

**Deccan Education Society's
Fergusson College (Autonomous), Pune
Department of Geology
M.Sc. Part II
Syllabus**

SEMESTER –III		
Units	TOPICS	No. of Lectures
GLY5301: Indian Stratigraphy (4 Credits) Core		
Unit 1	Precambrian Stratigraphy of Peninsular India - I	15
	Precambrian Stratigraphic framework of India. Dharwar Craton. Bastar Craton. Singbhum Craton. Aravalli Craton, Bundelkhand and Chota Nagpur Craton South Granulitic Terrain Proterozoic Mobile Belts : Pandyan Mobile Belt, Eastern Ghat Mobile Belt, CITZ Precambrian Igneous rocks	
Unit 2	Precambrian Stratigraphy of Peninsular India - II	15
	Stratigraphy, tectonics , Depositional Environment and Correlation of the following Proterozoic Basins/ Purana formations in India: Vindhyan Basin Cuddapah Basin Pranhita-Godavari Basin Bhima Basin Kaladgi Basin Chhattisgarh Basin	

Unit 3	Stratigraphic framework of the Himalayas	15
	<p>Precambrians of the Extra Peninsular Region</p> <p>Paleozoic sequences of Himalaya from Spiti region.</p> <p>Mesozoic of Spiti.</p> <p>Geology of the Indus –Suture Zone,</p> <p>Geology of the Shyok –Suture Zone,</p> <p>Stratigraphy of North-Eastern region of India</p> <p>The Trans-Himalayan and Karakoram Granite Batholith.</p> <p>Stratigraphy and tectonics of the Siwaliks.</p>	
Unit 4	Phanerozoic Stratigraphy of The Peninsular Region	15
	<p>Stratigraphic Boundaries in India –Archean- Proterozoic, Precambrian-Cambrian, Permo- Triassic, K-T</p> <p>Gondwana Sequence</p> <p>Jurassic of Kachchh and Jurassic of Rajasthan</p> <p>Cretaceous of Narmada valley/ Bagh Beds,</p> <p>Cretaceous of Tamil Nadu and Meghalaya</p> <p>Deccan Volcanic Province.</p> <p>Cenozoic of off shore –Krishna-Godavari Basin and Assam, Andaman-Nicobar Arc</p> <p>Quaternaries of Peninsular India.</p>	
	<p>Reference Books-</p> <p>Geology of the Central and Western India, Geological Society of India</p> <p>Geology of Karnataka, Geological Society of India</p> <p>Mathur U.B., Quaternary Geology: Indian Perspective, 2005</p> <p>Ramakrishnan M and Vaidyanadhan R, Geology of India (Vol. 1 & 2), 2010, Geological Society of India</p> <p>Saha A.K.: Crustal Evolution of Singhbhum-North Orissa, Eastern India, 1994, Geological Society of India</p>	

GLY5302: Exploration Methods (4 Credits)		
Unit 1	Geophysical Methods - I	15
	<p>Gravity method- Introduction, Principles, Types of Gravimeters, Concept of Bouguer Anomaly- Generalised interpretation of Gravity data- Salient Case Studies.</p> <p>Magnetic Method- Introduction, Principles, Types of magnetometers- Magnetic anomalies and their interpretation- Salient Case Studies.</p> <p>Air borne surveys in Gravity and Magnetic Methods</p> <p>Seismic Method- Introduction and Principles</p>	
Unit 2	Geophysical Methods - II	15
	<p>Seismic Reflection Method</p> <p>Seismic Refraction Method</p> <p>Seismic instruments and Field procedures</p> <p>Processing of Seismic data and Salient Case Studies.</p>	
Unit 3	Geophysical Methods - III	15
	<p>Electrical Method- Introduction, Principles and Anomalies</p> <p>Resistivity Method- Introduction, Principles and Interpretation of resistivity data and Salient Case Studies.</p> <p>Self-potential Method- Origin of self-potential instrumentation and field procedure and Salient Case Studies</p> <p>Induced polarization method- Electrolytic and Electrode polarization- Instruments and field procedure and Salient Case Studies.</p> <p>Electromagnetic method- Principles, Instruments and Salient Case Studies.</p> <p>Magnetotelluric Methods- Principle, Instruments, Field Procedure and Salient Case Studies.</p> <p>Ground Penetrating Radar- Principles and Applications.</p>	
Unit 4	Geochemical Methods	15
	<p>Geochemical methods- Introduction, Geochemical Anomaly,</p> <p>Geochemical cycle and Dispersion patterns.</p> <p>Geobotanical indicators of minerals.</p>	

