SOLAPUR UNIVERSITY, SOLAPUR

REVISED SYLLABUS - M.Sc. II Applied Geology

To be implemented from year 2011-2012

M.Sc. SEMESTER - III and IV

SCHOOL OF EARTH SCIENCES,

SOLAPUR UNIVERSITY, SOLAPUR.

SYLLABUS OT THE M. Sc . APPLIED GEOLOGY

STRUCTURE OF THE COURSE

SOLAPUR UNIVERSITY, SOLAPUR

REVISED SYLLABUS - M.Sc. I Applied Geology

To be implemented from year 2011-2012

M.Sc. SEMESTER - I and II

SCHOOL OF EARTH SCIENCES, DEPARTMENT OF ENVIRONMENTAL SCIENCE
SOLAPUR UNIVERSITY, SOLAPUR.
SYLLABUS OT THE M. Sc ENVIRONMENTAL SCIENCE
STRUCTURE OF THE COURSE

SEMESTER I

COURSE CODE	SUBJECT	Hours /week	EXTERNAL MARKS	INTERNAL MARKS
AGT 101	MINERALOGY AND OPTICS	4	70	30
AGT 102	IGNEOUS AND METAMORPHIC PETROLOGY	4	70	30
AGT 103	SEDIMENTOLOGY AND PALAEONTOLOGY	4	70	30
AGT 104	GEOMORPHOLOGY AND MORPHOTECTONICS	4	70	30
AGP 105	PRACTICAL RELATED TO AGT 101 & EST 102	6	70	30
AGP 106	PRACTICAL RELATED TO AGT 103 & EST 104	6	70	30

SEMESTER II

AGT 201	ECONOMIC GEOLOGY	4	70	30
AGT 202	INDIAN STRATIGRAPHY	4	70	30
AGT 203	HYDROGEOLOGY		70	30
AGT 204	GEOCHEMISTRY	4	70	30
AGP 205	PRACTICAL RELATED TO AGT 201 & AGT 202	6	70	30
AGP 206	PRACTICAL RELATED TO AGT 203 & AGT 204	6	70	30

SEMESTER III

AGT 301	STRUCTURAL GEOLOGY AND GEOTECTONICS	4	70	30
AGT 302	MINERAL EXPLORATION	4 4	70	30
AGT 303	ENGINEERING GEOLOGY AND MINING GEOLOGY	4	70	30
AGT 304	NATURAL RESOURCE AND WATERSHED MANAGEMENT	4	70	30
AGP 305	PRACTICAL RELATED TO AGT 301 & AGT 302	6	70	30
AGP 306	PRACTICAL RELATED TO AGT 303 & AGT 304	6	70	30

SEMESTER IV

AGT 401	ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT	4 4	70	30
AGT 402	ENERGY RESOURCES	4	70	30
AGT 403	REMOTE SENSING AND GIS	4	70	30
AGT 404	DISSERTATION	4	70	30
AGP 405	PRACTICAL RELATED TO AGT 401 & AGT 402	6	70	30
AGP 406	PRACTICAL RELATED TO AGT 403 & AGT 404	6	70	30

TOTAL DURATION OF THE COURSE: 2 YEARS
Each Semester will have 1 credits (25 Marks) for- Field training for long tour / In-plant Training,/ Industrial visits or Nature visits /Field work, data acquisition related to dissertations

Solapur University, Solapur

M.Sc.II APPLIED GEOLOGY

(w.e.f. June 2011)

SEMESTER III

AGT 301 STRUCTURAL GEOLOGY AND GEOTECTONICS (70 marks)

STRUCTURAL GEOLOGY (35 marks)

