MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI
PG - COURSES – AFFILIATED COLLEGES
Course Structure for M.Sc. Geology
(Choice Based Credit System)
(with effect from the academic year 2016- 2017 onwards)
(44th SCAA meeting held on 30.05.2016)

Sem	Sub 'Pr. No.	Subject status	Subject Title	Hrs/ week	Cre - dits	Marks				
						Maximum			Passing minimum	
						Int.	Ext.	Tot.	Ext.	Tot.
III	12	Core – 7	Igneous Petrology	5	4	25	75	100	38	50
	13	Core – 8	Sedimentary Petrology	5	4	25	75	100	38	50
	14	Core – 9	Research Methodology	5	4	25	75	100	38	50
	15	Elective –III (Choose any one)	a) Applied Geology (Engineering Geology,Mining Geology and Ore Dressing**)** b) Social Geology c) Nano Geo Sciences	5	5	25	75	100	38	50
	16	Practical - III	Igneous Petrology, Sedimentary Petrology & Elective – Applied Geology	10	-	-	-	-	-	-

IV	17	Core – 10	Metamorphic Petrology	5	4	25	75	100	38	50
	18	Core – 11	Economic Geology & Mineral Economics	5	4	25	75	100	38	50
	19	Core – 12	Applied Geology –II (Geophysics & Geo Chemistry)	5	4	25	75	100	38	50
	20	Practical – III	Igneous Petrology, Sedimentary Petrology & Elective – Applied Geology	--	3	50	50	100	25	50
	21	Practical- IV	Metamorphic Petrology, Economics Geology& Applied Geology –II(Geo Physics and Geo Chemistry)	10	4	50	50	100	25	50
	22	Practical – V	Geological Mapping and Field studies Mapping Short field trips and Professional training Field training and Specimen Collection Viva voce on mapping field training, industrial training and short field trips Project evaluation and Viva Voce	--	4	50	50	100	25	50
	23	Practical – VI	Project evaluation and vivo voce for Project	--	-	50	50	100	25	50
	24	Project	Project	5	9	50	50	100	25	50

MSU / 2016-17 / P.G-College / M.Sc. (Geology) / Semester-III / Ppr.no.12 / Core – 7

Igneous Petrology

UNIT I

Forms, structures and textures of igneous rocks and their significance-classification of igneous rocks - mineralogical and chemical, C.I.P.W, Niggli, Tyrrel, IUGS and Rosenbusch.

UNIT II

Application of physical chemistry in petrogenesis-phase rule and equillibrium in silicate system - consolidation of magma with binary systems and ternary systems - crystallization of two component systems diopside – anorthite system,alibite-anorthite system, leucite - silica system, and crystallization of three component systems Alibite -anorthite – diopside system, Anorthite – forsterite - silica system, Diopside-forsterite-silica system Nephline-kalsilite-silica system and Anorthite-leucite-silica system.

UNIT III

Crystallization of Magma with Particular Reference to Basaltic Magma-Reaction Principle-Diversity of Igneous Rocks - Petrographic Provinces-variation diagrams.

UNIT IV

Petrography and Petrology – Granite clan, Syenite clan, Gabbro clan, Lunar rocks, Ultrabasic and Ultramafic rocks, Peridotite, Dunite, Lamprophyre, Pegmatite, Aplite, Basalt, Spillite and Keratophyre.

UNIT V

Petrogenesis of Granite, Pegmatites, Alkaline rocks, Anorthosites, Carnbonatites, Charnockite, Ultrabasic rocks and Lamprophyres.

References:

1.Tyrrel,G.W,1963 Principle of petrology. Methunn&co
2.Turner,F.J,Verhoogen,J.1960-Igneous and Metamorphic petrology, McGraw Hill Co,Newyork.
3.Bowen,n.l.,1968 -Evolution of igneous rocks dover publication.
4.Huang,T,1962-Petrology McGraw hill book.Co .,
5. Hatch, F.E, Wells, A.K and Wells, M.K, 1949- Petrology of igneous rocks, Thomas Mury and co.
6. Hyndman, Donald, 1972- Petrology of Igneous and Metamorphic rocks,mcgraw hill book co…
7. Raymond,L.A ,2002 - Petrology, McGraw Hill book co., New York.