	Surface and subsurface sampling methods Case studies	
	<p>Reference Books-</p> <p>Dobrin MB, Introduction to Geophysical Prospecting, 2014, Mcgrawhill Exclusive</p> <p>Hawkes HE, Principles of Geochemical Prospecting, 1957, US Government Printing Office</p> <p>Kearey and Brooks, An Introduction to Geophysical Exploration, 2016, Wiley India</p> <p>Paransis D.S., Principle of applied geophysics, 1997, Chapman & Hall</p> <p>Ramakrishna T.S., Geophysical Practice in Mineral Exploration & Mapping, 2006, Geological Society of India</p>	
GLY5303: Petroleum Geology (4 Credits)		
Unit 1	Origin And Occurrence of Petroleum	15
	<p>Origin of Petroleum (Kerogen and Biomass) ,</p> <p>Organic and inorganic occurrence.</p> <p>Nature of source rock.</p> <p>Chemical Classification and composition of Petroleum and oilfield water</p> <p>Physical properties of petroleum.</p>	
Unit 2	Migration and Accumulation of Petroleum	15
	<p>Reservoir rock, types and classification</p> <p>Types of traps and seals</p> <p>Migration and accumulation of petroleum.</p> <p>Concept of Isopach and Isolith maps</p> <p>Concept of In place volume, Compressibility, Formation volume factor, Reserve formula.</p>	
Unit 3	Petroliferous Basins of India	15
	<p>Petroliferous basins of India</p> <p>Life cycle of an oil field</p> <p>Geophysical Prospecting Methods in Brief</p> <p>Unconventional reservoirs- Indian examples</p> <p>Low resistivity oil</p>	

Unit 4	Global Scenario of Petroleum Industry	15
	<p>Important Petroliferous provinces of the world -Arabian Peninsula, North Sea, West Africa Concept of Demand-Supply in Indian context OPEC and non OPEC countries. Energy Scenario and unconventional resources India's position as regards to petroleum and natural gas and its future prospects.</p>	
	<p>Reference Books-</p> <p>Bjorlykke, Knut, Petroleum Geoscience, 2015, Springer-Verlag Berlin Heidelberg</p> <p>Levenson, Geology of Petroleum, 2006, CBS Publishers & Distributors</p> <p>Petroliferous Basins of India</p> <p>Global Scenario of Petroleum Industry</p>	
GLY5304: Marine Geology and Oceanography		
Unit 1	Morphology of Oceans	15
	<p>Tectonic history of Oceans</p> <p>Ocean Morphology</p> <p>Marine Environments (with special reference to sedimentation processes)</p> <p>Marine Stratigraphy</p>	
Unit 2	Ocean Circulation & Palaeoclimate	15
	<p>Ocean Circulation</p> <p>Sea Level History and Seismic Stratigraphy</p> <p>Palaeoceanography & Quaternary Climate Change</p>	
Unit 3	Oceanic Sediments	15
	<p>Terrigenous deep sea sediments</p> <p>Biogenic and authigenic oceanic sediments</p>	
Unit 4	Trends in Geological Oceanography and Scope	15

	Techniques in marine sampling and mapping DSDP-ODP Programmes Coastal Hazards & Marine pollution Exclusive Economic Zones and status of mineral resources	
	Reference Book- Kennett JP, Marine Geology, 1982, Pearson	
GLY5308 Applications of GIS in Geology (2 Credit)		
Unit 1	Introduction to GIS Technology & Applications	15
	GIS Technology & Applications Conceptual model of Spatial information Conceptual model of Non-spatial information Relational Model, Object orientated Database Digitization, Editing, Structuring of map data Map Projections - Classification, Projection Type	
Unit 2	GIS Analysis	15
	Vector based spatial analysis Raster based spatial analysis Digital Elevation Model and Application Applications – Case studies <ul style="list-style-type: none"> • Exploration of Water, Minerals and Oil • Monitoring and management of Mines • Disaster management 	
	Reference Books- Anji Reddy M., Textbook of Remote Sensing and Geographical Information System, 2001, BSP BS Publication Burroughs P.A., Principles of Geographical Information Systems for Land Resources Assessment, 1986, Oxford University Press Shahab Fazal, GIS Basic, 2008, New Age International	
GLY5309 Natural Resource Management (2 Credits)		