Introduction:- Concept, approach and scope of structural geology, primary and secondary structures.
Stress:- Stress at a point, stress on a plane, stress ellipse, principle planes of stress and axial cross section. Mohr circle, Types of stresses and Mohr circle, configurations for them. Stress trajectories.
Strain:- Definition, displacement vector, displacement field, displacement gradient. homogeneous and inhomogeneous deformations, strain indicators, strain ellipse and reciprocal strain ellipse, Lagrangian and Eulerian specifications. Homogeneous deformation of straight line, circle and ellipse, change in lengths and orientations of lines in different zones within strain ellipse and corresponding geological structures. Types of homogeneous strain ellipsoids and effect of volume change on deformation. Determination of finite strains form originally spherical and ellipsoidal markers. Behavior of rocks with respect to stress and strain.
Geometry and Mechanics of folding:- Parameters for defining single folded surface. Different classifications of folds. Buckling, states of strain within and outside buckled layers and field evidences of buckling. Shear folds and Mechanics of similar folding. States of strain in similar fold. Modification of bucked and shear folds. Concept of fold vengeance.
Foliation:- Definition, Morphology of different types of axial plane foliation, trasposed foliation and other metamorphic foliation. Orientation of foliation within strain ellipsoid.
Lineations:- Definition, Classification, relation with respect to strain ellipsoid, significance of Lineations in tectonics.
Structural Analysis:- Principles of structural analysis, phases of structural analysis, scale homogeneity and symmetry. Structural analysis of areas of one, two and three phases of deformation, interference structure of different scales and their origin.
Joints and Shear zones:- Joints, their classifications and significance, Normal thrusts and strike slip faults, their classifications and characters. Mechanics of faulting with reference to stress and types of shear zones. Strain variations within shear zone. Origin and significance of different types of minor structures within shear zones. Sense of movement and its determination in shear zones.
Geometry of fold and thrust belts.
Introduction of experimental structural geology

Reference Books :-

Structural Geology, Fundamental and Modern Development by S. K. Ghosh.
Structural Geology by M. P. Billings.
Structural Geology by Devis.
Foundations of Sturctural Geology by R.G.Park.

GEOTECTONICS (35 marks)

Global characteristics of the earth: Earth as a planetary object, shape, size and internal structure, physical and chemical characters of crust, mantle and core, significance of Asthenosphere and outer core in geodynamics, measure features of continents and ocean basins. Features of the earth's crust, crustal divisions, physical characters of continents and ocean basins, continental shelf, slope and abyssal planes, island arcs and trenches, rift valleys, mid oceanic ridges, mountain chains.

Orogenesis: Precambrian and Phanerozoic orogenesis, source and nature of tectonic forces, comparison of hypothesis of orogenesis-contraction, expansion, convection, continental drift and sea floor spreading.

Plate Tectonics; Basic concepts and definition, types of plate margins their characters and associated processes like magnetism, seismicity, volcanism, mountain belts, plate tectonics and sedimentary basins-sedimentation pattern, Benioff zones, Plate tectonic models for the origin of folded mountain belts.

Tectonics of Indian sub continents; Physiographic divisions and their characters, Structural trend during the archaean and proterozoic, proterozoic sedimentary platform basins-their trend of tectonics, tectonic model of evolution of the Himalayas.

Plume hypothesis and micro plate tectonics.

Reference Books :-

The evolving continent by Windley.
Plate Tectonic and crustal Evolution by Condie.
Marine Geology by J.Kennet
Aspects of Tectonics by Waldiya.

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)

AGT 302 MINERAL EXPLORATION (70 marks)

Geological prospecting: Introduction to prospecting and exploration: scale of prospecting; classification of prospecting methods, objectives of exploration, principles of exploration, methods and stages.

Optimization of exploration: planning, choice of exploration methods, integrated exploration sequence, organization and operation during exploration. Evaluation of mineral deposit at various stages of exploration, workable standards.

Prospecting criteria and guides, geological criteria, climate stratigraphy, facies and lithological aspects, structure and geological aspects, geochemical and geophysical anomalies, geological conditions favorable for prospecting.

Exploration equipments and system, exploration openings, reconnaissance bore holes drilling system, exploration by underground and bore hole workings. Factors affecting choice of system. Methods and types of sampling, choice of sampling, sample spacing, grading mineral deposit, sample error and check

Geochemical prospecting:

Geochemistry in mineral exploration, classification of geochemical surveys orientation and virgin area surveys, association, mobility and path finder elements.

