examples.

GLP17101CR: Practical Structural Geology

Structural Geology: Preparation and interpretation of geological maps and sections. Exercises for determination of finite strain. Exercises of structural analysis. Plotting and interpretation of petro-fabric data and resultant diagrams.

Books recommended

Condie, K. C., 1976: Plate tectonics and crustal evolution. Pergamon.
Cox, A., 1996: Plate Tectonics. Blackwell.
Davis, G. R., 1984: Structural Geology of Rocks and Region. John Wiley.

Ghosh, S. K., 1995: Structural Geology Fundamentals of modern Developments. P. Press.
 Hobbs, B. E., Means, W. D. & Williams, P. F., 1976: An Outline of Structural Geology. JW.
 Kearey, P. and Vine, 2000: Global Tectonics. Black Well.
 Meyerhoff et al., 1996: SurgeTectonics, Kluwer Pub.
 Price, N. J. & Cosgrove, J. W., 1990: Analysis of Geological Structure. CU. press.
 Ramsay, J. G., 1967: Folding and Fracturing of Rocks. Mc Graw Hill.
 Ramsay, J. G. and Huber, M. I.,: Modern Structural Geology, Vol. I, II, III. Academic Press. Ragan, D. M. 2010
 Cambridge Univ. Press

GL17102CR: Mineralogy

Unit-I

Introduction to mineralogy, physical and chemical properties of minerals. Systematic mineralogy: Atomic structure, mineral chemistry and their PT-stability and mode of occurrence of silicates.

Unit-II

Chemical composition, crystal structure, P-T stability and mode of occurrence of following groups of nonsilicate minerals: Native elements, Sulfides, Sulfides, Sulfosalts, Oxides, Hydroxides, Carbonates.

Unit-III

Optical Mineralogy: Concept and application of optical indicatrix. Interference phenomenon. Orthoscopic and conoscopic study of minerals. Optic figure, optic sign, dispersion, pleochroism and absorption. Determinative methods in mineralogy: Refractive index (Colored Backline variation method), Pleochroism scheme and 2V Microscopic methods, Axiality and optic sign.

GLP17102CR: Practical Mineralogy

Mineralogy: Megascopic and microscopic identification of important rock forming minerals. Exercises in mineral optics. Preparation of thin section and polished sections. Etching and staining.

Books recommended:

Berry & Mason, 1988: *Mineralogy*. CBS Pub.
 Hutchinson, C. S., 1974: *Laboratory Handbook of Petrographic Techniques*. John Wiley.
 Kerr, P. F., 1977: *Optical Mineralogy*. McGraw Hill.
 Kerr, P. F., 1977: *Optical Mineralogy*. McGraw Hill.
 Nesse, 1987: *Optical Mineralogy*.
 Phillips, Wm, R. and Griffen, D.T., 1986: *Optical Mineralogy*. CBS Edition.
 Putnis, A., 2001: *Introduction to mineral Science*. Cambridge University Press. Putnis, A., 1992: *Introduction to mineral Science*. Cambridge University Press.
 Richard, V. G., 1997: *Dana's new Mineralogy*. John Wiley.
 Spear, F. S. 1993: *Mineralogical Phase Equilibria and Pressure-Temperature Paths*. Mineralogical Society of America Read, H. H., 1986: *Rutleys Elements of Mineralogy*.
 Winchell, A. N., 1968: *Elements of optical mineralogy*. Wiley Eastern Pvt Ltd.
 Winchell, A. W., 1937: *Elements of Optical Mineralogy* (Principles & Methods). John Wiley Pvt Ltd.

GL17103CR: Igneous Petrology

Unit-I

Introduction to igneous petrology: Magma: nature, cooling behavior, properties and chemistry; volatiles in silicate melts, magmatic crystallization, differentiation, magma mixing, mingling and partial melting

Unit-II

Rock associations and classification schemes of igneous rocks; IUGS and Chemical classification. Phase equilibria: Unary, Binary and Ternary systems

Unit-III

Application of Geochemistry in evolution of magma. Genesis, source and tectonic setting of different Magma Types: Basaltic, granitic and alkaline magmas.