Unit 1	Natural Resource Management	15
	<p>Natural resources- soil, water, minerals</p> <p>Classification of the Natural Resources</p> <p>Renewable resources-with Indian scenario (solar, wind, tidal, biofuels)</p> <p>Energy Resources-oil, natural gas, atomic minerals</p> <p>Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.</p> <p>Wetlands-classification. Conservation & Management</p> <p>Coastal resources & Coastal Zone Management</p> <p>Function and values of the resource ; Supply and demand</p> <p>Environmental Impact Analysis</p> <p>Polices and legislation concerning natural resources</p> <p>Conservation & Management of natural resources: soil, water, minerals</p> <p>Bio resources</p> <p>Energy Management</p> <p>Sustainability ; UNEP programme towards sustainable development</p> <p>Geospatial technology for NRM</p> <p>Energy Audit and Management</p>	
Unit 2	Environmental Science	15
	<p>Fundamental concepts of environmental geosciences, its scope and necessity.</p> <p>Ecology and Ecosystems</p> <p>Biogeochemical cycles</p> <p>Geological hazards</p> <p>Coastal hazards</p> <p>Water pollution and other Issues; Case histories</p> <p>Groundwater pollution source</p> <p>Soil pollution</p> <p>Sand Mining, Solid Waste Management , Eutrophication, Wastewater treatment</p> <p>Global climate change, United Nations Framework Classification</p>	

	Anthropogenic environmental impacts Ecotourism and other environmental services	
	<p>Reference Books-</p> <p>Bell F.G.: Geological Hazards: Their Assessment, Avoidance and Mitigation, 2002, E & FN Spon</p> <p>Keller EA, Environmental Geology, 2011, Pearson</p> <p>Smith K., Environmental Hazards: Assessing Risk and Reducing Disaster, 2013, Routledge</p> <p>Valdiya K.S., Environmental Geology: Ecology, Resource and Hazard Management, 2013, McGraw-Hill Education (India) Private Limited</p>	

GLY5310 Oil field Practices (2 Credits)		
Unit 1	Drilling Operations In Oil Field	15
	Types oil wells and geotechnical order Methods of Oil well drilling Types of Drilling Rigs\ Rotary drilling Drilling Mud Concept of Subsurface pressure. Directional Drilling Coring: Introduction and Techniques	
Unit 2	Formation Evaluation	15
	Well logging- Techniques, Principles and Instrumentation Interpretation of logs Mud logging: Principle, Techniques, Tools and Interpretation MWD (Measurement While Drilling)/LWD (Logging While Drilling): Principle, Tools of MWD/LWD, Data Analysis and Interpretation. Formation (Drillstem) Testing: Introduction, Tools and Techniques of DST, Retrievable Formation Tester (RFT)	
	<p>Reference Books-</p> <p>Hearst and Nelson and Paillet, Well Logging for Physical Properties 2000, John Wiley & Sons</p> <p>Kennedy JL, Fundamentals of drilling--technology and economics 1983, PennWell</p> <p>Rider M. H., The Geological Interpretation of Well Logs, 1996, Whittles Publishing</p>	

GLY5311 Geostatistics and Computer Application in Geology (2 Credits)		
Unit 1	Introduction to Probability: random experiments, events, sample space, definition of probability. Baye's theorem; Random variables, discrete and continuous probability distributions; Binomial, Poisson, Normal, Gamma, Exponential, Hypergeometric, Multinomial, Chi-square, t and F distributions; Introduction to statistical inference: sampling distributions, point and interval estimation; Linear models: ANOVA; Linear and multiple regression Eigen Value	15
Unit 2	Introduction to multivariate techniques; PCA, factor analysis, linear discriminant analysis, classification; Application of geostatistical techniques to earth sciences. Use of computers and software as tools in the areas of geological problem-solving, report-writing, and presentations; Brief idea about computer software used in earth sciences.	15
	Reference Books- Davis, J.G., Statistics and data analysis in geology, 1986, John Wiley. Johnson, R.A. and Wichern, D.W., Applied multivariate statistical analysis, 1982, Prentice Hall Inc., New Jersey. Walpole, R.E. and Myers, R.H., Probability and statistics for engineers and scientists, 1989, Macmillan Publ. Co.	
GLY5305 Practicals related to GLY 5301 (4 theory credits) and those chosen subjects totaling to 4 theory credits. (4 Credits Core)		
GLY5306 Practicals related to remaining theory subject totaling to 8 theory credits (4 Credits Core)		
	A) Practicals for GLY5301: (2 Credit) Study of typical hand specimens of rocks from different lithological units of Indian Stratigraphy. Study of Palaeogeographical maps of India for different geological periods. Study of geological maps of different units of Indian Stratigraphy. Interpretation of regional geological maps.	
	B) Practicals for GLY5302: (2 Credit) Study of patterns of geophysical responses from various geological mediums. Plotting a Drift curve for an observed gravity data to which an elevation correction is applied, Plotting and interpretation of gravity profiles, Simulations of causative bodies. Study of maps related to Gravity and Magnetic anomalies	

