Solapur University, Solapur

Choice Based Credit System (CBCS)

Syllabus

M.Sc. Part I & II Applied Geology

To be implemented from the year 2016 onwards

School of Earth Sciences

Solapur University, Solapur

M. Sc Applied Geology

SOLAPUR UNIVERSITY
SCHOOL OF EARTH SCIENCES
M.SC. APPLIED GEOLOGY
2015-2016 ONWARDS
PART I

SEMESTER I
STRUCTURE OF THE CBCS PATTERN

SR. NO.	PAPER CODE	TITLE OF THE PAPER	LOAD/ WEEK	TOTAL LOAD	CREDITS	MARKS
1.	AGT 101	Mineralogy and Optics (3:1)	04	56	04	100
2.	AGT 102	Geochemistry	04	56	04	100
3.	AGT 103 a.(Elective)	Sedimentology and Palaeontology (2:2)	04	56	04	100
4.	AGT 104 a.(Elective)	Structural Geology and Morphotectonics (2:2)	04	56	04	100
5.	AGP 105	Practical related to AGT 101 and 102 (2:2)	04	56	04	100
6.	AGP 106	Practical related to AGT 103 and 104 (2:2)	04	56	04	100
7.	AGT 107	Soft skill ICT, Scientific English	01	08	0.50	13
		Tour and Tour report			0.25	06
		Seminar			0.25	06
Total				400	25	625
OPTIONAL SUBJECT						
1.	AGT 103 b.(Elective)	Sedimentary Petrology and Palaeontology (2:2)	04	64	04	100
2.	AGT 104 b.(Elective)	Applied Geomorphology	04	64	04	100

SOLAPUR UNIVERSITY
SCHOOL OF EARTH SCIENCES
M.SC. APPLIED GEOLOGY
2015-2016 ONWARDS
PART I

SEMESTER II
STRUCTURE OF THE CBCS PATTERN

SR. NO.	PAPER CODE	TITLE OF THE PAPER	LOAD/ WEEK	TOTAL LOAD	CREDITS	MARKS
1.	AGT 201	Economic Geology	04	56	04	100
2.	AGT 202 a.(Elective)	Indian Stratigraphy	04	56	04	100
3.	AGT 203 a.(Elective)	Hydrogeology	04	56	04	100
4.	AGT 204	Igneous and Metamorphic Petrology (2:2)	04	56	04	100
5.	AGP 205	Practical related to AGT 201 and 202 (2:2)	04	56	04	100
6.	AGP 206	Practical related to AGT 203 and 204 (2:2)	04	56	04	100
7.	AGT 207	Soft skill ICT, Scientific English	01	08	0.50	13
		Tour and Tour report			0.25	06
		Seminar			0.25	06
Total				400	25	625
OPTIONAL SUBJECT						
1.	AGT 202 b.(Elective)	Precambrian Geology	04	64	04	100
2.	AGT 203 b.(Elective)	Watershed Management	04	64	04	100

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SCHOOL OF EARTH SCIENCES
M.SC. APPLIED GEOLOGY
2015-2016 ONWARDS
PART II

SEMESTER III
STRUCTURE OF THE CBCS PATTERN

SR. NO.	PAPER CODE	TITLE OF THE PAPER	LOAD/ WEEK	TOTAL LOAD	CREDITS	MARKS
1.	AGT 301 a.(Elective)	Geotectonics and Physical Oceanography (2:2)	04	56	04	100
2.	AGT 302	Mineral Exploration(4)	04	56	04	100
3.	AGT 303 a.(Elective)	Engineering Geology and Mining Geology(2:2)	04	56	04	100
4.	AGT 304	Fuel Geology and Resources Management (2:2)	04	56	04	100
5.	AGP 305	Practical related to AGT 301 and 302 302 (2:2)	04	56	04	100
6.	AGP 306	Practical related to AGT 303 and 304 302 (2:2)	04	56	04	100
7.	AGT 307	Soft skill ICT, Scientific English	01	08	0.50	13
		Tour and Tour report			0.25	06
		Seminar			0.25	06
Total				400	25	625
OPTIONAL SUBJECT						
1.	AGT 301 b.(Elective)	Marine Geology	04	64	04	100
2.	AGT 303 b.(Elective)	Geotechnical Engineering	04	64	04	100

SOLAPUR UNIVERSITY
SCHOOL OF EARTH SCIENCES
M.SC. APPLIED GEOLOGY
2015-2016 ONWARDS
PART II

SEMESTER IV
STRUCTURE OF THE CBCS PATTERN

SR. NO.	PAPER CODE	TITLE OF THE PAPER	LOAD/ WEEK	TOTAL LOAD	CREDITS	MARKS
1.	AGT 401	Environmental Geology and Disaster Management (2:2)	04	56	04	100
2.	AGT 402	Remote Sensing and GIS	04	56	04	100
3.	AGT 403 a.(Elective)	Planetary Geology and climate (2:2)	04	56	04	100
4.	AGT 404 a.(Elective)	Research Methodology (4)	04	56	04	100
5.	AGP 405	Practical related to AGT 401 and 402 402 (2:2)	04	56	04	100
6.	AGP 406	Practical related to AGT 403 and 404 402 (2:2)	04	56	04	100
7.	AGT 407	Soft skill ICT, Scientific English	01	08	0.50	13
		Tour and Tour report			0.25	06
		Seminar			0.25	06
Total				400	25	625
OPTIONAL SUBJECT						
1.	AGT 403 b.(Elective)	Survey and Analytical methods in Geology (2:2)	04	64	04	100
2.	AGT 404 b.(Elective)	Advance GIS (4)	04	64	04	100

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SCHOOL OF EARTH SCIENCES
M.SC. APPLIED GEOLOGY
2015-2016 ONWARDS
STRUCTURE OF THE CBCS PATTERN

SEMESTER I

SR. NO.	PAPER CODE	TITLE OF THE PAPER
1.	AGT 101	Mineralogy and Optics (3:1)
2.	AGT 102	Geochemistry
3.	AGT 103 a.(Elective)	Sedimentology and Palaeontology (2:2)
4.	AGT 104 a.(Elective)	Structural Geology and Morphotectonics (2:2)
5.	AGP 105	Practical related to AGT 101 and 102 (2:2)
6.	AGP 106	Practical related to AGT 103 and 104 (2:2)
7.	AGT 107	Soft skill ICT, Scientific English
		Tour and Tour report
		Seminar
Optional Subject		
1.	AGT 103 b.(Elective)	Sedimentary Petrology and Palaeontology (2:2)
2.	AGT 104 b.(Elective)	Applied Geomorphology

SEMESTER II

SR. NO.	PAPER CODE	TITLE OF THE PAPER
1.	AGT 201	Economic Geology
2.	AGT 202 a.(Elective)	Indian Stratigraphy
3.	AGT 203	Hydrogeology
4.	AGT 204 a.(Elective)	Igneous and Metamorphic Petrology (2:2)
5.	AGP 205	Practical related to AGT 201 and 202 (2:2)
6.	AGP 206	Practical related to AGT 203 and 204 (2:2)
7.	AGT 207	Soft skill ICT, Scientific English
		Tour and Tour report
		Seminar
Optional Subject		
1.	AGT 202 b.(Elective)	Precambrian Geology
2.	AGT 203 b.(Elective)	Watershed Management

SR. NO.	PAPER CODE	TITLE OF THE PAPER
1.	AGT 301 a.(Elective)	Geotectonics and Physical Oceanography (2:2)
2.	AGT 302	Mineral Exploration
3.	AGT 303 a.(Elective)	Engineering Geology and Mining Geology(2:2)
4.	AGT 304	Fuel Geology and Resources Management (2:2)
5.	AGP 305	Practical related to AGT 301 and 302 (2:2)
6.	AGP 306	Practical related to AGT 303 and 304 (2:2)
7.	AGT 307	Soft skill ICT, Scientific English
		Tour and Tour report
		Seminar
Optional Subject		
1.	AGT 301 b.(Elective)	Marine Geology
2.	AGT 303 b.(Elective)	Geotechnical Engineering