Geochemical dispersion and landscape: patterns of deep seated origin, formation of productive plutons, geochemical provinces, host rock petrochemistry, ores relative to productive plutons.

Biogeochemical and geobotanical surveys: choice of sampling medium and their anomalies, mapping technique, merits and demerits, biogeochemical and geobotanical indicators.

Data handling and statistical interpretation of data, organization and data bank, univariate and multivariate analysis, calculation of background, threshold and cut off values.

Geophysical prospecting:

Introduction to geophysical prospecting, classification and types of prospecting methods, concept and principles of gravity and magnetic surveys, anomalies, their correction, instrumentation and field data acquisition, interpretation and application to geological problems

Concept of seismic reflection and refraction methods, instrumentation and field data acquisition, preparation of travel times curves, seismic stratigraphic sequences and identification of subsurface structure

Types of electrical surveys, electrode configuration, field data, resistivity methods interpretations of subsurface lithology and structures by qualitative and quantative analysis.

Radiometric prospecting, principles and concept, GM and scintillation counters, field data acquisition and interpretation.

Subsurface Geophysical exploration: Types of Well Logging, Instruments, subsurface structural and stratigraphic correlation.

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)

Sr. No.	Author	Title	Publisher
1.	Kreiter	Geological prospecting	--
2.	A.W. Rose, H.E. Hawkes & J.S. Webb	Geochemistry in Mineral Exploration	Academic Press
3.	G.J.S. Govette	Rock geochemistry in mineral exploration	Elsevier
4.	Fleteher W.K.	Analytical methods in geochemistry prospecting	Elsevier
5.	Beus A.A. & Grigorian S.V.	Geochemical exploration methods for mineral deposits.	Applied Publishing Co.
6.	Dobrin M.B.	Introduction to geophysical prospecting	Mcgraw Hill Book Company Inc.
7.	Ramchander Rao. M.B.	Outlines of geophysical prospecting for geologists.	--
8.	William Lowric	Fundamentals of Geophysics	Cambridge University Press.
9.	Telford W.M., Geldart L.P. & Sheriff R.E.	Applied Geophysics	Cambridge University Press

AGT 303 ENGINEERING GEOLOGY AND MINING GEOLOGY (70 MARKS)

ENGINEERING GEOLOGY (35 marks)

Engineering properties of rocks., rock discontinuity, physical characters of building stones. Modulus of elasticity for rocks, modulus of deformation. Geological investigation for civil engineering. Project for site selection of dams and reservoir. Dams foundation rock problem. Geotechnical evaluation of tunnel alignment and transportation routes. Geotechnical evaluation for site selection of bridges. Mass movement – land slides causes of hill slope, instability. Earthquakes and seismcity, seismic zones of India. Types of engineering structures involved in watershed management.

BOOKS

Engineering Geology by Davis.
Geology and Engineers by Laggets
Engineering Geology by Parbeen singh.
Principle of Engineering Geology by Krynine and Jedd

MINING GEOLOGY (35 marks)

Application of rock mechanics in mining, planning, exploration and exploratory mining of surface and underground mineral deposit involving diamond drilling, shaft sinking, drifting cross cutting, winzing, stopping, room and pillaring, top-slicing, sub level caving and block caving, cycles of surface and under ground mining operations. Exploration for placer deposit. Open pit mining . ocean bottom mining , types of drilling methods viz. diamond drilling and chern drilling. mining hazards-mine diseases, mine inundation, fire and rock burst, mine gasses, open cast and underground mining methods.

Reference Books :-

Mining geology by Mckinstry
Elements of mining by clark G.B
Courses in mining geology by Arogyaswami R.P.N.
Introduction to geophysical prospecting by Dobrin

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)

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AGT 304 NATURAL RESOURCE AND WATERSHED MANAGEMENT (70 marks)

NATURAL RESOURCE MANAGEMENT (35 marks)

Description and Types of Natural Resources. Renewable and Non-renewable Natural Resources, Supply, Demand, Function and Values. Role of Resources in
Social and Ecological concerns and Human use and impact on Natural Resources.
Tools and Techniques for Development and Management of Natural Resources.
Arid & Semi-arid land: Classification, Protection and Conservation.
Soil types and Mineral: Conservation & Management.
Coast: Coastal Resources and their Management.
Land use-Land Cover planning.
Introduction to Application of Remote Sensing in Resource Management.
Mineral Policy, mining legislation, brief out line of national and international law, conservation of natural recourses.
Natural hazard mitigation and management exploration planning.