	<p>Analysis of seismic refraction data for velocities and thickness of sub-surface layers.</p> <p>Interpretation of Seismic Data</p> <p>Plotting, collection and interpretation of resistivity data.</p> <p>Analysis of self-potential data.</p> <p>Simple interpretation of geophysical well logs.</p>	
	<p>C) Practicals for GLY5303: (2 Credit)</p> <p>Ratio maps: sand-shale, Limestone facies maps</p> <p>Preparation of Structural contour maps.</p> <p>Preparation of Isopach maps, Isolith, Isopay, Isoporosity maps</p> <p>Interpretation of different geological cross-sections from well data.</p> <p>Study of Porosity and Permeability.</p> <p>Darcy's law numerical examples, Archie's equation</p>	
	<p>D) Practicals for GLY5304: (2 Credit)</p> <p>Reading coastal toposheets and hydrographic sheets</p> <p>Preparing bathymetric cross-sections using Hydrographic sheets</p> <p>Distribution of major bathymetric and tectonic features in the global oceans</p> <p>Identification of oozes and authigenic sediments</p> <p>Distribution of carbonate and siliceous oozes, glacio-marine, pelagic clay and volcanogenic sediments in global oceans</p> <p>Grain-size analysis using pipette analysis</p> <p>Assigning different kinds of marine sediments to different bathymetric settings</p> <p>Distribution of Global Pressure belts</p> <p>Distribution of global surface currents and the thermohaline circulation- 'Conveyor Belt'</p>	
	<p>E) Practicals for GLY5308: (1 Credit)</p> <p>Geo-referencing of Toposheet and Satellite Data</p> <p>Image subsetting</p> <p>Resolution merge</p> <p>DEM generation</p> <p>Unsupervised and Supervised Classification.</p> <p>Preparation of vector database and maps</p> <p>Corrections of errors in GIS database</p> <p>Geo processing of Vector data- clip, merge, union, intersect</p>	
	<p>F) Practicals for GLY5309: (1Credit)</p> <p>Introduction to the methods of Environmental Impact assessment</p> <p>Assessment of Soil – Water – Energy Mineral Resources</p> <p>Delineation of natural resources by using remote sensing techniques</p> <p>Study of physical properties of Coal</p>	

	Study of physical properties of Atomic/Radioactive Minerals	
	<p>G) Practicals for GLY5310: (1Credit)</p> <p>Description and identification of well cuttings based on physical properties, calcimetry and fluorescence.</p> <p>Master log preparation.</p> <p>Description of core samples.</p> <p>Basic log interpretation.</p> <p>Correlation of electrical logs.</p> <p>Calculations of Shale factor and shale density.</p> <p>Introduction, Aspects of Balance Cross Section and examples, Types of Cross Section, Applicability.</p>	
	<p>H) Practicals for GLY5311: (1Credit)</p> <p>Statistical data analysis in Geosciences.</p> <p>Computation of various statistical parameters for a given data; student test, chi-square test; least square method; Statistical models</p>	
	GLY5307:- Practicals related Field studies (1credit)	

Semester IV		
	GLY5401 Economic Geology (4 Credits) (Core)	
Unit 1	Ore Forming Process (I)	15
	<p>Scope and Application of economic geology.</p> <p>Concept of metalliferous and non metalliferous deposits, ore, gangue, tenor, grade, resources, reserves etc.</p> <p>Mineralisation related to Plate tectonics, Structural controls on ore localization.</p> <p>Primary and Secondary ore forming process-Metallic & non-metallic Deposits</p> <p>Genetic classification of ore deposits- Stratiform, Stratabound, Porphyry, Volcanogenic Massive Sulphide deposits, Sedex deposits.</p>	
Unit 2	Indian Ore Deposits (I)	15
	<p>Mode of occurrence, geological and geographic distribution; Classification of the following mineral deposits.</p> <ul style="list-style-type: none"> - Chromium, Iron, Manganese, Copper, Molybdenum, Lead and Zinc 	
Unit 3	Indian Ore Deposits (II)	15
	<p>Mode of occurrence, geological and geographic distribution; Classification of the following mineral deposits.</p> <ul style="list-style-type: none"> - Gold, Aluminum (Bauxite), Barite, Uranium, Thorium, Coal, Carbonatites and rare earth elements. <p>Introduction to Mineral Economics</p>	
Unit 4	Industrial Mineralogy	15
	<p>Industrial Mineralogy- Introduction to industrial specifications of raw materials used in the important industries.</p> <p>Outline of techniques used in testing raw materials</p>	