Sedimentary Petrology

UNIT I

The texture of sediments-size, shape and roundness, porosity and permeability. textures of non - clastic sediments – the mechanical and chemical structures of sedimentary rocks-classification of sedimentary rocks - graban, krynine, pettijohn and Goldschmidt.

UNIT II

Study of important clastic and non-clastic rocks, sandstones, classification.terminology, chemical composition, origin of chemical cements. Mud rocks - mineral and chemical composition, sedimentary structure, compaction of mud rocks and porosity.

UNIT III

Mineralogy, carbonate frame work, Organic matter, Limestone, sedmentary structures. Diagenetic process. Sedmentary classification of limestone. Dolomite –primary and secondary mechanism of dolomitisation, dedolomitisation. Evaporites and native sulpur. Chert-texture, genesis and origin. Phosphates-mineralogy and genesis.

UNIT IV

Concept of sediment size and grade scale - principles of mechanical analysis, parameters of the frequency distribution of sediments-median, mode,mean,sorting velocities of small particles-stoke's law. Porosity and permeability and their determination in sediments. Measurement of roundness and sphericity and their significance.

UNIT V

Methods of heavy minerals seperation and their sigificance in sediments-sedimentary environments and facies-diagenesis and lithification-physical and chemical factors in sedimentation.

References:

1. Blatt H, Middletion, Grand Murray.R, 1972.Origin of sedimentary rocks, Prentice Hall.
2. Carver,R.E.197. Procedures in sedimentary petrology, Inter Science.
3. Folk.F.L., 1968.Petrology of sedimentary rocks Hempill's University station Texas,.
4. Krumbein W.C.and Pettijohn F.J. 1938, Manual of sedimentary petrology, Appleton Century co.
5. Pettijohn F.J.,Potter,p.e. 1972.Silver.r.sand and stones. Springer-Verlag.
6. Pettijohn F.J. 1857. Sedimentary rocks.harper&row,.
7. Selley R.C. 1972. Ancient sedimentary environments Corwell University press.

MSU / 2016-17 / P.G-College / M.Sc. (Geology) / Semester-III / Ppr.no.14 / Core - 9

Research Methodology

UNIT I

INTRODUCTION TO RESEARCH: Definition – scientific Method – Bias and Prejudice in scientific research – Hypothesis, theory and scientific Law – Research design – Preparation of research project – Report writing.

UNIT II

THESIS WRITING: Structure of thesis - Copyright waiver- Declaration - Title page - Abstract - Acknowledgments - Table of contents - Introduction - Literature review - Materials and Methods - Theory - Results and discussion - Conclusions and suggestions for further work – Summary - References – Bibliography - Footnotes and endnotes and appendices

UNIT III

FIELD WORK IN GEOLOGY: Field instruments (Geological Rock Hammer, Brunton, GPS, Altimeter, pedometer), Essentials of topographic and geological maps and mapping - pre-requirements and sampling of geological specimens (fossils, rocks, oriented rocks, groundwater and unconsolidated sediments), measurements of structural features in rock types – bedding, lineation, foliation, fold, fault, shear zone and unconformity.

UNIT IV

INSTRUMENTATION: General principles, description and uses of following: Polarizing microscopes, ore microscopes, Scanning Electron Microscope, mirror stereoscope, heavy mineral separators (mechanical and electromagnetic). Analytical instruments: General principles, description and uses of following; XRF, XRD, Atomic Absorption Spectrophotometer, Electron Probe Micro Analyzer, Inductively Coupled Plasma – MS.

UNIT V

GEOLOGICAL LABORATORY PROCEDURES: Maceration techniques, thin section making, induration techniques for unconsolidated sediments, tracers, staining techniques for feldspar identification - Construction and use of wind rose, fence diagram, Wolf's net, equal area, trilinear diagram.