SEMESTER III

SEMESTER IV

SR. NO.	PAPER CODE	TITLE OF THE PAPER
1.	AGT 401	Environmental Geology and Disaster Management (2:2)
2.	AGT 402	Remote Sensing and GIS (2:2)
3.	AGT 403 a.(Elective)	Planetary Geology and climate (2:2)
4.	AGT 404 a.(Elective)	Research Methodology (4)
5.	AGP 405	Practical related to AGT 401 and 402 402 (2:2)
6.	AGP 406	Practical related to AGT 403 and 404 402 (2:2)
7.	AGT 407	Soft skill ICT, Scientific English
		Tour and Tour report
		Seminar
Optional Subject		
1.	AGT 403 b.(Elective)	Survey and Analytical methods in Geology (2:2)
2.	AGT 404 b.(Elective)	Advance in GIS (4)

Paper No: AGT 101 **Title: MINERALOGY AND OPTICS**
Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1	Concepts of light under microscope, Uniaxial and biaxial ellipsoids, Interference figures of uniaxial and biaxial minerals, Determination of optics sign and pleochroism, Determination of optic axial angle(2V), Flash figures, bravais lattice and point lattice,32 classes of symmetry , Twinning and their laws in feldspars.	**14**
Unit2	Crystal cell structure, chemistry diagnostic properties and stability fields of 1olivine 2. characteristic difference in opx and cpx, 3.alkali amphiboles and Ca-amphiboles	**14**
Unit3	Cell structure, Chemistry, Diagnostic optical properties and paragenesis of 1. Mica-dioctahedral and Trioctahedral, 2.alkali and plagioclase feldspars 3.Feldspathoids, 4.zeolites	**14**
Unit4	Structure, Chemistry, optical properties and paragenesis of 1.Clayminerals, 2.Alumino Silicates, 3. Garnets, 4.Epidote, 5.Basemetals, 6.Spineloids, Sn–W-Mo, 7. Gemstone	**14**

REFERENCEBOOKS:

1. An introduction to the Rock Forming Minerals Deer, Howie and Zussman.
2. Rock Forming Minerals Deer, Howie and Zussman.(Vol.1-5)
3. A textbook of Mineralogy by Dana.
4. Elements of Mineralogy Berry Mason.
5. Principles of Geochemistry Brian Mason, C.B.Moore.
6. Optical mineralogy P.F. Keer.
7. Optical Crystallography E.E. Wahlstrom.
8. Optical Mineralogy Philips and Dana T. Griffen.
9. A practical introduction optical mineralogy, Gribble and Hall.
10. An introduction to crystallography Phillips.
11. Minerals and rocks: exercise in crystallography, mineralogy and hand specimen Corneis Klein.
12. Mineralogy, Dexter Perkins,3rd Edition, PHI Publication.

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

Paper No: AGT 102 **Title: GEOCHEMISTRY**

Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1	Introduction to the principles of geochemistry. Historical geochemistry. Origin and cosmic abundance of elements, Goldschmidt's geochemical classification of elements .Primary differentiation of earth, Brief classification and composition of meteorites, Distribution of elements in igneous, metamorphic and sedimentary rocks.	**14**
Unit 2	Comparative planetology: composition of crust, mantle and core of earth, Aspects of equilibrium thermodynamics- enthalpy and entropy, free energies, chemical potentials, fugacity and activity. Few problems related to thermodynamics Mineral stability– Pauling rules, speciation of elements during magmatic crystallization. Major and minor elemental substitution, laws of Goldschmidt, Ahren rules and Ringwood rules, Secondary environmental geochemistry, causes and products of chemical weathering, physico-chemical factors in sedimentation, fench diagrams, their signification and limits.	**14**
Unit 3	Composition of hydrosphere, Differences between the seawaters and freshwater composition, gains and losses of the Oceans, Composition and stratification of atmosphere, evolution of atmosphere through geological time. Gains and losses to atmosphere, aspects of air pollution, Climate changes during geological history and evolution of atmosphere in last 10000years, aspects of Palaeo climatology.	**14**
Unit 4	Use of trace and rare earth elements in geological problems, Isotope geochemistry, types of isotopes, natural and artificial radioactivity. Basic concepts in dating techniques: decay clocks and accumulation clocks, Dating techniques using Rb-Sr, U-Th- Pb,K-Ar, S,CandO methods, Quality controls of data generation, Wet and Dry chemical analysis, Partial and total analysis.	**14**

Reference Books:

1.Geochemistry pathways and processes 2nd edition, Harryy.mc sween Jr, Steven M. Richards on and Maria E Uhle. Overseas Press
2. Radioactive minerals, Dhanaraju, geological society of India, Banglore.
3. Principles of Geochemistry, Mason and Moore; John Wiley & Sons
4. Introduction to geochemisty .K.B. Krauskopf; Mcgraw- Hill Publication
5. Geochemistry in Mineral Exploration. A.W. Rose, H.E. Hawkes &J.S. Webb;Applied Publication
6. Handbook of Geochemistry Wadephol.
7. Statistical Methods in Exploration Geochemistry. Govett. J. G.S. Elsevier Publication
8. Nuclear Methods in mineralogy & geology techniques & applications., Attila Vertes, Sandor Nagy & Karoly Suvegh.PlenumPress
9. Stable Isotope Geochemistry, J.Hoefs, Springer- Verlag

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

Paper : AGT 103 Title: SEDIMENTOLOGY AND PALAEONTOLOGY
Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit 1	Introduction and principles of sedimentology, Sedimentary cycle and diastrophic cycle, Sedimentary processes : Weathering–Mechanical ,Chemical and Biological , Transport mechanism saltation, traction and suspension, Deposition by fluids, Reynold number and Froude number, their application. Sedimentary textures of clastic and nonclastic rocks,concept of size and shape, Shape aspects–sphericity and roundness, surface textures fractals, Fabric measurements.	**14**
Unit 2	Classification of sedimentary environments: continental, marine and transition. Structures in alluvial, fluvial, deltaic, lacustrine, coastal, marine, glacial and Aeolian conditions, classification of clastic and non clastic rocks, classification of sandstone, classification of sedimentary basin and their tectonic setting, products of various basins, heavy minerals and their significance in province studies . Dolomitisation and dedolomitisation, Lithification and types of diagenesis.	**14**
Unit 3	Concepts offossil records its significance in mineral exploration stratigraphy and paleo-environmental studies, Morphology and classification of forminifera and their applications, morphology and classification of trilobites and their significance.	**14**
Unit 4	Evolution of 1.Devonian fishes, 2. Mesozoic reptiles, Siwalik mammals and their paleogeology, Gondwana flora, evolution of man.	**14**

REFERENCE BOOKS:

1. An introduction to sedimentology, Selley R.C.,Academic press.
2. Sedimentary rocks 3rd edition, Pettijohn F.J., CBS Publication Stratigraphy and sedimentation 2nd edition, W.H. Freeman and Co.
3. Principles of sedimentology, Friedman and Sanders J.m., John Wiley.
4. Origin of sedimentary rocks., Blatt H., Middleton Gand Murry R, Pentile Hall.
5. Petrology of sedimentary rocks., Folk R. L., Hemphill publication Co.
6. Sedimentary petrology: An introduction., Tucker M.E., ELBS., Blackwell Scientific Publication.
7. Applied sedimentology – Sukhtankar R.K . CBS Publishers.
8. Invertebrate palaeontology and evolution(2nd ed.) By Clarkson E.N.K.
9. Elements of Palaeontology Babin C.
10. Principles of Invertebrate Paleontology Shock & Twenhofel.
11. Paleontology of Vertebrates Jean Chaline.
12. Macropaleontology Bignot.
13. Paleontology Invertebrate Wood. Henry.

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

Paper No: AGT 104 Title: STRUCTURALGEOLOGY AND MORPHOTECTONICS
Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit 1	Concept of primary and secondary structures, Types of stress and strain analysis using deformed objects homogeneous and heterogeneous deformations, Mohr circle, strain indicators, strain ellipse and reciprocal strain ellipse, behavior of rocks with respect to stress and strain. Determination offinite strains from originally spherical and ellipsoid ac markers.	**14**
Unit 2	Geometric classification of folds, mechanics of folding, folding in shear zones, buckling- states of strain within and outside buckled layers and field evidences of buckling , Faults and joints classification and significance, Mechanics of faulting with reference to stress and types of shear zones Geometry of thurst sheets, brittle and ductile structures in shearzones. Lineation and foliations morphology and classification ,significance of minor structures to determine major structures, Classification of unconformities and significance.	**14**
Unit 3	Concept of uniformitarianism morphological concepts of Davis Peenck, King Geomorphic processes, Erosional and depositional formsof1.Fluvial,AeolianKarst, Glacial and marine , various controls and scale of landforms and drainage network.	**14**
Unit 4	Coastal geomorphology, Classification of coasts , erosional and depositional features , Lineament analysis , Neotectonic evidences, Climate and landforms.	**14**

REFERENCEBOOKS

1. Fundamentals of Geomorphology R.J.Rice
2. Geomorphology RichardJ. Chorley, StanleyA. Schumm, DavidE. Sugden.
3. Principles of Geomorphology WillamD. Thornbury.
4. Geomorphology Majeed Husain.
5. Indian Geomorphology H.S. Sharma.
6. Experimental fluvial Geomorphology Stanley A. Schumm, .Paull Mosaley, William E. Weaver.
7. Geomorphology and Remote Sensing in Environmental management S.Singh
8. The Evolving Continents Windley.
9.The Geology of Continental Margins Burkeand Drake.
10.The Breakup of Pangaea R.S.Dietzand J.C.Holden.