Ghosh, S. K., 1995: Structural Geology Fundamentals of modern Developments. P. Press.
 Hobbs, B. E., Means, W. D. & Williams, P. F., 1976: An Outline of Structural Geology. JW.
 Kearey, P. and Vine, 2000: Global Tectonics. Black Well.
 Meyerhoff et al., 1996: SurgeTectonics, Kluwer Pub.
 Price, N. J. & Cosgrove, J. W., 1990: Analysis of Geological Structure. CU. press.
 Ramsay, J. G., 1967: Folding and Fracturing of Rocks. Mc Graw Hill.
 Ramsay, J. G. and Huber, M. I.,: Modern Structural Geology, Vol. I, II, III. Academic Press. Ragan, D. M. 2010
 Cambridge Univ. Press

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Chemical composition, crystal structure, P-T stability and mode of occurrence of following groups of nonsilicate minerals: Native elements, Sulfides, Sulfides, Sulfosalts, Oxides, Hydroxides, Carbonates.

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GLP17102CR: Practical Mineralogy

Mineralogy: Megascopic and microscopic identification of important rock forming minerals. Exercises in mineral optics. Preparation of thin section and polished sections. Etching and staining.

Books recommended:

Berry & Mason, 1988: *Mineralogy*. CBS Pub.
 Hutchinson, C. S., 1974: *Laboratory Handbook of Petrographic Techniques*. John Wiley.
 Kerr, P. F., 1977: *Optical Mineralogy*. McGraw Hill.
 Kerr, P. F., 1977: *Optical Mineralogy*. McGraw Hill.
 Nesse, 1987: *Optical Mineralogy*.
 Phillips, Wm, R. and Griffen, D.T., 1986: *Optical Mineralogy*. CBS Edition.
 Putnis, A., 2001: *Introduction to mineral Science*. Cambridge University Press. Putnis, A., 1992: *Introduction to mineral Science*. Cambridge University Press.
 Richard, V. G., 1997: *Dana's new Mineralogy*. John Wiley.
 Spear, F. S. 1993: *Mineralogical Phase Equilibria and Pressure-Temperature Paths*. Mineralogical Society of America Read, H. H., 1986: *Rutleys Elements of Mineralogy*.
 Winchell, A. N., 1968: *Elements of optical mineralogy*. Wiley Eastern Pvt Ltd.
 Winchell, A. W., 1937: *Elements of Optical Mineralogy* (Principles & Methods). John Wiley Pvt Ltd.

GL17103CR: Igneous Petrology

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Introduction to igneous petrology: Magma: nature, cooling behavior, properties and chemistry; volatiles in silicate melts, magmatic crystallization, differentiation, magma mixing, mingling and partial melting

Unit-II

Rock associations and classification schemes of igneous rocks; IUGS and Chemical classification. Phase equilibria: Unary, Binary and Ternary systems

Unit-III

Application of Geochemistry in evolution of magma. Genesis, source and tectonic setting of different Magma Types: Basaltic, granitic and alkaline magmas.

GLP17103CR: Practical Igneous Petrology

Igneous Petrology: Megascopic and microscopic study of igneous lithotypes. Modal analysis. Chemographic diagrams (ACF & AFM ternary diagrams)

Books recommended:

Albert, J., 1967: Descriptive petrology of the Igneous Rocks. Mc-Graw Hill, New York.
Alexander, Mc. B., 1987: Igneous Petrology. Prentice Hall.
Barth, T. F. W., 1956: Theoretical Petrology. Mc-Graw Hill, New York.
Best, M. G., 1986: Igneous Petrology, CBS Pub.
Bose, M. K., 1997: Igneous Petrology. World Press.
Hall, A., 1988: Igneous petrology. ELBS Longman.
Harker, A., 1944: Natural History of Igneous Rocks. McMillan Press.
Hatch & Wells, Text Book of Petrology. CBS Pub.
McBirney, A. R., 1993: Igneous Petrology. John Wiley.
Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall.
Turner & Verhoogen, 1999: Igneous and Metamorphic Petrology. CBS Pub.
Shelley, D., 1995: Descriptive Petrology of the Igneous Rocks. Chapman & Hall.
Winter, J.D. 2010. Igneous and Metamorphic Petrology.
Blatt H. & Tracy R.J. 1995. Petrology: Igneous, Sedimentary & Metamorphic. WHF & Co, New York.