References

1. Phillips, E.M and Pugh, D.S., 1994. 'How to get a PhD: a handbook for students and their supervisors'. Open University Press, Buckingham, England.
2. Tufte, E.R., 1983. 'The visual display of quantitative information'. Graphics Press, Cheshire, Conn.
3. Mishra R.P., 1989. Research Methodology. Concept Publishing Co, New Delhi..
4. Comption R.R., 1962.Manual of field geology, Wiley.
5. Lahee H., 1959. Field geology, McGraw-Hill.

MSU / 2016-17 / P.G-College / M.Sc.(Geology) / Semester-III / Ppr.no.15 / Elective - III (a)

Applied Geology (Engineering Geology,Mining Geology and Ore Dressing)

UNIT I

Engineering Geology: Role of engineering geology in civil construction and mining industry various stages of engineering geological investigation for civil engineering projects. Engineering properties of rocks, properties of building stones - soil physical and engineering properties of soils - classification of soil and soil groups of India - Granite industries.

UNIT II

Geological consideration for evaluation of Dams and Reservoir sites Dam foundation,rock problems. Geochemical evaluation of tunnel alignments and transportation routes. Method of tunneling, soft and hard rock tunneling. Earthquake and seismicity,seismic zones of India. A seismic design of building. Influence of geological conditions on foundation and design of buildings.

UNIT III

Mass movement- Landslides-and their causes. Land subsidence and their causes and prevention measures. Geological investigation pertaining to foundation of Bridges and Highways.Types of engineering structures to prevent coastal erosion. Improvement of sites – Grouting – back filling and site reinforcement – Rock bolting – soil stabilization.

UNIT-IV

Mining Geology : Prospecting, Sampling and evaluation of ore resources. Definition of terms – Open cast and underground mining. Alluvial mining, Underground mining methods,Coal mining methods, Room and Pillar method, Longwall advancing Long wall retreating, Horizon mining , Underground hydraulic mining and strip mining.

UNIT – V

Ore Dressing: General Principles- Size reduction, Rod mills, Ball mills and Tube Mills. Screening. Principles of Magnetic separation and electrostatic separation. Floatation - Beneficiation of some important metals: Copper – Aluminium – Iron – Gold – Manganese – Titanium – Zinc – Lead.

References:

1. Richards R.H.and C.E. Lecke, 1927. Hand book of ore dressing , Mc.Graw Hill Book co.
2. Gaudin A.M., 1939. Principles of mineral dressing , Mc – Graw Hill Book co.
3. Truscott S.J. 1923– Text book of ore dressing , Macmillan co.
4. Gohahle and Rao, T.C. 1972. ore deposits of India – Thosman Press India ltd.
5. Krynine and Judd – Principle of Engineering Geology and Geotechniques.
6. Valdiya, K.S. 1987.Environmental Geology - Indian Context, Tata – McGrawhill New Delhi.1977.
7. Arogyaswamy , R.N.P. 1996. Courses in mining geology , Oxford & IBH – Publishers.

MSU / 2016-17 / P.G-College / M.Sc. (Geology) / Semester-III / Ppr.no.15 / Elective – III (b)

Social Geology

UNIT I

GEOLOGICAL HERITAGE: Needs to protect-measures of conservation-brief description of any five geological heritage locatites of India-Geologial organizations of India - Role of geologist in Nation building - Case histories of people's movement to protect land and water.

UNIT II

WATER RESOURCES: Interlinking of Rivers-Surface water and Groundwater Budget-Groundwater Borewell Strategies for Optimal Use-Groundwater borne diseases and mitigation measures- quality standards for potable water – Ground water exploitation by industries and its social implications: conservation and conjunctive use – Rainwater harvesting.

UNIT III

DISASTER PREPAREDNESS: Personal, private and public precautions and safety measures to be observed before, during and after geological events such as earthquakes – tsunamis – landslides - caving and fire in petroleum and coal fields.

UNIT IV

SOCIAL IMPLICATION OF MINING: Environmental issues concerning mineral mining - geological and social effects of river sand abstraction-Rehabilitation of local populace of mine area-Land reclamation-mining waste disposal.

UINT V

MINERAL ECONOMICS: National Mineral Policy-Mineral wealth of India-Mining laws-minor and major minerals-mineral royalties - Geological modification due to developmental activities-coastal regulation.