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

AGT 103: SEDIMENTARY PETROLOGY & PALAEONTOLOGY 70 marks

Unit 1	Weathering & erosion: sediment transport, modes of transport, fluid flow, transport types, movement of particles, Sedimentary environment and facies - marine, non-marine; marginal marine, fluvial, lacustrine, vertical and lateral relationship. classification of sedimentary rocks, Petrogenetic study of following sedimentary rocks : conglomerate, breccia, sandstone, siltstone, shale. Carbonate rock - limestone, dolomite, marl, evaporite, phosphorite, chert	14
Unit 2	Structures and textures in sedimentary rocks and their significance. Application of trace element, rare-earth element and stable isotope geochemistry to sedimentological problems. Tectonics and sedimentation: classification, definition and description of sedimentary basins, paleocurrent analysis and its application in basin analysis. Sedimentary basins of India.	14
Unit 3	Concept of organic evolution and fossil record, Evolution of Devonian fish, Mesozoic reptiles, siwalik mammals Evolution of man Study of gondwana and intertrappean flora	14
Unit 4	Micropalaeontology: introduction, morphology, classification and stratigraphic record of foraminifera and their application. Significance of fossils in mineral exploration, Stratigraphy and palaeogeography.	14

BOOKS

1. Bhattcharya, A and Chakraborti, C., 2000: Analysis of Sedimentary Succeccion. Oxford – IBH Blatt,
2. H, Murray, G.V. and Middleton, R.C., 1980: Origin of Sedimentary Rocks
3. Boggs Sam Jr., 1985: Principal of Sedimentary and Stratigraphy, Prentice
4. Cover, R.E.1971 : Procedures in Sedimentary Petrology. Wiley Interscience, John Wiley
5. Davis, R.A. Jr., 1992: Davis, R.A. Jr., 1992: Depositional System. Prentice Hall
6. Einsele , G., 1992: Sedimentary Basins. Springer Verlag
7. Friedman, G.M. and Sander, J.E., 1978: Principles of Sedimentology. John Wiley
8. Guy Plint, A., 1995: Sedimentary Facies Analysis. Spi. Publ IAS No. 22 , Blackwell

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

AGT 104 b (Elective) APPLIED GEOMORPHOLOGY Marks 70

Unit 1	Introduction to Geomorphology as a science and its brief history; Fundamental concepts in geomorphology, main branches of geomorphology. Theories, techniques and fieldwork (including field experiments) in geomorphology The geomorphic system: - morphologic and cascading system. General System Theory Concepts: - Uniformitarianism and Neocatastrophism. Open system. Ergodic principle. Equilibrium – types of equilibria. Complex response and geomorphic thresholds.	14
Unit 2	Geomorphic processes – weathering, mass movement, erosion and transportation, slope morphology, models of slope development. Dynamics of landforms – fluvial, coastal and karst landforms, Glacial processes and landforms, ice ages, Aeolian processes and landforms.	14
Unit 3	Climatic Geomorphology and Tectonic Geomorphology. Quantitative morphology – Geomorphological mapping and geomorphometry. DEM and digital geomorphometry. Fractals in Geomorphology. Remote Sensing and GIS Applied Geomorphology – Nature and objectives, Geomorphic hazards – fluvial, coastal and slope. Terrain classification – Principles, methods and applications. Applied fluvial geomorphology . Applied geomorphology in coastal-zone management	14
Unit 4	Applied Geomorphology in Indian context, Geomorphology and regional planning, Geomorphology and hazard planning, Geomorphology and urbanization, Geomorphology and mineral exploration, Geomorphology and hydrology	14

Books

1. Brunsden, D. and Thornes, J.B. (1979): Landscape sensitivity and change. Transactions, Institute of British Geographers, 4: 463-484.
2. Wolman, M.G. & W.P Miller. (1960): Magnitude and frequency of forces in geomorphic processes. Journal of Geology, 68: 54-74.
3. Chorley, R. J. (1962): Geomorphology and General System Theory U. S. Professional Paper 500-B.
4. Chorely, R. J., Schumm, S. A., Sugden, D. E. (1984): Geomorphology, Methuen, London.
5. Schumm, S.A. and R.W. Lichty. (1965): Time, space and causality in geomorphology. American Journal of Science, 263: 110-119.
6. Goudie, A. S. (2004) (Eds.). Encyclopedia of Geomorphology. Routledge, London
7. Hart, M. G. (1986): Geomorphology, Pure and Applied. George Allen and Unwin, London.
8. Hails, J. R. (1977): Applied Geomorphology. Elsevier, Amsterdam.

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

Paper No: AGT 201 **Title: ECONOMICGEOLOGY**

Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1	Significance of minerals in national economy. Tenor, grade and specification for minerals. India's status in mineral production Strategic, critical and essential minerals. National minerals policy. Principles and concepts of mineral. Economics, Mineral processing technology, gravity concentration method, magnetic separation, heavy mineral separation, froth flotation method, United Nations Framework of Classification of ore deposits	**14**
Unit 2	Ore bearing fluids: magma & magmatic fluids, hydrothermal fluids, meteotric waters, sea & connate water, metamorphic fluids, thermal springs & mine waters Classification of ore deposits –Lindgren and Bateman classifications. Controls of ore localization magmatic epochs and metallogenic provinces of India. Microtexture of Ore, Paragenesis and Zoning. Fluid inclusion, Geothermometry, wall rock alterations and their applications. Ore microscope polishing and mounting of ores. Physical and Optical properties of important ore minerals.	**14**
Unit 3	Processes of formation of mineral deposits: magmatic concentration, metamorphism, contact metasomatism, Hydrothermal, submarine exhalatives, volcanogenic deposits, residual. Mechanical concentration, oxidation & supergene enrichment and skarn deposits. Ores in igneous rocks , Ores deposits of metamorphic affiliations. Strata bound and stratiform ore deposits. Mineralization associated with convergent and divergent plate boundaries.	**14**
Unit 4	Overview of mineral deposits viz: Iron, manganese, chromium, base metals, precious metals, Industrial and refractory minerals with special reference to distribution in India. Their geology, Stratigraphy & depositional environments. Use of micro hardness tester and reflectivity, XRD studies in determinative mineralogy.	**14**

References:-

1. Economic mineral deposits, M.L. Jensen &A.M. Batman, John Wiley & Sons
2. The Geology of Ore deposits, J.M. Gulbert & C.F. Park(JR), SWH Freeman & Co.
3. Mineral processing technology, B.A.Wills, Peragamon Press.
4. Metal depositin relation of plate tectonics, F.J. Sawkins, Springer–Verlag Press.
5. Ore deposits, Evans,--
6. Ore Genesis : A Holistic Approach, Asoke Moodherjee, Allied Publishers Ltd.
7. Ore Petrography & Microscopy ,J.R. Craig & D.T. Vaughan, John Wiley & Sons.
8. Mineral Economics, R.K. Sinha,--
9. Mineral Resources of India, R.K. Sinha & Krishnaswamy , Oxford & IBH Publishing Co. Pvt. Ltd.
10. An introduction to Ore Geology, Anthony, M. Evans, Blackwell Scientific publication, 1980.
11. Ore Genesis, Ashok Mukherji, A holistic approach, Prentice Hall, Culcutta. A.K.
12. India's mineral wealth, Brown J.C.and Dey, Oxford 1936.
13. Ore Microscopy, Cameron E.N.,Wiley 1966.
14. Economic Geology, Umeshwar Rao, -----