GL17104DCE: Field Training

Geological Field Training shall be conducted on every alternate week in the valley.

GL17105DCE: Crystallography

Unit-I

Nature of crystals: distinction between crystalline and amorphous material. Parallel growth, crystal form, crystal habit. Twinning-types, causes and laws. External & Internal symmetry in crystals; Symmetry elements; Improper axis; Combination of symmetry elements.

Unit-II

Crystal Systems: Normal classes of crystals, spherical and stereographic projections. Crystal structure of minerals: dimorphism, polymorphism, pseudomorphism, isomorphism, solid solution and exsolution.

Books recommended

Berry & Mason, 1988: Mineralogy. CBS Pub.
Kerr, P. F., 1977: Optical Mineralogy. McGraw Hill.
Nesse, 1987: Optical Mineralogy.
Phillips, Wm, R. and Griffen, D.T., 1986: Optical Mineralogy. CBS Edition.
Putnis, A., 2001: Introduction to mineral Science. Cambridge University Press. Putnis, A., 1992: Introduction to mineral Science. Cambridge University Press.
Richard, V. G., 1997: Dana's new Mineralogy. John Wiley.
Spear, F. S. 1993: Mineralogical Phase Equilibria and Pressure-Temperature Paths. Mineralogical Society of America Pub.
Read, H. H., 1986: Rutleys Elements of Mineralogy.
Winchell, A. N., 1968: Elements of optical mineralogy. Wiley Eastern Pvt Ltd.

GL17106DCE: Economic Geology

Unit-I

Ore Geology: Space-time distribution of mineral deposits and global metallogeny with special reference to India. Processes of formation of different mineral deposits. Weathering and Placer deposits. Different types of ore reserves, Mineral economics and its significance. National Mineral Policy

Fluid inclusions: types, assumptions, techniques and limitations.

Unit-II

Ehlers and Blatt, 1999: Petrology, (Igneous, Sedimentary and Metamorphic). CBS Pub.
 Einsele, G., 1992: Sedimentary Basins. Springer Verlag.
 Friedman, G. M. and Sander, J. E., 1978: Principles of Sedimentology. John Wiley.
 Miall, A. D., 1999: Principles of Sedimentary Basin Analysis. Springer-Verlag.
 Pettijohn, F. J., Potter, P.E. and Siever, R., 1990: Sand and Sandstone. Springer Verlag.
 Reading, J. G. 1996: Sedimentary Environment and Facies. Black well.
 Reineck, H. E. and Singh, I.B., 1975: Deposition Sedimentary Environment. Springer-Verlag.
 Selley, R. C., 1976: Introduction of Sedimentology. Academic Press, London. Sengupta, S., 1997: Introduction to Sedimentology. Oxford-IBH.

GL17202CR: Geochemistry

Unit-I

Introduction to geochemistry: Origin and abundance of elements in the solar system and in the Earth. Geochemical cycle of elements. Geochemical classification of elements: major elements, trace elements and PGEs. Goldschmidt's classification of trace elements. Goldschmidt's rules for ionic substitution.

Unit-II

Major, Trace & Rare Earth Element (REE) Geochemistry: Concepts of partitioning and distribution coefficients of trace elements between solid and liquid phases vis-à-vis partial melting and magma generation. Distribution of REE in earth's mantle and crust. Introduction to analytical methods

Unit-III

Radiogenic and cosmogenic isotope geochemistry, Stable isotope geochemistry (oxygen, hydrogen, carbon & sulphur): nature, abundance, fractionation and applications.

GLP17202CR: Practical Geochemistry

Geochemistry: Calculation CIPW norms, preparation of variation diagrams. Calculation of weathering indices in soil and sediments. Presentation of analytical data.