References

1. Knell, S.J., 2000.Thed Culture of English Geology, 1815-1851:A Science Revealed Through its Collecting.UK:Ashgate,400pp.
2. Prasad, K.N., 2006.An Introduction to Earth Science: Heritage Site. A.P.H.Publishing Corporation.
3. Bell. F.G. 1998. Environmental Geology Princiaples and Practice. Blackwell science. Oxford.597.
4. Rowe. R.K. Geotechnical and geoenvironmental engineering handbook . Ed. R.K. Edition. U.S.A.

Nanogeosciences

UNIT – I

INTRODUCTION TO NANOGEOSCIENCE: Introduction – Definition – Applicable fields of study – Types and environment of nanoparticles – Natural and anthropogenic inputs – Size – dependent stability and reactivity of nanoparticle – Benefits – Risks – Remediaation.

UNIT – II

NANOMINERALOGY: Nanocrystal – Transformation of nanoparticle structure – Nanoparticle growth – surface impurities – Biomineralization: microbial biomineralization – Nanostandard materials.

UNIT – III

NANOSYSTEMS: Mineral-water-bacteria – Biomimetic Soils and sediments – Atmospheric particulates- Carbon cycle – Organic-Inorganic Nanoparticle Interactions in sedimentary systems – Magnetic nanomaterials – Biogenic magnetite – Zeolites,Clays, Fe-Ti oxides, and phosphate minerals.

UNIT – IV

NANOTECHNOLOGY: Brief principles and description of :calorimetry, UV visible Infra-Red, Raman and NMR spectroscopy,Scanning electron microscopy (SEM) Atomic Force Microscopy, Electron Microprobe and High-Resolution Transmission Electron Microscopy – Definition and applications of nano-satellites and micro-satellites.

UNIT-V

NANOMATERIALS: Properties at the nanoscale – Categories: Metal and Ceramic Nanopowders,Carbon Nanotubes and Nanospheres, Nanowires, Quantum Dots, Dendrimers, Protein and Structured Polymer Strands – Nanometrology – Dispersions – Top-down and Bottom-up methods.

References:

1. Andersen, M.M. and Rasmussen, B., 2006. Nanotechnology development in Denmark-environment opportunities and risk. Riso National Laboratory, Denmark.
2. Chemical Industry R&D Roadmap for Nanomaterials By Design: From Fundamentals to Function,2003. www.ChemicalVision2020.org.
3. Cientifica,2003.”The Nanotechnology Oppurtunity Report”,2nd Edition, Executive Summary. CMP Cientifica,2002.”Nanotechnology”The Tiny Revolution.
3. Nartikar.Y.Y. Fu. 2010.Hand book. Nanoscience and Technology.
4. Muralidharan. V.S. M 1998. Nanoscience. Alagappa Chettiar College of Engineering technology.

MSU / 2016-17 / P.G-College / M.Sc. (Geology) / Semester – III / Ppr.no.16 / Practical III

Practical exam IV Semester / end of Second year
Practical III

IGNEOUS PETROLOGY, SEDIMENTARY PETROLOGY AND
ELECTIVE APPLIED GEOLOGY SUBJECT

Megascopic and mircoscopic study of igneous, sedimentary rocks. Petrochemical calculations CIPW Norm, Variation diagram of Harker, Niggli and ACF, AKF, AFM diagrams, determination of various parameters of sedimentary rocks and their interpretations, Mechanical analysis of sediments - Graphic representation and statistical analysis of data. Mineral seperation in sediments.

Problems related to engineering geology, Mining geology, ore dressing, / Social geology/ Nano geoscience. Ore reserve estimation.

MSU / 2016-17 / P.G-Colleges / M.Sc. (Geology) / Semester – IV / Ppr. no.17 / Core - 10

Metamorphic Petrology

UNIT I

Agents and kinds of metamorphism, the Gibbs Phase Rule and Goldschmidt's mineralogical phase rule.

UNIT II

Classification of metamorphic rocks. Metamorphic textures and structures. Metamorphic grades and zones concepts-depth zones, contact metamorphic zones, Barrowian zones, Buchan zones, Sanbagawa zones, Franciscan zones, Dharwarian zones. Paired metamorphic belts.