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

Paper No: AGT 202 **Title: INDIAN STRATIGRAPHY**

Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1	Precambrian Stratigraphy of Peninsular India. Classification, Structure and Tectonics of Archaean Provinces of Peninsular India. Correlation of Archean Stratigraphy in India. Archaeans of the Extra-Peninsular region.	**14**
Unit 2	Archaean- Proterozoic boundary problem Stratigraphy, classification and evolution of the following proterozoic basins of Peninsular India. Cuddapah Basin Vindhyan Basin, Delhi SuperGroup, Pranhita- Godavari Basin, Indravati Basin, Bhima-Kaladgi Basin	**14**
Unit 3	Stratigraphy, tectonic and classification of Gondwana formations, Stratigraphy, tectonic and classification of Deccan volcanic, Stratigraphy and classification of marine transgression in South India, Stratigraphy and classification of Jurassic formation in Kutch Correlation of Paleozoic–Mesozoic and Cenozoic stratigraphic succession in ExtraPeninsular India	**14**
Unit 4	K.T. boundary problem, Fossils of Siwaliks, Rise of Himalaya Glacial periods in Indian stratigraphic	**14**

Reference Books :

1. Historical Geology and Stratigraphy of India Ravindra kumar
2. Geology of India & Burma D.N.Wadia
3. A Manual of Geology of India and Burma Pascoe volume1,2,3,4
4. Geology of Maharashtra,G,G,Deshpande,Geological Society of India, Banglore.
5. Geology of India Vol.1.and Vol2. Ramakrishnanand Vidynathan, Geological Society of India, Bangalore.

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

Paper No: AGT 202 **Title: HYDROGEOLOGY**

Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1	Introduction , Scope of Hydrogeology, Hydrologic cycle : Types of Precipitation, Evapotranspiration, Initialization, Runoff, Age of groundwater and classification of groundwater, Darcy law and its range of validity, Hydraulic conductivity methods of determination of hydraulic conductivity, Hydrographic units, Hydraulic conductivity for an anisotropic aquifer , Groundwater movement and tracer technique, Groundwater equations for steady and unsteady flow.	14
Unit 2	Occurrence of groundwater: Types of openings in the rocks, Groundwater in Granitic, Basaltic, Metamorphic, Lime stones, Alluvium (unconsolidated sedimentary), Sandstones and Shale, Porosity, permeability, specific yield, specific retention, transmitivity storage coefficient (definations and methods of determination) Hydrographs, Watertable and piezometric level contour maps construction and interpretation Well hydraulics: Determination of aquifer characteristics from pump tests (Thies, Thesis, Chow's Cooper Jacobs, Rustonand Singh, Recovery methodetc.)	14
Unit 3	Fresh and salt water relationship in coastal area and islands, Ghyben–Hergberg principal and its modification, prevention and control of seawater intrusion, Groundwater provinces of India, Introduction to various methods of prospecting and exploration of groundwater Geological, Geophysical, Remote sensing, Consumptive and Conjuctive use of surface and groundwater, Types of confining layers, Types of Aquifers, Basic ideas of groundwater development and management	14
Unit 4	Artificial recharge methods and structures , Waterlogging problems, Problems of overexploitation, Groundwater legislation , Assessment of groundwater quality, Geochemistry of groundwater, Computer application in Hydrogeological studies .	14

References:

1. Groundwater, Todd,D.K., JohnWiley.
2. Hydrogeology, Davies, S.N.&Dewiest, R.J.M. JohnWiley.
3. Groundwater, Freeze, R.A.& Cherry, J.A., Prentice Hall.
4. Applied Hydrogeology, Fetter, C.W., Merill publishing.
5. Groundwater, Raghunath, N.M. Wiley Eastern.
6. Groundwater assessment-development and management. Karanth, K.R. Tata Mc GrawHill.
7. Regional Groundwater quality, Alley, W.M., VNR, NewYork.
8. Water. Subramaniam. V, Kingston Publ. London.
9. Groundwater and Tubewells, S.P.Garg, CBS Publication.
10. F.M. Introduction to Groundwater Hydrology,
11. Theory of Aquifer tests USGS, Wisler,C.P and Brater E.F.
12. Chow V.T.(edi) Handbook of Applied Geology.
13. Groundwater Resource and Evaluation,Walton,W.C.
14. David k.Todd and larry W.Mays, Groundwater hydrology,3rd edition,WileyIndia.

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

Paper No: AGT 204 Title: IGNEOUS AND METAMORPHIC PETROLOGY
Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit 1	Magma–physical and chemical properties and cooling behavior, magmatic crystallisation ,differentiation and assimilation Phase equilibria studies of binary and ternary silicate systems 1. Silica –Lucite, 2.Forsterite-Silica, 3.Orthoclase – Albite, 4.Diopside–Anorthits–Albite with petrogenetic significance, IUGS classification of igneous rocks, Magmatism related to plate tectonics-tholeiitic basalts, calc–alkaline magmatism.	**14**
Unit 2	Petrogenetic, Chemical, Mineralogical and field aspects of important rocks of India–Deccan flood basalts ,Layered intrusions, Carbonatites, Granitoids and formation of perthites, Kimberlites, Lamprophyres.	**14**
Unit 3	Metamorphism and metamorphic processes, characteristics of metamorphic reactions solid-solid, dehydration, decarbonation, Oxidation and their significance, Diagrammatic representation of mineral paragenesis–ACF,AKF,AFM ,Isograde and borrowian metamorphic zones, metamorphic facies differentiation, Retrograde metamorphism, metamorphism related to plate tectonics and paired metamorphic belts	**14**
Unit 4	Eskolas regional metamorphic facies Zeolite Greenschist , Glaucophaneschist, Amphibolite schist, Granulite, Eclogite, products of pelite, basic, ultrabasic and impure calcarious rocks. Thermal metamorphic facies sanidinite), Hornfels	**14**

Reference Book:

1) Metamorphism and metamorphic belts Miyashiro A.
2) Metamorphic petrology Turner F.J.
3) Metamorphic petrology Turner and Verhoogen.
4) Igneous and metamorphic petrology by Turner and Verhoogen.
5) Metamorphic Petrology by Winkler.
6) The Dynamic Earth System, A.M. Patwardhan, PHI Publication
7) Deccan Volcanism, K.V. Subbarao and R.N. Sukheswala, Geological Society of India, Memoir.No:3
8) Principles of Igneous and Metamorphic Petrology, John D Winter, PHI Publication
9) Petrology: Igneous and metamorphic best.
10) Metamorphic petrology, Harker.
11) Petrology: Igneous, metamorphic, sedimentary, Elher/ Blatt.
12) Evolution of Igneous rocks, Bowen N.L.

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

Optional Subjects:

AGT 202. a(Elective): PRECAMBRIAN GEOLOGY 70 marks

Unit 1	**Global distribution and tectonic setting of Precambrian crust :-** Areal distribution, Palaeomagnetism & continental reconstruction Dating of Precambrian rocks Orogenies & tectonic framework of Precambrian cratons Scheme of classification of Precambrian crust	14
Unit 2	Archaean Crust Introduction, distribution & salient characteristics of Archaean crust Geologic setting by cratons: Antarctica, Greenland, Australia, Africa, Indian Craton : Evolution of Granite- Greenstone and Granulites belts. Precambrian provinces of India. Distribution, stratigraphic correlation, succession, structure geochronology and economic importance Archean groups of rocks. Precambrian igneous intrusions: Locations, associated rock types and ages of the Precambrian anorthosites, alkaline rocks and carbonatites in coastal- and southern granulite terrains. Archean tectonic patterns.	14
Unit 3	Proterozoic Crust Early, Middle & Late Proterozoic crust : salient features and distribution. Proterozoic sedimentary basins of India: Palaeoproterozoic basins: Structure, lithology and evolution of Papaghani, Bijawar, Sonrai, Gwalior, Abujmar basins. Meso-Neoproterozoic basins: Structure, lithology and evolution of Cuddapah, Vindhyan, Pranhita-Godavari, Pakhal, Kaldgi, Bhima, Chhattisgarh, Khariar, Indravati and Sabari basins. Precambrian igneous intrusions in Purana basins: Locations, associated rock types and ages of igneous rocks in Vindhyan, Khariar, Indravathi and Cuddapah basins.	14
Unit 4	Evolution of continental crust Endogenous processes and product: Archaean heat flow and geothermal gradient, nature, composition, Metamorphism of Archaean crust, Archaean ocean crust, Mafic dyke swarm. Exogenous processes and products : Sea water composition, BIF, evaporates and palaeosol deposits, sedimentation and mineral deposits. Life in Precambrian	14

Books and References:

Amuthu, C.S. (1985) Archaean Geology. Oxford and IBH Publ.