Reference Books :-

Mineral economics : Sinha and Roy.
Mineral economics : Chatterjee.
Indian Bureau of Mines, Govt. of India.
Handbook of energy technology by V. Daniel Hunt.

WATERSHED MANAGEMENT (35 marks)

Definition of watershed, factors affecting rainfall, surface runoff, soil moisture and groundwater recharge. Groundwater development techniques in a watershed, groundwater budgeting, consetative use of surface and groundwater, groundwater and rainwater harvesting, and techniques in watershed development. Groundwater withdrawal its effect on groundwater reservoirs. Factors useful for the developments of dynamic groundwater modeling. People participates in watershed management, crop pattern and its influence in watershed development. Types of engineering structures. Artificial recharge and conservation techniques, artificial precipitation, types of cloud, evaporation, Evapotranspiration in watershed development. Introduction to government and non government agencies. Role of geologist in watershed management and development.

Reference Books :-

Groundwater hydrology by Todd
Hydrogeology by karanth
Groundwater evaluation by Walton.
Dynamic earth system : A.M. Patwardhan.
Engineering Geology by Davis.
Geology and Engineers by Laggets
Engineering Geology by Parbeen singh.
Principle of Engineering Geology by Krynnen and judd

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)
AGP 305 PRACTICAL RELATED TO AGT 301 AND AGT 302

Practical AGT 301 (Structural Geology and Geotectonics) (70 marks)

STRUCTURAL GEOLOGY:

Maps for drawing sections.
Exercises for determination of finite strain.
Exercises for fold analysis by t/graphs.
Exercises for structural analysis.
Exercises for shear zones.
Exercises for synthetic fiber for the determination of strain.

GEOTECTONICS

Study of Tectonic elements of the given tectonic maps.
Identification of palaeotectonic regimes and delineating their characterstics.
Identification of different tectonic features in the given map/ sketches.
Study of tectonic maps of different parts of India.
interpretation of Neotectonic features using aerial photographs.

Practical AGT 302 (Mineral exploration)

Reserve calculation problems
Problems on structures and site selection
Management of resources
Types of reconnaissance and determinative mineralogical aspects.
Microscopic studies of ores, coal, placer minerals.
Identification, testing and evaluation of gem minerals and their quality improvement suggestion.
Geohistory analysis
Determination of moisture content/ specific gravity of coal.

INTERNAL EVALUATION (30 Marks)
(Viva-voce + Journal + Data evaluation)

AGP 306 PRACTICAL RELATED TO AGT 303 AND AGT 304

Practical AGT 303 (Engineering Geology and Mining Geology) (70 marks)

Engineering Geology
Salient points for the constructive of contours of bunds, stream bunds, percolation tank, subsurface dam etc.
Use of morphometric analysis in planning watershed development.
Calculation of water balance for a watershed.
Plotting of chemical data of water samples from watershed area.
Interpretation of resistivity data of watershed area.
Drainage analysis.

Mining Geology
Mine valuation and calculation
Mine survey problems.
Terminology of mines

Practical AGT 304 (Natural Resource and Watershed Management)

Practical Natural Resource
Reserve calculation problems
Problems on structures and site selection
Management of resources
Types of reconnaissance and determinative mineralogical aspects.
Microscopic studies of ores, coal, placer minerals.
Identification, testing and evaluation of gem minerals and their quality improvement suggestion.

Practical Watershed Management
Identification and mapping of natural hazards and zones and terminology of the associated features : viz, floods, landslides, glaciers, with the help of topographic sheets, aerial photographs and LANDSAT imageries.
Determination of pollutants from surface and subsurface water samples.
Assessment of the mining hazards with respect to case histories.
Classification of coastal zones and mapping.
Utilization of coastal environmental maps with the help of toposheets, aerial photographs and LANDSAT imageries.
Interpretation of underground structures on the basis of seismic data.