	<p>Reference Books-</p> <p>Bateman AM, Economic Mineral Deposits, 1981, John Wiley & Sons Inc</p> <p>Dolbear Samuel H, Industrial Minerals and Rocks (Nonmetallics other than Fuels), 1949, The American Institute Of Mining And Metallurgical Engineers New York</p> <p>Jain S.K, Mineral Processing, 2008, CBS Publishers & Distributors</p> <p>Rajendran, Aravindan, Srinivasamoorthy, Mineral Exploration- Recent Strategies, 2007, New India Pub</p> <p>Umeshwar Prasad, Economic Geology - Economic mineral deposits 2e, 2016, CBS Publishsers and Distributors</p>	
<p>GLY5402 Hydrogeology, Watershed Development and Management (4 Credits)</p>		
Unit 1	Hydrogeology	15
	<p>Rock hydrologic properties</p> <p>Factors controlling accumulation and movement in different rocks</p> <p>Lithological and structural and controls on groundwater occurrence</p> <p>The concept of aquifer and types of aquifers; Concept of watersheds, Groundwater accumulation and movement</p> <p>Groundwater and Watersheds</p> <p>Aquifer properties; Concept of aquifer mapping</p> <p>Concept of Hydrosphere and the hydrologic cycle, Scope and Importance (Uses) of Groundwater, Age of Groundwater</p> <p>Climate, topography and geology: their influence on groundwater</p>	
Unit 2	Wells, Well Hydraulics, Groundwater Quality and Distribution in India	15
	<p>Well Inventory</p> <p>Well hydraulics: Principles, Procedures and Concept</p> <p>Pumping tests: i) Well tests, ii) Aquifer Performance tests iii) Slug tests</p>	

	<p>Quality of Groundwater</p> <p>Springs and base flows</p> <p>Groundwater Exploration Techniques</p>	
Unit 3	Groundwater Development and watershed development	15
	<p>Wells (types) design and construction, well characteristics</p> <p>Groundwater Monitoring</p> <p>Concept of integrated aquifers and watershed development in relation to groundwater resources</p> <p>Rainwater and rooftop harvesting codes</p> <p>Sea water ingress and mitigation measures</p>	
Unit 4	Groundwater Management and Governance	15
	<p>Groundwater Management</p> <p>Groundwater Balance equation for watershed (Groundwater assessment in a region)</p> <p>Groundwater Budget (Village water audit)</p> <p>Conjunctive use of surface and groundwater resources</p> <p>Participatory Ground Water Management (PGWM) and Community Based Ground Water Management (CBGWM)</p> <p>Concept of Water User Groups: Case studies</p> <p>Protocols of Ground Water Management</p> <p>Groundwater Governance</p> <p>Policy, Legislation and Institutions</p> <p>Role of NGOs, Panchayati Raj</p> <p>Science, policy and regulatory frameworks: integrating disciplines</p> <p>Typology concept in groundwater management, Groundwater Modeling</p> <p>Groundwater provinces in India, Groundwater in Maharashtra State</p>	
	<p>Reference Books-</p> <p>Davis S.N. and Dewiest R.J.M.: Hydrogeology 1968, John Wiley & Sons</p> <p>Fetter CW, Applied Hydrogeology, 4th Edition,2001, Pearson</p> <p>Karanth, K.R.: Groundwater Assessment Development and Management 1e, 1987, Tata McGraw-Hill Education Publishers</p> <p>Raghunath, H.M.: Groundwater, Wiley Eastern Ltd</p> <p>Todd, D.K.: Groundwater Hydrology 3e, 2015, Wiley India Exclusive</p>	