Ramakrishnan, M. and Vaidyanadhan, R. (2008) Geology of India, Vol.1, Geological Society of India, Bangalore.

Condie, K.C. (1981) Archaean Greenstone Belts, Developments in Precambrian Geology, 3, Elsevier.

Condie, K.C. (1989) Plate Tectonics and Crustal Evolution, 3rd Ed., Pergamon, Oxford Press.

Goodwin, A.M. (1991) Precambrian Geology: The dynamic evolution of continental crust, Academic Press.

Windley, B.F. (1984) The Evolving Continents, John Wiley and Sons, New York.

Valdiya, K.S. (2010) The making of India Geodynamic Evolution. Macmillan Publishers India Ltd.

Pichamuthu, C.S. (1985) Archaean Geology: An introduction to the early history of the earth, Oxford & IBH Publishing Co., New Delhi.

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

AGT 203. b(Elective): WATERSHED MANAGEMENT 70 marks

Unit 1	Watershed definition, size, characteristics, factors affecting, watershed operations: causes and consequences of watershed deteoration. Definition, different approaches and objectives of watershed management. Peoples participation and organisation. Watershed management plan.	14
Unit 2	Erosion process : Factors affection soil erosion, soil erosion and its types, modelling of erosion using Universal soil loss equation. Groundwater table – depth, perched, capillary rise, recharge. Land capability classification : purpose and basic eight classes.	14
Unit 3	Rainfall and its measurement: Formation precipitation/rainfall, rainfall pattern in India, rainfall parameters, rainfall measurement types. Estimating runoff processes, factors affecting runoff, design of peak runoff through rational and cook's method.	14
Unit 4	Agronomic measures of soil and water conservation. Basic engineering measures for soil and water conservation, contour cultivation, bunding, terracing, continuous contour and staggered trenches, treatment of catchments, gully plugging, check dams, small storage structures, designing of simple bund structure.	14

Books:

1. Common guidelines for watershed development projects (2008). Government of India
2. Dhruva N.V.V., Sastry G.O., (1990): Watershed management, ICAR, New Delhi.
3. Frevert R.K., Schwab G.O., Edminster T.W., and Barnes K.K. (2009) Soil and water conservation engineering, 4th edition, John willey and sons, New York.
4. Jain S.K. and Sing V.P. (2006) Water resources system planning and management, Elsvier India, New Delhi
5. Mukherjee A. (2004) Participatory learning and action: Monitoring and evaluation and participatory monitoring and evaluation, Concept publishing company, New Delhi.
6. Rao K.V.S. (2003) Watersheds: comprehensive development, B.S. Publication.
7. Sharda V.N., Sikka A.K. and Juyal G.P. (2006) Participatory integrated watershed management: A field manual, central soil and water conservation research training institute, Dehradun.
8. Singh R.V. (2003) watershed planning and management, Yash publication, Bikaner

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

PRACTICAL COURSE AGP105 (MINERALOGY&OPTICS+GEOCHEMISTRY)
(100MarksTotalCredits:04)
MINEROLOGY AND OPTICS:-

Sample preparation and obtaining XRD pattern.

Indexing an XRD pattern. Calculation of 2Ø and d spacing values. Calculation of mineral formula of the following; a) Olivine, b)Pyroxene, c)Amphibole, d)Garnet.

Determination of anorthite content of plagioclase by optical properties.

Megascopic and Microscopic identification of major rock forming minerals with emphasis on distinguishing features.

OPTICS:-

Study of optic figures, optic axis, optic sign and flash figures of uniaxial and biaxial minerals. Determination of refractive index of uniaxial and biaxial minerals using various minerals.

Determination of birefringence with the help of Michael Levy chart, quartz wedge and by using berek compensator.

Determination of 2V by 4 axes universal stage. Scheme of Pleochroism.

Geochemistry

Brief outlines of analytical methods and instrumentation.

Analysis of water quality for various purposes- agricultural, industrial and domestic; pH, Conductivity, carbonate, Bicarbonate, Total Hardness, Chlorides, Sulfate and nitrates by titration. Estimation of Ca, Na, K by flame photometer and F, Br, I by Ion analyzer.

Silicate analysis; Preparation of Solution 'A', Estimation of SiO_2 and Al_2O_3 preparation of solution B; Estimation of Total Fe, Na_2O and K_2O.

Calorimetric Methods- Estimation of Cu, Zn, Mo.

Determination of total heavy metals (bloom test) in water and soils.

Note:

Internal evalution for 30 marks are carried out in the form of regular journal completion, viva-voce, field work and report and laboratory tests.

70 marks practical examination shall be held at the end of the semester.

PRACTICAL COURSE AGP106 (SEDIMENTOLOGY AND PALAEONTOLOGY + GEOMORPHOLOGY AND MORPHOTECTONICS)

(100 Marks Total Credits: 04)

SEDIMENTOLOGY AND PALAEONTOLOGY

Megascopic and Microscopic characters of Clastic rocks, Limestone and heavy minerals.

Study of Sedimentary structures and their attributes, study of sedimentary textures -size analysis by sieving and other techniques.

Determination of sphericity and roundness of grains, graphical presentation of data and determination of statistical parameters; insoluble residue analysis and preparation of acetate peels of limestone.

Identification and study of Invertebrate fossils, illustration functional morphology and classification. Identification of Micro-fossils-foraminifera and ostracoda.

Identification of plant fossils- Gondwana and intertrappean. Sample preparation in micropalaeontological studies

GEOMORPHOLOGY AND MORPHOTECTONICS

Drainage basin and morphometry.

Basin demarcation

Ordering of streams–Strahler's and Horton methods

Relief and slope analysis–profiles and maps.

Identification of landforms on toposheets (aerial photographs and satellite imageries) Soils: textural characteristics, study of representatives oil profiles.

Morphometric analysis: bifurcation ratio, Drainage density, stream frequency, constant of channel maintenance.

Note:

Internal evalution for 30 marks are carried out in the form of regular journal completion, viva-voce, field work and report and laboratory tests.

70 marks practical examinations hall be held at the end of the semester.

PRACTICAL AGP 203 (Sedimentary petrology)

1. Identification and description of important sedimentary rocks in hand specimen.
2. Petrographic studies of important sedimentary rocks.
3. Graphic representation of data, histogram, cumulative curves, frequency curves, rose diagram, star symbols.
4. Study of invertebrate fossils, illustration, function and classification
5. Identification of microfossil, foraminifera and ostracods.
6. Identification plant fossil, gondwana and intertrappean
7. Sample preparation in micropalaeontological studies**.**

PRACTICAL AGP 104 (Applied Geomorphology)

1. Study of structural and lithological features from aerial photographs and satellite images,
2. Lineament analysis : Preparation rose diagram and their interpretation
3. Aerial and linear parameters of Drainage basin
4. Relief and slope analysis - Profiles and maps
5. Identification of landforms on toposheets, aerial photographs and satellite images
6. Soils : textural characteristics, study of representative soil profiles

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

PRACTICAL AGP205 (Economic Geology + Indian Stratigraphy)

TotalCredits:04 Marks-100

Economic Geology

Study of Ore Microscope.

Study of Typical Megascopic Ores. Study of Ores under Microscope. Optical Parameters.

Determinative Mineralogy. Study of Ore Textures.

Preparation of Paragenetic Sequence. Ore reserve calculation. Microchemical techniques.

Indian Stratigraphy

Preparation of Indian stratigraphy column

Identification of Precambrian Stratigraphy of South India. Preparation of Dharwar distribution map.

Identification of purana basins of India.

Preparation of tectonic evolution map of cuddapah basin. Map showing evolution of vindhyan stratigraphy. Distribution of Aravali supergroup and Delhi group.

Preparation of map showing Gondwana supergroup and succession from type area. Map showing marine transgression of South India.

Tectonic evolution of Himalayas.

Note: Internal evalution for 30 marks are carried out in the form of regular journal completion, viva-voce, fieldwork and report and laboratory tests. 70 marks practical examination shall be held at the end of the semester.

PRACTICAL AGP 206 (Hydrogeology + Igneous and Metamorphic Petrology)

Total Credits:04 Marks-100

Hydrogeology

Preparation and interpretation of Hydrogeological maps. Computation of Hydraulic Gradient.

Groundwater flow maps and flow net analysis, problem related to Darcy's law.

Analysis of well inventory data, pump test analysis, field techniques and computation of aquifer parameters by different methods.

Use of well logging techniques.

Application of computer programs in solving groundwater problems.