INTERNAL EVALUATION (30 Marks)
(Viva-voce + Journal + Data evaluation)

EACH SEMESTER WILL HAVE 1 CREDIT (25 MARKS) FOR – FIELD TRAINING FOR LONG TOUR/IN PLANT TRAINING/INDUSTRIAL VISIT OR RECONNAISSANCE FIELD WORK DATA ACQUISITION RELATED TO DISSERTATION.

SEMESTER IV

AGT 401 ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT (70 marks)

- Fundamental concept, scope and necessity of Environmental geology.
- Introduction to structure, composition and characters of lithosphere, biosphere and hydrosphere.
- Introduction to Ecosystem: Classification, role and structure.
- Man made Pollution of Air, Water, Soil, and Coast. Their types, sources and causes of pollutants. Controlling measures.
- Introduction to various types of disasters.
- Study of Natural Hazards like meteorite impact hazard, landslides, floods and drought, earthquakes, mining, volcanic eruptions: their classification, causes, assessment, prediction and controlling measures.
- Zonation mapping and monitoring the natural hazards through GIS and remote sensing techniques.
- Waste: Source and classification of waste products. Waste disposal and recycling methods. Control and management of waste materials.
- Use of GIS and remote sensing in reduction of natural disasters.
- Systematic study of pre-disasters and post-disasters with reference to preparedness, relief and recovery operations.
- Case histories of natural disasters of India viz. Koyana earthquake, Killari earthquake, East coast cyclones, Tsunami, drought prone regions of India with special reference to Maharashtra, Konkan railway landslides.

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)

Reference Books -

- Environmental geology : E.K. Keller.
- Environmental geology : K.S. Valdiya
- Man and environmental : K.C. Sahu
- Geology and man : Laurence lindgren.
- Geology and society : Coates
- Dynamic earth system : A.M. Patwardhan.

AGT 402 ENERGY RESOURCES (70 marks)

Role of fuels in National development, Types of fuels, Conventional and non-conventional energy resources.

Detail study of solid, liquid and gaseous hydrocarbons with respect to their formation conditions, occurrences, migration, trapping. Study of reservoir rocks, trap rocks and cap rocks. Nature of hydrocarbons, origin of oil. Study of sedimentary basins. Enhanced recovery operations for petroleum and natural gas.

Coal petrographic and petrological study, classification of coal deposits, coalification, chemical constituents of coal, processing of Tertiary and Gondwana coal. Introduction to various radioactive minerals, their half lives and breeding characteristics. Use of atomic energy as alternative energy resource. Nature and types of Uranium deposits and their occurrence and genesis. Nuclear fusion and Nuclear breeder. Nuclear waste and its management. Atomic mineral surveys.

Introduction to other tapeble energy sources eg. Ocean thermal energy, wind energy, biomass energy and geothermal energy, tidal energy, solar energy.

Reference Books -

Petroleum Geology by F..K. North
Petroleum formation and occurrence by Tissot and Welte
Petroleum asia journal, A.A.P.G. Journal
Handbook of Energy Technology by V.D. Hunt
Introduction to Petroleum geology by Hobsson and Tirtsoo.

Nuclear Geology by Ashwathnarayan
Development in Petroleum Geology by Hobson.
Coal Deposits by Tatsch
Petroleum Development in Geology by Dicky
Geothrmal Systems by Reach and Mufflur.

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)

AGT 403 REMOTE SENSING AND GIS (70 marks)

REMOTE SENSING

- Concept of Remote Sensing : Electromagnetic energy, Interaction of EMR with atmosphere and earth material, atmospheric windows, EMR spectrum. Platforms, sensor types, MSS.
- Aerial Remote Sensing : Flight planning, types of aerial photographs. Photogrammetry – stereoscopic vision, scale, relief displacement, parallax, vertical exaggeration.
- Satellite Remote Sensing : LANDSAT & IRS characteristics, products and FCC.
- Interpretation techniques, visual and digital in brief. Recognition of photo elements and terrain elements like size, shape tone, texture, pattern, shadow, sight and association.
- Terrain analysis: Relief, landforms, drainage pattern.
- Use of remote sensing in lithology, structure and geomorphology.
- Application of remote sensing in groundwater and mineral exploration.