GLY5403 Engineering Geology and Geotechniques (4 Credits)		
Unit 1	Rock Mass Characterisation	15
	Scope of Engineering Geology. Engineering properties of rocks. Methods of determining engineering properties of rocks. Behavior of rocks under stress. Rock failure mechanisms. Engineering properties of soils. Methods of soil investigations.	
Unit 2	Geotechnical Studies	15
	Drilling in geotechnical field and Drilling Equipments Rock Quality Designation (RQD) and Core Recovery (CR) Core logging and bore logging RMR(Rock Mass Rating) (Bienawiski, 1989) Types of foundations and Safe Bearing Capacity Laboratory and Field Geotechnical Tests	
Unit 3	Engineering Structures	15
	Geological considerations for the selection of various sites. Dam sites and types of Dams and Spillways. Forces acting on Dam wall. Reservoir competency. Siltling of reservoirs. Tunnels: Tunnel sites and Tunnel alignment. Bridges, Y ducts Roads and similar structures	
Unit 4	Geo-Techniques	15
	Slope Stability Analysis Applications Remote Sensing in Engineering Geology Types of Synthetic materials used as remedial measures. Estimation of Over-burden thickness and Rock strata classification. Preparation of Report and Presentation of Engineering data. Building Stones and Road Material Aggregates: Classification, Aggregate resources development,	
	Reference Books- Blyth, F G H. A geology for engineers.-7th ed Krynine and Judd: Principles of Engineering Geology and Geotechniques. Parbin Singh, Engineering Geology, S.k. Kataria & Sons Rise and Wateson: Elements of Engineering Geology.	
GLY5408 Mining Geology (2 credits)		

Unit 1	Guides To Ore And Drilling Methods	15
	<p>Concept of reserve and resource- Resources classification, EMG classification</p> <p>Deterministic methods and Probabilistic Methods</p> <p>Concept of ore blending- Numerical concept of volume and weightage, Estimation of bulk density, Assay classification</p> <p>Ringed Target and Intersecting loci</p> <p>Regional and Topographical Guides</p> <p>Mineralogical Guides</p> <p>Structural Guides</p> <p>Stratigraphic Guides</p> <p>Types of Dills - Percussion Drills, Rotary Drills, Miscellaneous Drills</p>	
Unit 2	Mining Methods – Open Cast And Underground Cast	15
	<p>Mining Methods- Selecting Mining Machinery,</p> <p>Alluvial Mining</p> <p>Introduction to the terminologies used in exploration and exploitation of the ore in the mine -Mining methods</p> <p>Concept of exploration and mining license (National Mineral Policy)</p> <p>Strategic minerals</p> <p>Concept of national Wealth-Basic Mining law, Market Analysis</p> <p>Preparation of Mining Plan and Mining Scheme and Mine Closer Plan</p>	
	<p>Reference Books-</p> <p>Gaudin A.M, Principles of Mineral Dressing,1939, McGraw Hill, NewYork</p> <p>Ghose AK, Prof.B.B.Dhar, Mining Challenges of 21st Century,2000,A.P.H.Publishing Coperation, Delhi</p> <p>Panigrahi D.C,Mine Environment and Ventilation,2001,CRC Press</p> <p>Singh OP, Mining Enviroment,Problems & Remedies,2005 Regency, New Delhi</p> <p>Singh RB, P. Pal Roy, Blasting in Ground Excavation and Mines, 1993, A Balkema Publishers</p>	
GLY5409 Gemmology (2 Credits)		
Unit 1	Introduction and Gem Species	15

	<p>Introduction to Gems- Basic properties of gems- Formation of gems.</p> <p>Description of following gem species with respect to their varieties (colour wise), Chemical composition, Crystal system, Physical and optical properties, Characteristic inclusions and Geographical Occurrences.</p> <p>Corundum, Beryl, Garnet, Felspar, Silica, Tourmaline, Topaz, Spinel and Chrysoberyl</p> <p>Opaque gem varieties.</p> <p>Rare Gemstones (Peridot, kyanite, iolite, sphene, zircon, apatite etc)</p>	
Unit 2	Diamonds, Gem Synthesis, Treatments and Gem Identification	15
	<p>Gem instruments and their use in gem stone identification,</p> <p>Causes of colours in gem stones.</p> <p>Treatments of gem stones and their detection.</p> <p>Imitation and composite stones.</p> <p>Gem synthesis and distinction between Synthetic and Natural gem stones.</p> <p>Advance Techniques of gem Identification</p> <p>Organic Gemstones</p> <p>Diamonds</p>	
	<p>Reference Books-</p> <p>Anderson B.W., Gem Testing, 1979, Better World Books</p> <p>Bruton Eric, Dimonds , 2nd edition, 1979 chilton book co.</p> <p>Karanth RV, Gem & gem Industry in India, 2000, Memoir 45, geological society of India, Bangalore</p> <p>Read, P.G. ,Gemmology, 1999, Butterworth, Landon</p>	
GLY5410 Sequence Stratigraphy (2 Credits)		
Unit 1	Introduction to sequence stratigraphy	15
	<p>Historical Development, Interdisciplinary nature of sequence stratigraphy</p> <p>Fundamental concepts of sequence stratigraphy: definitions and terminologies</p> <p>Methods of Sequence Stratigraphic</p>	
Unit 2	Basic concepts of Base level changes, accommodation and shoreline Shifts	15
	<p>Base level cycles, allogenic controls on sedimentation: significance and signatures, sediment supply and energy flux, sediment</p>	