IGNEOUSPETROLOGY:-

Study of the mineralogy and textures of igneous rocks in thin sections.

Calculation of CIPW norms and Niggli calculations for all types of saturated and unsaturated rocks. Megascopic and microscopic study of representative rocks.

Quantitative mineralogical studies on thin section and rock classification. Classification of igneous rocks under IUGS scheme

Classification of volcanic rocks under TAS scheme.

METAMORPHICPETROLOGY:-

Study of representative metamorphic rocks megascopically and microscopically.

Study of mineralogy and structures of metamorphic rocks in thin sections, paragenetic (Chronological) interpretations.

Model analysis and calculations of ACF, AFM, AKF diagrams. Geothemobarometric calculations.

Note: Internal evalution for 30 marks are carried out in the form of regular journal completion, viva-voce, fieldwork and report and laboratory tests. 70 marks practical examination shall be held at the end of the semester.

Practical AGP 202 (Precambrian geology)

Study of Precambrian and proterozoic rocks in hand specimens from known Indian stratigraphic horizons and type localities.
Exercises on stratigraphic correlation and classification of Precambrian rocks.
Exercises on Seismic and magneto-stratigraphic interpretations during precambrian.
Study and understanding of crust during archaean.
Identification Archaean and proterozoiccratons in India.

PRACTICAL

1. Study of drainage pattern
2. Determination of contour interval and profile.
3. Determination of drainage density.
4. Study of water holding capacity.
5. Study of wilting coefficient
6. Estimation of peak runoff
7. Estimation soil erosion
8. Studies based on bund geometry
9. Demarcating contour interval on the field.

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

Softskills ICT, Scientific English, Report writing (Marks 25: Credit 01)

Unit I: ICT and its necessity,Computer software and hardware,operating System software, Software applications, Computer network–types, LAN, Internet WWB, Webservers, browsers and their use,email, ICT softtools- MSword, Ms-Excel, MSPowerpoint. (06)

Reporting the tour/fieldwork, Introduction, Abstract, Aim of the fieldwork, Methodology, Results and conclusions, References(02)

Note:

The evaluation of AGP 107 is at the end of the semester. There shall not be internal evaluation for this.

References:

Computer fundamental (P.K.Sinha), Microsoft office access 2007: The complete reference books, Virginia Anderson, Mc GrawHill publication.

Soft skill ICT, Scientific English, Report writing (Marks:25, Credit:1)

Unit1 : ICT programmes and their implementation, ICT and poverty all eviation, Government of India programme for district level and talukas level computerization, Types of ICT application for rural natural and human resources. Technological challenges of the disaster management plan for the state of Maharashtra and India.

Note:

The evaluation of AGP 207 is at the end of the semester. There shall not be internal evaluation for this.

References:

Information and communication technology: V.C. Pandey. Ishabooks, Delhi.

Information and communication technology in development. Cases from India, Subhash Bhatnagar and Robert Schware.

Paper No: AGT 301 Title: GEOTECTONICS AND PHYSICAL OCEANOGRAPHY
Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit 1:	Plate tectonics; Basic concepts and definition, types of plate margins their characters and associated processes like magnetism, seismicity, volcanism mountain belts, Benioff zones. Tectonic evolution of continents, cratons and ocean basins. Tectonics of Indian sub continent. Orogenesis: Precambrian and Phanerozoic orogenesis, source and nature of tectonic forces, comparision of hypothesis of orogenesis – contraction, expansion, convection, Plume hypothesis and micro plate tectonic, sea floor spreading. Tectonic model of evolution of the Himalayas.	**14**
Unit 2:	Morphologic and tectonic domains of the ocean floor. Structure, composition and mechanism of the formation of oceanic crust. Ocean margins and their significance. Opening and closing of ocean gateways and their effects on circulation and climate during the Cenozoic. Sea level processes and Sea level changes.	**14**
Unit 3:	Estuaries: classification and nomenclature; tides in estuaries; estuarine circulation and mixing; depth – averaged and breadth – averaged models; sedimentation in estuaries; salinity intrusion in estuaries; effect of stratification; Oceanic sediments: Factors controlling the deposition and distribution of oceanic sediments; geochronology of oceanic sediments, diagenetic changes in oxic and anoxic environments. Indian perspective: Ridges deltas, hot spots.	**14**
Unit 4:	The global wind system; action of wind on ocean surface; Ekman's theory; Sverdrup, Stommel and Munk's theories; upwelling and sinking with special reference to the Indian ocean. Inertial currents; divergences and convergences; geostrophic motion; barotropic and baroclinic conditions; oceanic eddies, relationship between density, pressure and dynamic topography; relative and slope currents. Wind driven coastal currents; typical scales of motion in the ocean. Indogangetic delta.	**14**

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)

Paper No: AGT 302 **Title: MINERAL EXPLORATION**
Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1:	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.	**14**
Unit 2:	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 deposits, sample error and check. 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, identification of subsurface structure	**14**
Unit 3:	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.	**14**
Unit 4:	Geochemistry in mineral exploration, classification of geochemical surveys, association of elements, mobility and path finder elements. Geochemical dispersion and landscape: patterns of deep seated origin, formation of productive plutons, geochemical provinces, host rock petrochemistry, ores related 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.	**14**

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. **Reference Books:**

1. Geological prospecting -- Kreiter
2. Mineral Exploration by A.W. Rose, H.E. Hawkes & J.S. Webb
3. Rock geochemistry in mineral exploration by G.J.S. Govette Elsevier
4. Analytical methods in geochemistry prospecting by FleteherW.K.Elsevier
5. Geochemical exploration methods for mineral deposits.by Beus A.A. &Grigorian S.V.
6. Introduction to geophysical prospecting by Dobrin M.B.
7. Outlines of geophysical prospecting for geologists.by Ramchander Rao. M.B. --
8. Fundamentals of Geophysics by William Lowric
9. Applied Geophysics by Telford W.M., Geldart L.P. & Sheriff R.E.

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

Paper No: AGT 303 Title: ENGINEERING GEOLOGY and MINING GEOLOGY
Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit 1:	Engineering properties of rocks., rock discontinuity, physical characters of building stones. Modulus of elasticity for rocks, modulus of deformation. Geological investigation for civil engineering. Geological criterias for site selection of dams, tunnels and reservoir. Dams foundation rock problem. Geotechnical evaluation of tunnel alignment lining, bridgesand transportation routes. Rock man classification methods for restoration of slope	**14**
Unit 2:	Mass movement – land slides and causes of hill slope instability, methods of surface subsurface investigation, slope stability analysis. Earthquakes and seismicity, seismic zones of India. Types of engineering structures involved in watershed management. Problems of groundwater in engineering projects. Geotechnical case studies of major projects in India. RQD properties of soil, low bearing capacity, rock aggregates their classification and properties, manufacturing of sands, aggregates.	**14**
Unit 3:	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.	**14**
Unit 4:	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. Mine restoration and safety.	**14**

Reference Books :-

Engineering Geology by Davis.
Engineering Geology by Parbeensingh.
Principle of Engineering Geology by Krynnen and Judd
Geology and Engineers by Laggets
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)

Paper No: AGT 304 Title: FUEL GEOLOGY AND RESOURCES MANAGEMENT
Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit :1	Role of fuels in national development, Types of fuels, Conventional and Non-Conventional energy resources. eg. Fossil fuels, Coal, Petroleum, Natural gas, Ocean Thermal energy, Wind energy, Biomass energy and Geothermal energy, Tidal energy, Solar energy and Energy from the waste. Status of Conventional and Non- Conventional energy resource in India.	**14**
Unit :2	Physical properties of petroleum, composition of petroleum and natural gas; genesis of hydrocarbons, conversion of organic matter to petroleum, migration and accumulation of oil; study of reservoir rocks, trap rocks and cap rocks; different types of traps including structural traps, stratigraphic traps and combination traps, salt dome; methods of petroleum exploration; Enhanced recovery operations for petroleum and natural gas. Oil producing basins of India and their stratigraphy and structure. Shale and oil gas hydrates	**14**
Unit :3	Origin and composition of coal, Coal petrographic, classification of coal deposits, chemical constituents of coal, distribution and stratigraphyof Tertiary and Gondwana coal in India.	**14**
Unit :4	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 . Distribution in India. Brief introduction to radioactive surveys.	**14**

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.
Petroleum Geology by Levorson