GIS

- Basic concept of GIS, components, history and applications.
- Hardware and software requirement for GIS
- Map features, scale, resolution, accuracy and database extent.
- Map projection and parameters: Geographical co-ordinate system, types of projection and parameters, projection transformation and managing in GIS.
- Geospatial data models: Spatial and non-spatial data, VECTOR AND RASTER models.
- GIS ANALYSIS : Digitization, editing and structuring of map data, overlay analysis. Digital elevation and terrain models (DEM/DTM), buffer analysis and query analysis.
- Introduction to Global Positioning System, their applications and limitations.

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)

Reference Books -

Principles and applications of photogeology by S.N. Pande
Photogeology and regional mapping by J.A.E. Allum.
Remote sensing and image interpretation by Lilley sand
Photogeology by Miller and miller.
Thermal and microwave remote sensing by sabins.
Photogeology Panda

AGT 404 DISSERTATION **(70 marks)**

Student will submit their independent dissertation work at the end of semester IV. Under the suppression of respective Guides Assessment of the dissertation and internship will be based on the submitted M. Sc. dissertation report, seminar and viva-voice examination for 100 marks.

INTERNAL EVALUATION (30 Marks)
(Seminar + Term paper + Test)

AGP 405 PRACTICAL RELATED TO AGT 401 AND AGT 402
Practical AGT 401 (Environmental Geology & Disaster Management) (70 marks)

PRACTICAL ENVIRONMENTAL GEOLOGY (35 marks)

- Identification and mapping of natural hazards and zones and terminology of the associated features: viz, floods, landslides, glaciers, with the help of topographic sheets, aerial photographs and LANDSAT imageries.
- Determination of pollutants from surface and subsurface water samples.
- Assessment of the mining hazards with respect to case histories.
- Classification of coastal zones and mapping.
- Utilization of coastal environmental maps with the help of toposheets, aerial photographs and LANDSAT imageries.

PRACTICAL NATURAL DISASTAR MANAGEMENT

- World wide distribution of disasters.
- Mapping of disaster prone zone with the help of remote sensing.
- Study of case histories of natural disasters in India

Practical AGT 402 (Energy Resources) (35 marks)

- Coal types rank and grid, proximate analysis of coal
- Reserve calculation, preparation of polished sections
- Study of section under the microscope, petrography of coal, physical properties of crude, Incipassination and palaeontological remains of coal
- Flash point and smoke point of crude, refractive index for crude.
- Calculation of reservoir, petroliferous basins of India.
- Identification of radioactive minerals.

INTERNAL EVALUATION (30 Marks)
(Viva-voce + Journal + Data evaluation)

AGP 406 PRACTICAL RELATED TO AGT 403 AND AGT 404
Practical AGT 403 (Remote Sensing & GIS) (70 marks)

PRACTICAL REMOTE SENSING (35 marks)

- Determination of photo scale and height determination
- Study of different Erosional, depositional landforms and tectonics landforms.
- Interpretation of lithology and structures from aerial photograpghs and satellite imageries.
- Study and analysis of lineaments and drainage from aerial photographs.

PRACTICAL GIS

- Nature of sources of geographical data.
- Georeferencing and digitization
- Preparation of DEM/DTM
- Slope, buffer, mosaiking and overlay analysis

Practical AGT 403 (Dissertation) (35 marks)

INTERNAL EVALUATION (30 Marks)
(Viva-voce + Journal + Data evaluation)

EACH SEMESTER WILL HAVE 1 CREDIT (25 MARKS) FOR – FIELD TRAINING FOR LONG TOUR/IN PLANT TRAINING/INDUSTRIAL VISIT OR RECONNAISSANCE FIELD WORK DATA ACQUISITION RELATED TO DISSERTATION.