UNIT III

Concept of metamorphic facies.facies classification of metamorphic rocks.Views of Eskola, Winkler, Turner and Verhoogen. Graphical representation of facies diagrams - ACF and AKF diagrams. Metamorphic differentiation. Metasomatism, Granitisation.

UNIT IV

Thermal, cataclastic ,and regional metamorphism and their effects on carbonates,argillaceous,arenaceous and acid ,basic and ultrabasic igneous rocks. Retrograde metamorphism.

UNIT V

Migmatisation, Charnockitisation, Palingenesis, Origin of Eclogites, origin of Amphibolites metamorphism In relation to plate tectonics, Magmatic emplacements and orogenesis.

REFERENCES

1. Tyrrell, G.W. 1963. Principles of Petrology, Methunn, Co.
2. Winkler H.G.F. 1974. Petrogenesis of Metamorphic rocks, Third Edn. Springer Verlag.
3. Turner F.J. 1968. Metamorphic Petrology, McGraw Hill.
4. Miyashiro, A. 1973. Metamorphism and metamorphic belts Allan and Unwin.
5. Hyndman, F.D. 1972. Petrology of Igneous & Metamorphic rocks McGraw Hill.
6. Bhaskar Rao,1986, Metamorphic petrology, International Book house, Second ED,m 12. Bangalow Road, Delhi- 110 007.Williams, H ,F.J Turner and C.M., Ghilbert, 1954, Petrography. W.H. Freeman and Co.,
7. Winkler, H.G.S. 1979. Pertogenesis of Metamorphic rocks, Springer Verlag Vth ed.

MSU / 2016-17 / P.G-Colleges / M.Sc. (Geology) / Semester – IV / Ppr. no.18 / Core – 11

Economic Geology and Mineral Economics

UNIT-I

Concept - Scope of study- Peculiarities In mineral industry - A brief outline of World's mineral resources including marine origin. Mining laws - major and minor minerals - royalty on minerals- an overview of the mines and minerals (regulation and development) act. Tenor, grade and specification of ores.

Unit II

Strategic, critical and essential minerals - classification of minerals from military point of view - Mineral conservation and substitution - Outline of National Mineral policy. Process of formation of mineral deposits; Magmatic concentration – Contact metasomatism-Hydrothermal processes-Metasomatic replacement –Sedimentation- Evaporation – Residual and mechanical concentration – Oxidation and supergene enrichment – Metamorphism.

Unit III

Controls of ore localization, Mineral paragenesis and zoning, Geothermometry, geobarometry, paragenetic sequence, zoning and dating of ore deposits. Features, structures of ore and gangue minerals. Fluid inclusions, wall rock alteration. Metallogenic Epochs and Provinces – Geologic setting and genesis of the following Indian mineral deposits. Iron, Manganese, Chromium, Nickel, Cobalt, Vanadium, Molybdenum, Tungsten, Copper, Lead, Zinc, Tin, Gold, Silver, Aluminium, Magnesium, Titanium, Uranium, Thorium, Mineral wealth of Tamilnadu and Pondicherry.

Unit IV

Minerals used in the manufacture of cement, Abrasives, Precious and semi-precious minerals, Refractories, Metallurgical, Fertilizer, Building Industries, Ceramics, Glass, Chemicals, Paints and Pigments and Insulators – Mineral water and Ground water.

Unit V

Ore microscopy – The ore microscope, Preparation of polished surface of ores, Physical and optical properties of ore mineral, microchemical techniques and applications of ore microscopy. Techniques of investigations in ore mineragraphic studies.