	<p>accommodation, shoreline trajectories</p> <p>Stratigraphic surfaces: types of stratal terminations, sequence stratigraphic surfaces, system tracts</p> <p>Clastic and Carbonate Facies Models.</p>	
	<p>Reference Books-</p> <p>Emery, D, Sequence Stratigraphy, 1996, Blachwell Scientific Publ.</p> <p>Miall, A.D., The Geology of Stratigraphic Sequence, 1997, Springer-Verlag.</p> <p>W.G. Hatlelid, Seismic stratigraphy and global changes of sea level, 1977, American Association of petroleum Geologists, Vol.26.</p>	
GLY5411 Micropalaeontology (2 Credits)		
Unit 1	<p>Applied Micropaleontology: Definition and scope,</p> <p>Surface and subsurface sampling methods, Laboratory techniques and equipments for micropaleontological studies</p> <p>Geological Timescale.</p> <p>Calcareous Microfossils</p> <p>Foraminifera : morphology, biostratigraphic significance, application and paleobathymetric reconstructions.</p> <p>Calcareous algae: Classification, morphology and biostratigraphic significance; applications and paleobathymetric interpretation.</p> <p>Ostracoda: classification, morphology and biostratigraphic significance, applications and paleoclimatic studies.</p> <p>Introduction to Bryozoa: classification, morphology and biostratigraphic significance (In brief).</p> <p>Introduction to Calcareous Nannofossils, Outline morphology; biostratigraphic and paleoclimatic significance (In brief).</p> <p>Introduction to Pteropods and Calpionellida and their significance (In brief).</p>	15
Unit 2	<p>Siliceous Microfossils:</p> <p>Diatoms: morphology and classification, and Application</p> <p>Introduction to Silicoflagellates and Radiolaria, their morphology and significance (In brief)</p>	15

	<p>Organic walled Microfossils: Pollens and Spores: Morphology, Classification and Applications; Palynomorphs</p> <p>Introduction to Acritarch , Dianoflagellates and Phytoliths; morphology and significance (In brief)</p> <p>Phosphatic Microfossils: Conodonts: morphology; stratigraphic significance (In brief)</p> <p>Industrial and Environmental Applications</p>	
	<p>Reference Books-</p> <p>Haq and Boersma, Introduction to Marine Micropaleontology, 1978, Elsevier.</p> <p>Jones RW, Micropaleontology in Petroleum exploration, 1996, Clarendon Press Oxford</p> <p>Kathal, P.K., Applied Geological Micropaleontology, 2011, Scientific Publishers, Jodhpur.</p> <p>Kennett and Srinivasan, Neogene Planktonic Foraminifera: A phylogenetic Atlas, by, Hutchinson Ross, USA. 1983.</p> <p>Kundal, P. and Humane, S.K. (Eds.) Applied Micropaleontology, 2010, Gondwana Geological Society, V. 24 (1).</p> <p>Prothero, D.R., Bringing Fossil to Life – An Introduction to Paleontology (2nd Ed.), 2004, McGraw Hill.</p> <p>Seaward, A.C., Plant fossils, Today’s and Tomorrow, 1991, New Delhi.</p> <p>Wray, J.L., Calcareous Algae, 1977, Elsevier.</p>	
<p>GLY5405 Practicals related to GLY -5401 (4 theory credits) and those chosen subjects totaling to 4 theory credits (4 Credits Core)</p>		
<p>GLY5406 Practicals related to remaining theory subject totaling to 8 theory credits (4 Credits Core)</p>		
	<p>A) Practicals for GLY5401: (2Credit)</p> <p>Study of ores in hand specimens.</p> <p>Preparation of charts showing distribution of importance of ore deposits in India.</p> <p>Mineralogical and textural study of common ores under microscope.</p>	