Books recommended:

Attendron, H. G., 1997: Radioactive and Stable Isotopes Geology. Pergamon Press.
 Cox, P. A., 1995: Elements of Earth. Oxford Univ. Press.
 Faure, G., 1986: Principles of Isotope Geology. John Wiley.
 Garrels & Christ, 1966: Solution Minerals and Equilibria. Pergamon Press.
 Gunter, F., Principles and Applications of inorganic Geochemistry.
 Henderson, P., 1987: Inorganic Geochemistry. Pergamon Press.
 Hoefs, J., 1980: Stable Isotope Geochemistry. Springer Verlag.
 Krauskopf, K. B., 1967: Introduction to Geochemistry. McGraw Hill.
 Marshal, C. P. and Fairbridge, R. W., 1999: Encyclopedia of Geochemistry. Kluwer Academic.
 Mason, B. and Moore, C. B., 1991: Introduction to Geochemistry. Wiley Eastern.
 Nordstrom, D. K. and Munoz, J. L., 1986: Geochemical Thermodynamics. Blackwell. Raid, C. E., Chemical Thermodynamics. Chapman & Hall.

GL17203CR: Palaeontology & Stratigraphy

Unit-I

General aspects of paleobiology: Modern concepts of origin of life. Precambrian fossil record and Origin of Metazoa. Taphonomy and Fossil communities.

Unit-II

Micropaleontology: Introduction to various groups of microfossils, their importance in geology and hydrocarbon exploration. Important plant fossils from Indian stratigraphic horizons.

Vertebrate paleontology: Vertebrate fossils of Siwalik Group and their stratigraphic significance

Unit-III

Stratigraphy: Introduction to sequence stratigraphy. Outline idea about Seismic Stratigraphy, Magnetostratigraphy. Boundary problems: Boundary problems in stratigraphy with reference to Precambrian - Cambrian, Permian -Triassic, KT boundary, Pliocene - Pleistocene boundaries.

GLP17203CR: Practical Palaeontology & Stratigraphy

Palaeontology & Stratigraphy: Identification, classification and morphological study of selected invertebrate fossils with labelled diagrams. Taxonomic study of selected Gondwana plant fossils. Study of selected important rocks & fossils from Indian stratigraphic horizons and preparation of stratigraphic column.

Books recommended

Arnold, C. A., 1947: An introduction to Paleobotany. McGraw - Hill Book Co.

Bignot, G., 1985: *Elements of Micropaleontology*. Graham and Trotman.

Brasier, M. D., 1980: *Microfossils*. George Allen & Unwin.

Clerkson, E. N. K., 1998: *Invertebrate Paleontology and evolution*. Black Well. Colbert, E. H, 1955: *Evolution of Vertebrate*. John Wiley & sons, London.

Dunbar, C. O, Rodger, J., 1957: *Principles of stratigraphy*. Wiley International.

Glassner, M. F., 1945: *Principles of Micropaleontology*. Hafner Pub.

Krishanan, M. S., 1968: *Geology of India and Burma*. Higginbothams Pvt. Ltd., Madras.

Kumar, R, 1998: *Fundamentals of Historical Geology and Stratigraphy*. Wiley Eastern Limited.

Shork & Twenholf, 1987: *Principles of invertebrate Paleontology*. CBS Pub., N. Delhi.

Wadia, D. N., 1957: *Geology of India*. Mcmillan, London.

Weller, J. M., 1960: *Stratigraphy Principles & Practice*. Harper & Row Pub.

Wood, H., 1968: Paleontology invertebrate. CBS Pub., N. Delhi.

GL17204DCE: Field Training

Geological Field Training of 4 to 6 weeks shall be conducted at different parts of India.

GL17205DCE: Engineering Geology

Unit-I

Principles of engineering geology: Engineering properties and classification of rocks. Factors affecting engineering properties of rocks. Rock stability tests. Engineering properties of soils. Soil liquefaction and creep. Stress distribution in soils and foundation failures.

Unit-II

Geological considerations for construction of dams, reservoirs, and tunnels Tunnel alignment and transportation routes. Methods of tunneling and various types of tunnel support.

Geological consideration for construction of roads, buildings and bridges

Unit-III

Mass movements with special emphasis on landslides and slope stability. Earthquakes and seismic zones of India. Case history of engineering projects and geological causes for failures of engineering structures and remedial measures

Books recommended:

Arms, K., 1990: Environmental Science. Saunders College Pub.

Bell, F. G., Engineering Properties of Soils and Rocks.

Bell, F. G., 1999: Geological Hazards their assessment, Avoidance & Mitigation. E&FN S. London.

Bell, F. G., 1999: Geological Hazards. Routledge, London.

Bryant, E., 1985: Natural Hazards. Cambridge University Press.