AGT 301. a(Elective): MARINE GEOLOGY: 70 marks

Unit 1	Plate Tectonics and large scale earth processes. Historical development of plate tectonics. Mid Ocean Ridges, Subduction Zones, Plate Tectonic Cycle, Driving mechanisms. Sea Level changes, Mineral resources :Polymetallic nodules, phosphorites, carbonates, placer deposits and petroleum resources, gas hydrates with special reference to Indian Ocean.	14
Unit 2	Oceanic sediments: Factors controlling the deposition and distribution of oceanic sediments; Sedimentology and sedimentary processes. Different types/classification of sediments in the ocean basins, composition of sediments, distribution & source of sediments on mearshore areas. Surveying, sampling and laboratory techniques for the study of coastal and estuarine sediments.Analysis of sedimentological data and interpretation Coastal Geomorphology : Erosion, Transportation, Deposition by sea. geochronology of oceanic sediments.	14
Unit 3	Morphologic and tectonic domains of the ocean floor. Structure, composition and mechanism of the formation of oceanic crust. Seawater-basalt interactions, hydrothermal vents- chemical and biological significance of hydrothermal vents systems. Ocean margins and their significance. Ocean Circulation, Coriolis effect and Ekman spiral, convergence, divergence and upwelling, El Nino. Thermohaline circulation and oceanic conveyor belt. Tectonic evolution of ocean basins.	14
Unit 4	Paleoceanography –Approaches to paleoceanographic reconstructions; various proxy indicators for paleoceanographic interpretation. Joint Global Ocean Flux Study (JGOFS) and its applications in Paleoceanography. Ocean Drilling Programme and its major accomplishments in paleoceanography. Opening and closing of ocean gateways and their effect on circulation and climate during the Cenozoic. Sea level processes and Sea level changes.	14

Books & References:

1. Introductory oceanography (5th ed), 1988 Thurman,H.V., Mercill Publ. Co, Ohio.
2. Oceanography (5th ed), 1990 –Grant Gross, M., Prentice Hall.
3. Coastal and estuarine sediment dynamics, 1986 – Dyer,K.R., John Wiley & Sons.
4. Beach processes and sedimentation, 1976 – Komar, P.D., Prentice Hall
5. Beaches and Coasts (2nd ed), 1972 – King, C.A.M.,Edward Arnold
6. Introduction to marine micropaleontology, 1978 – Haq, B.U. and Boersma, A. (Eds.), Elsevier
7. Introduction to geophysical prospecting, 1976 – Dobrin, M.B., McGraw-Hill.
9. The mineral sources of the sea, 1965 – Mcro, J.L.,Elsevier, Amsterdam.
10. Earth resources. 1969 – Skinner, B.J., Prentice Hall
11. Marine minerals: advances in research and resource assessment, 1987 – Teleki, P.G. et al. D. ReidelDordrechart.
12. Marine geology and oceanography of the Arabian Sea and coastal Pakisthan 1984 – Haq. B.U. and Milliman, J.D., Van Norstrand Reinhold Co.
13. Marine Geology, 1982 – James P. Kennet. Prentice Hall INC Englewood, Cliffs, N.J. 07632

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

AGT 303 b (Elective) : GEOTECHNICAL ENGINEERING 70 Marks

Unit 1	Importance of geological studies in engineering investigations, dependence of design on geological features of project site. Complexity of soil structure, major soil deposits of India, Field identification of soils. Introduction to soil exploration-objective and purpose. Three phase soil system, weight -volume relationships, Index properties of soil–methods of determination and their significance. IS and Unified Soil classification systems.	
Unit 2	Subsurface Explorations for Water Retaining Structures: Various Physical and Mechanical properties of rocks affecting strength & water tightness of them from foundation point of view. Effect of weathering, deterioration of rock masses on exposure to atmosphere & hydrothermal alteration of rocks on water retaining structures & suitable treatment for such rocks. Geological Foundation Treatments for weak and fragmented rock, fractured rocks, jointed rock, leakages etc. in various Civil Engineering Projects .	
Unit 3	Rock Mechanics: General principles of rock mechanics. Dependence of physical and mechanical properties of rocks on geological characters. Various laboratory testing methods. Calculation of R.Q.D. Joint Frequency Index, Various Methods of Geomechanical classifications of rocks such as Terzahagi, U.S.B.M, R.M.R., R.S.R., Q. system, Deer and Miller, Bieniawaski'sGeomechanical classification etc. and computation of representative rock formation such as DTB.	
Unit 4	Stability of Slopes- Classification of slopes and their modes of failure, Taylor's stability number, Infinite Slopes in cohesive and cohesion less soil, Landslides- Causes and remedial measures. Introduction to Geoenvironmental engineering, subsurface contamination, contaminant transport, effects of subsurface contamination, Control and remediation, Soil- A geochemical trap, detection of polluted zones, Monitoring effectiveness of designed facilities.	

Books &References :

1. Jaeger – Rock Mechanics in Engineering, Cambridge Univ Press London, 1990.
2. Megaw T. M.& Tunnels: Planning, Design, Construction
3. Goodmann – Engg. Geology.
4. J. V. Bartlett - Int. ED, Ellis Horwood ltd. John Willey & Sons
5. Bieniawski Z. T. - Engineering Classification of jointed Rock Masses.
6. Introduction to Rock Mechanics by B. P. Verma-Khanna Pub New Delhi

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

Paper No: AGT 401 Title: ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT

Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit 1	Fundamental concepts of Environmental Geology, Concept of ecosystem – biotic communities, food chain and Ecologic Pyramids. Biogeochemical cycles. Impact of anthropogenic activities on air, water and soil resources. Their types, sources and causes of pollutants, coastal pollution; mixing and dispersal of pollutants in estuaries and near-shore areas; coastal zone management.Controlling measures.	**14**
Unit 2	Waste: Source and classification of waste products. Waste disposal and recycling methods. Control and management of waste materials.Impact assessment of anthropogenic activities such as urbanization, open cast mining and quarrying, disposal of mine and radioactive wastes, fly ash, use of fertilizers. Environmental protection – legislative measures in India. Remediation measures.	**14**
Unit 3	Study of Natural Hazards like meteorite impact hazard, landslides, floods and drought, earthquakes, mining, volcanic eruptions: their classification, causes, assessment, prediction and controlling measures. Use of GIS and remote sensing in natural disasters management. Preparedness for relief and recovery operations	**14**
Unit 4	Case histories of natural disasters of India viz. Koyana earthquake, Killari earthquake, Uttar Kasi, Nepal earthquake, Jammu and Kashmir ,Uttarakhand floods, East coast cyclones, Tsunami, drought prone regions of India with special reference to Maharashtra,	**14**

Reference:

Environmental chemistry; A.K. De
Environmental Geology; Keller
Environmetal Geology; Valdiya
Mineral economics : Sinha and Roy.
Mineral economics : Chatterjee.
Indian Bureau of Mines, Govt. of India.
Handbook of energy technology by V. Daniel Hunt.

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

Paper No: AGT 402 **Title: REMOTE SENSING and GIS:**
Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1	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.	**14**
Unit 2	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.	**14**
Unit 3	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.	**14**
Unit 4	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. Use of GIS in lithological, structural, groundwater and mineral exploration. Introduction to Global Positioning System,and its applications and limitations.	**14**

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.
PhotogeologybyPanda
Textbook of Remote sensing and GIS by M. Anjireddy

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

Paper No: AGT 403 Title: PLANETARY GEOLOGY AND CLIMATE
Load/week:04 Total load : 56 Credits:04 Marks: External :70
Internal:30

Unit 1	Solar system : major concepts, planets, satellites, asteroids, meoteorites and comets; formation and internal differentiation of the planets; general features of terrestrial and Jovian planets. Planetary atmosphere; exogenic and endogenic processes association with origin and internal evolution of planets – Planetary volcanism, craters, impact cratering processes, elemental composition, mineralogy and petrology; thermal, seismic and magnetic properties and chronological techniques.	**14**
Unit 2	Planetary surfaces, atmospheres, interiors, magnetic fields, and ring systems and their associated origins. The Sun and its effects on the planets. The moon and its terrestrial analog IO, Phobos and Deimos, minor bodies such as asteroids, comets, meteorites. Past, present and future planetary exploration mission.	**14**
Unit 3	Earth's atmosphere: evolution, structure and chemical composition, Solar radiation and terrestrial radiation: electromagnetic spectrum, latitude and seasonal variations, effect of atmosphere, greenhouse effect and heat budget, Temperature measurements and controls, lapse rate and inversion of temperature.	**14**
Unit 4	Atmospheric pressure and winds: pressure measurement and distribution, wind observation and measurement, factor affecting wind, geostrophic wind and gradient wind, local winds, models of general circulation of the atmosphere, Jet stream, Atmospheric moisture: forms of condensation and precipitation, hydrological cycle, Stable and unstable atmosphere: environmental lapse rate, dry and wet adiabatic lapse rate and atmospheric stability, Air masses: classification and modification, Fronts: characteristics and types, Classification of climates : Thornthwaite's and Koppen's classification.	**14**