References:

1. Bateman. A.M. Economic mineral deposits, John Wiley & Sons
2. Krishnaswamy. S . 1972.India's Mineral Resources, Oxford and IBH Publishers New Delhi .
3. Gokhale and Rao Oredeposits of India, Thompson press, New Delhi.
4. Sinha,R.K.,sharma,N.L.,1976-Mineraleconomics.second edition ,oxford&ibh publicating co.New Delhi,368pp.
5. Krishnaswamy,S.,- 1971 – Indian Mineral Resources, oxford&ibh publishing co., New Delhi.
6. Arogyaswamy,R.N.P.,1973 - Courses in Mining Geology ,oxford and ibh publishing co., New Delhi.
7. Kaulis Kisos Chatterjee (1970), An introduction to mineral economics, Wiley Easternlimited publisher, New Delhi.
8. Sinha R.K and Sharma N.L (1970), Mineral economics, Oxford and IBH publishing co.,
9. Umathya R.M (2006), Mineral deposits in India, Datisons publisher, Nagpur.
10. Umeshwar Prasad (1996), Economic geology, CBS publishers and distributors, New Delhi.

MSU / 2016-17 / P.G-Colleges / M.Sc. (Geology) / Semester – IV / Ppr.no.19 / Core - 12

Applied Geology II (Geophysics and Geochemistry)

Unit I

Geophysics – Definition – Subsurface exploration – Interrelationship between geology and geophysics - Geophysical methods – Types of measurements – exploration based on electrical resistivity method – Instrumentation and field Procedure – electrode arrangement of different configuration – VES, 2D ERI, 3D ERI (ERI – Electrical Resistivity Imaging – Square array method – Fundamentals of seismic prospecting - Seismic studies– field procedure – Data interpretation. Principles of gravity method- gravimeter- field surveys and interpretation.

Unit II

Magnetic studies – Instrument for magnetic survey – field procedure – data interpretation. Radioactivity and its detection- Scintillation Counter. Field procedure and interpretation, principle of air – borne and well logging methods.

UNIT-III

Definition,aims and scope, geochemical structure and compostion of the earth. Different hypothesis about core, mantle and crust. Distribution of elements in the geospheres. Geochemical affinity. Geochemical classification of elements. Geochemisty of geospheres, lithosphere, hydrosphers, biosphere and atmosphere.

UNIT-IV

Geochemical differentiation of elements, geochemistry of lithosphere(a) magmatic cycle with reference to behaviour of elements during crystallization, differentiation,early magmatic, middle magmatic and late post magmatic stages magmatic cycle. The chemical principles of crystal.

UNIT-V

Exogenic Cycle – Sedimentation – Principles – Process – Products of Weathering. Geochemical Classification of Sediments.

References:

1. Dobrin M.B., and Savit C.H.,1988. Introduction to Geophysical Prospecting (4th ed.,) McGraw – Hill, New York.
2. Parasnis D. S .1997, Principles of applied geophysics, Chapman & Hall, 2-6 Boundary Row, London SE1 8HN, UK.
3. Ramachandra Rao, M.B., Prasaranga, 1975. Outlines of Geophysical Prospecting - A manual for geologists by University of Mysore, Mysore,.
4. Telford, W.M. Geldart, L.P. and Sherriff, R.E., 1990. Applied Geophysics, 2nd Ed, Cambridge University Press, Cambridge, 770 pp.
5. Kruskopf.E.B. 1967. Introduction to geochemistry, mcgraw, hill.
6. Brian mason, 1966.principles of geochemistry,willey
7. Brounlow,A.N. 1979.Geochemistry,prentice hall.

Practical exam IV Semester / end of Second year
Practical III

IGNEOUS PETROLOGY, SEDIMENTARY PETROLOGY AND
ELECTIVE APPLIED GEOLOGY SUBJECT

Megascopic and mircoscopic study of igneous, sedimentary rocks. Petrochemical calculations CIPW Norm, Variation diagram of Harker, Niggli and ACF, AKF, AFM diagrams, determination of various parameters of sedimentary rocks and their interpretations, Mechanical analysis of sediments - Graphic representation and statistical analysis of data. Mineral seperation in sediments.

Problems related to engineering geology, Mining geology, ore dressing, / Social geology/ Nano geoscience. Ore reserve estimation.

Practical – IV
Metamorphic Petrology - Economic Geology, Applied Geology II
Geophysics and Geochemisty)

Practical V

Geological Mapping and Field studies
Mapping,
Short field trips, Professional training,
Field training, Industrial training and Specimen collection.
Viva Voce on Mapping, Field training, Industrial training and Short field trips.

Practical VI

Project evaluation and vivo voce for Project

Project