	<p>Chemical analysis of ore minerals and assaying.</p> <p>Megascopeic characterization of banded coals.</p> <p>Proximate analysis of coal.</p> <p>Microscopic examination of polished coals (Identification of macerals in coal).</p> <p>Study of physical properties of industrial minerals and materials required for different industries.</p> <p>Preparation of charts showing specifications of materials required for different industries.</p>	
	<p>B) Practicals for GLY5402: (2Credit)</p> <p>Analysis of rainfall data.</p> <p>Preparation of water level contour maps and their interpretation.</p> <p>Analysis of pumping test data by simple graphical methods for determination of aquifer and well characteristics.</p> <p>Plotting and analysis of hydro-geochemical data.</p> <p>Hydro geological significance of morphometric parameters of a watershed.</p> <p>Use of computer in groundwater data analysis.</p> <p>Salient points for the construction of contour bunds, stream bunds, percolation tank subsurface dams etc.</p> <p>Use of morphometric analysis in planning watershed development.</p> <p>Calculation of water balance for a given watershed.</p>	
	<p>C) Practicals for GLY5403: (2Credit)</p> <p>Various methods of Surveying used in engineering geology.</p> <p>Plane table surveys, use of dumpy level and theodolite.</p> <p>Magnetic Compass Survey.</p> <p>Demonstration of engineering properties of geological materials.</p> <p>Interpretation of bore-hole data.</p> <p>Preparation of bore logs/ lithologs/RQD/RMR.</p>	
	<p>D) Practicals for GLY5408: (1Credit)</p>	

	<p>Mine valuation and calculation by uniform spacing on rectangular co-ordinate method.</p> <p>Included area problems related to valency.</p> <p>Area influenced methods of combining irregular spaced assay.</p> <p>Triangle grouping of irregular spaced assayed.</p> <p>Veins problems (linear groups, minimum stopping widths).</p>	
	<p>E) Practicals for GLY5409: (1Credit)</p> <p>Study of rough gemstones</p> <p>Visual observation of gem stones for color, lustre, cut, optical phenomenon</p> <p>Identification of Anisotropic and Isotropic gem stones by using dichroscope and polariscope</p> <p>Use of 10 X lens, U.V.lamp and refractometer.</p> <p>Use of gemological microscope to study inclusions in gemstones.</p> <p>Study of organic gemstones</p> <p>Study of rare gemstones</p> <p>Study of imitations, stimulants, synthetics and composite stones.</p> <p>Identification of natural gemstones from their simulants, imitations and synthetics.</p>	
	<p>F) Practicals for GLY5410 (1Credit)</p> <ol style="list-style-type: none"> 1. Description of basic concepts in seismic and sequence stratigraphy. 2. Preparation of facies maps and facies diagrams. 3. Study of vertical profile sections of some selected sedimentary environments. 4. Study of significant system tracts. 	
	<p>G) Practicals for GLY5411 (1Credit)</p> <ol style="list-style-type: none"> 1. Techniques of separation of microfossils from matrix and preparation of slides. 2. Microscopic study of Calcareous, Siliceous, Phosphatic and organic walled microfossils. 3. Study of surface ultra-structures of microfossils. 4. Depth biotopes and estimation of paleo-depth using microfossil assemblages 5. Study of some important microfossils useful in Indian Stratigraphy with special reference to Cenozoic petroliferous basins of India. 	
<p>GLY5407 Fieldwork component Core (1 Credit)</p>		

GLY5404 Dissertation (4 Credits)

Field studies, Laboratory studies/ data processing, reference work and presentation of the thesis are four major components of the course. Students opting for this course should adhere to the following procedure.

Precise title and outline of work is to be submitted to the Head of the Department.

The student shall spend about one week in the field.

The field work shall be carried out only during vacation or holidays, and in no case student will be permitted to remain absent from regular teaching on account of dissertation.

The student shall maintain field diaries and other records relevant to dissertation.

Every month the student shall submit the progress report and laboratory work done, through the supervisor to Head of the Department.

The student shall do dissertation at his own cost. The department will not spare funds for this purpose.

The student shall give a seminar before the submission of the dissertation.

The student shall submit the dissertation before the commencement of practical examination.

Non compliance of any of the above rules will disqualify students for grant of terms.

Three copies neatly typed on thesis size paper, well bound together with maps and illustrations of the Dissertation, on the basis of the work carried out by the student, will be submitted, through the supervisor concerned, to the Head of the Department of Geology, before the commencement of the practical examination, for being forwarded to the Board of Examiners.

In case of student receiving help (training and / or participation in ongoing research activities) from other Institution / Organization for their dissertation work, the associated scientist from that Institute/ Organization will function as co-supervisor.

Assessment of Dissertation will be out 100 marks and shall include a viva voce examination carrying 20 marks. The Dissertation will be examined at the time of the practical examination at the end of IV Semester, by the board of examiners. The Board of Examiners will consist of supervisor, co-supervisor, Head of the Department and one teaching faculty member appointed by Head of Department in consultation with the supervisor.