Reference books:

Foure G., and Mensing T.M., Introduction to Planetary Science

Taylor and Francis, Introduction to Planetary Geology

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

Paper No: AGT 404 **Title: RESEARCH METHODOLOGY**
Load/week:04 **Total load : 56** **Credits:04** **Marks: External :70**
Internal:30

Unit 1:	**Formulation of Research Problem:** Criteria of quality research, types of research, significance, literature review, purpose, process of literature review, analysis of an article, search engine, formulation of research problems. Research ethics and plagiarism.	**14**
Unit 2:	Definations of problem, objectives of research, planning of experiments, data collection and record keeping, results and discussions, presentation of research outcome as a research paper or filing patent.	**14**
Unit 3 :	Indices, publications, types, Impact factor, calculation of Impact Factor, uses, Calculation of immediacy Index, SCOPUS index, h – index, advantages, criticism ISSN, ISBN numbers.	**14**
Unit 4:	Various search engines available on internet, normal vs advanced search, key – words, formulation of search statement, Listing various journals in relevant topic, Science abstracts, e – database. Application of Computers in research, internet browsing, tool bar options, provisions of MS – word, MS – Excel, MS – PowerPoint, Coral draw, SPSS	**14**

Reference Books:

1. Research Methods - Ram Ahuja, Rawat Publications
2. Philosophy of Science – Mario Bunge, Transaction Publishers
3. Research Methodology - Methods and Techniques, C. R. Kothari New Age
4. Fundamentals of Statistics - Goon, Gupta and Das Gupta (Vol. I & Vol. II)

INTERNAL EVALUATION **(30 Marks)**

(Seminar + Term paper + Test)

GIT 303: ADVANCED TECHNIQUES IN GIS **(Marks: External 70)**
Internal 30

1	**Surface Analysis & decision making models**	Interpolation Method, Dem, Tin, Variance Filter, Slope and Aspect, Relief And Hill Shading. Fuzzy Logic, Operation On Fuzzy Set Fuzzy Vs. Boolean, Basic Rules Of Inference, Artificial Neural Network.	**14**
2	**Recent Trends In GIS**	**Recent Trends:** Location Based Services, Virtual Globe, Enterprise Resource Planning, SAP ERP. **Internet and GIS:** Introduction, History, Services, Open Geospatial Consortium (OGC), Geographic Markup Language (GML), Keyhole Markup Language (KML), Web Map Services.**WEB GIS. Open source GIS**	**14**
3	**Spatial Decision Support System (DSS)**	Introduction, Process of spatial Decision Making, Types of Problems, Characteristics of DSS, Efficiency and Effectiveness of Decision Making, Architecture of A DSS, Spatial DSS and Expert System	**14**
4	**Spatial Multicriteria Decision Analysis**	Introduction, Components, Estimation of Weights: Trade off Method, Rating Method, Ranking Method, Weighted Summation, Paired Comparison. **Spatial Data Mining :** Method of Knowledge Discovery In Spatial Database, Spatial Mining Tasks: Spatial Classification, Spatial Clustering, Association Rules	**14**

INTERNAL EVALUATION **30 MARKS**
(Seminar+Termpaper+Test)

Reference Books:

- GIS and Multi-criteria Analysis by MakrewskiJacek, USA, 1999.
- Principals of GIS by Burrough P.A. Mac Donneli R.A. published by Oxford University Press, 2000.
- Expert Systems and Applied Artificial Intelligence, E. Turban, Macmillan, 1992
- Introduction to Expert Systems, Peter Jackson, Harlow, England: Addison Wesley Longman, 1999.
- Neural networks: A comprehensive Foundation, Simon Haykins, Prentice Hall Inc., 1999.
- Fuzzy sets, uncertainty and information, Geroge J. Klir, Tina A. Folger, Prentice Hall inc., 2000.
- Genetic Algorithms in Search, Optimization, and Machine Learning, Goldberg, David Edward, Addison-Wesley Pub. Co., 1989
- Genetic Programming: On the Programming of Computers by Means of Natural Selection, J. Koza, The MIT Press, 1992.

AGP 305 PRACTICAL RELATED TO AGT 301 AND AGT 302 (70 marks)

Practical AGT 301 (Geotectonics and Physical oceanography)

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.
Maps related to Ocean features

Practical AGT 302 (Mineral exploration)

Reserve calculation problems
Problems on structures and site selection
Management of resources
Types of reconnaissance and determinative mineralogical aspects.
Sample analysis using AAS *
Mineral characterization using XRD *

*With the help of common facility centre of Instrumentation.

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)

Practicals of Engineering Geology:

Salient points for the construction of contours of bunds, stream bunds, percolation tank, subsurface dam etc.

Use of morphometric analysis in planning watershed development.

Plotting of chemical data of water samples from watershed area.

Structural maps for engineering construction

Engineering properties of rocks.

Determination of Rock strength and soil strength.

Ground subsidence and their improvement techniques.

Practicals of Mining Geology:

Mine valuation and calculation

Mine survey problems.

Terminology of mines

Calculation of reserve

Practical AGT 304(Fuel Geology and Resources Management)

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.

Isopach maps of petroleum reserve

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.

INTERNAL EVALUATION (30 Marks)

(Viva-voce + Journal + Data evaluation)

Practical AGT 301 (Marine Geology)

Beach profile plotting and volume computation-

Pretreatment of sediment- Grain size analysis (sand grade) - Grain size data computation, graphical representation and interpretation
Depositional environment studies using a data set of river, dune and beach
Techniques for heavy mineral separation
Computation of gravity data- Computation of Graphical representation and interpretation of bathymetry data set
Study of bathymetry maps - Study of seismic profiles

INTERNAL EVALUATION (30 Marks)
(Viva-voce + Journal + Data evaluation)
A 15 to 21 days field study tour is compulsory for all the semesters.

Practical AGP 304 Geotechnical Engineering

1. Study of Engineering Geological map
2. Study and Interpretation of seismic zonation map of India
3. Preparing geological cross sections from drill hole data & using them for designing of civil engineering structures in folded & faulted region, spillways on igneous rocks etc.
4. Study of soil profile of different terrains of India
5. Study of Morphometric parameters of terrain
6. Computation of RQD & Joint Frequency Index

INTERNAL EVALUATION (30 Marks)

(Seminar + Term paper + Test)

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.

AGP 405 PRACTICAL RELATED TO AGT 401 AND AGT 402 (70 marks)

Practical AGT 401 (Environmental Geology & Disaster 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.
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(Remote Sensing & GIS)

Determination of photo scale and height determination
Study of different erosional, depositional landforms and tectonics landforms.
Interpretation of lithology and structures from aerial photographs and satellite imageries.
Study and analysis of lineaments and drainage from aerial photographs.
Nature of sources of geographical data.
Georeferencing and digitization
Preparation of DEM/DTM
Slope, buffer, mosaicing and overlay analysis

INTERNAL EVALUATION (30 Marks)

(Viva-voce + Journal + Data evaluation)

AGP 406 PRACTICAL RELATED TO AGT 403 AND AGT 404 (70 marks)

Practical AGT 403 (Planetary Geology and climate)

Interpretation of daily weather report
Wind rose diagram; Line graph; Dispersion diagram
Study of Planetary images and construction of geological maps from orbital images of Terrestrial planets.
Study of meteorites.

Practical AGT 404 (Research Methodology)

Students had to do project work on allotted topics

INTERNAL EVALUATION (30 Marks)

(Viva-voce + Journal + Data evaluation)

GIP 303 PRACTICAL OF ADVANCED TECHNIQUES IN G I S
(Marks: External 35)

Internal 15

1	Overview of Q GIS software (Open source)
2	Interpolation: IDW, Kriging
3	Surface Analysis: DEM, Slope, Aspect, Contour, Hillshade, Viewshade, TIN
4	Google Earth: Layer creation : Point, Line, Polygon
5	Site suitability Analysis using Multi Criteria Analysis In Arc GIS

INTERNAL EVALUATION 30 MARKS
(viva-voce+jour

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.