DEPARTMENT OF GEOLOGY
KURUKSHETRA UNIVERSITY
KURUKSHETRA

SCHEME OF EXAMINATION AND COURSES OF READING

FOR

M.Tech. Applied Geology 5 Year Integrated Course
(Under Self Financing Scheme)

SEMESTER – I TO X

(w.e.f 2014-15)

Course Name	**: M.Tech. Applied Geology** **5 Year Integrated Course**
Course Type	: Post Graduate
Exam. Scheme	: Semester
Duration	: Five Years

Scheme of Courses & Examination

M.Tech. 1st Year (Semester-I &II) Common with all Branches of B.Tech.

Scheme of Courses & Examinations

SEMESTER – III

Course No.	Course Title	Marks: Theory	Practical	Sessional	Total	Duration of Exam (Hrs.)
GT-301	Introduction to Geosciences	100	--	50	150	3
GT-302	Physical Geology	100	--	50	150	3
GT-303	Structural Geology	100	--	50	150	3
GT-304	Crystallography and Mineralogy	100	--	50	150	3
GT-305	Palaeontology-I	100	--	50	150	3
GT-306	Crystallography and Mineralogy Lab	--	75	25	100	3
GT-307	Palaeontology and structural Geology Lab	--	75	25	100	3
		Total			950	

SEMESTER – IV

Course No.	Course Title	Marks: Theory	Practical	Sessional	Total	Duration of Exam (Hrs.)
GT-401	Geomorphology	100	--	50	150	3
GT-402	Geochemistry-I	100	--	50	150	3
GT-403	Basic Petrology	100	--	50	150	3
GT-404	Energy Mineral Resources of India	100	--	50	150	3
GT-405	Computational and Statistical Methods in Geology	100	--	50	150	3
GT-406	Field Training – I	--	--	--	150	3
GT-407	Petrology Lab	--	75	25	100	3
GT-408	Computer Lab	--	75	25	100	3
		Total			1100	

SEMESTER – V

Course No.	Course Title	Marks: Theory	Practical	Sessional	Total	Duration of Exam (Hrs.)
GT-501	Economic and Ore Geology	100	--	50	150	3
GT-502	Plate Tectonics	100	--	50	150	3
GT-503	Igneous Petrology	100	--	50	150	3
GT-504	Sedimentology	100	--	50	150	3
GT-505	Geophysical Prospecting	100	--	50	150	3
GT-506	Practical: Based on GT-501; GT-503	--	75	25	100	3
GT-507	Practical: Based on GT-504, GT-505	--	75	25	100	3
		Total			950	

SEMESTER – VI

Course No.	Course Title	Marks: Theory	Practical	Sessional	Total	Duration of Exam (Hrs.)
GT-601	Stratigraphy	100	--	50	150	3
GT-602	Structural Geology-II	100	--	50	150	3
GT-603	Metamorphic Petrology	100	--	50	150	3
GT-604	Applied Geochemistry	100	--	50	150	3
GT-605	Mineral Exploration	100	--	50	150	3
GT-606	Practical : Based on GT-601, GT-602	--	75	25	100	3
GT-607	Practical : Based on GT-603, GT-604, GT-605	--	75	25	100	3
GT-608	Field Training-II				150	3
		Total			1100	

SEMESTER – VII

Course No.	Course Title	Marks: Theory	Practical	Sessional	Total	Duration of Exam (Hrs.)
GT-701	Remote Sensing Technology	100	--	50	150	3
GT-702	Surveying	100	--	50	150	3
GT-703	Micro palaeontology and Palynology	100	--	50	150	3
GT-704	Hydrogeology	100	--	50	150	3
GT-705	Petroleum Geology	100	--	50	150	3
GT-706	Practical: Based on GT-701 and GT – 702	--	75	25	100	3
GT-707	Practical: Based on GT-703, GT-704 and GT- 705	--	75	25	100	3
					950	

SEMESTER – VIII

Course No.	Course Title	Marks: Theory	Practical	Sessional	Total	Duration of Exam (Hrs.)
GT-801	Environmental Geoscience	100	--	50	150	3
GT-802	Coal Geology and Technology	100	--	50	150	3
GT-803	Mining Geology	100	--	50	150	3
GT-804	GIS Technology	100	--	50	150	3
GT-805	Engineering Geology	100	--	50	150	3
GT-806	Practical: Based on GT-801 and GT – 804	--	75	25	100	3
GT-807	Practical: Based on GT-802, GT-803 and GT- 805	--	75	25	100	3
					950	

SEMESTER – IX

Course No.	Course Title	Marks: Theory	Practical	Sessional	Total	Duration of Exam (Hrs.)
GT-901	Well Logging	100	--	50	150	3
GT-902	Geoscientific Instrumentation and Analytical Techniques	100	--	50	150	3
GT-903	Advanced Stratigraphy, Palaeogeography and Paleoecology	100	--	50	150	3
GT-904	Geohazards and Disaster Management	100	--	50	150	3
GT-905	Organizational Behavior and Business Management	100	--	50	150	3
GT-906	Practical: Based on GT-901, GT-902 and GT-904	--	75	25	100	3
GT-907	Practical: Based on GT-903 and GT- 905	--	75	25	100	3
					950	

SEMESTER – X

Course No.	Course Title	Total
GT-1001	Project work	150
GT-1002	Dissertation	150
GT-1003	Viva voce	150
		450

KURUKSHETRA UNIVERSITY KURUKSHETRA
DEPARTMENT OF GEOLOGY

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **03**
SUBJECT CODE : **GT- 301**
COURSE TITLE: **INTRODUCTION TO GEOSCIENCES**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

OBJECTIVES: To provide an overview of Earth Sciences including earth processes, resources and geo-hazards.

Course Contents:

S.No.	Contents
1	Earth, its place in solar system, physical features on its surface, other basic features (mass, shape, size, density, etc.) and its interior
2	Minerals, rocks, gems and gemstones
3	Volcanoes, earthquakes and tsunamis, glaciers, landslides, mudflows and avalanches,
4	Evolution of life on earth through ages
5	Remote sensing, GIS and GPS
6	Mineral exploration and geophysical exploration
7	Groundwater, hydrocarbons and coal
8	Rock deformation, mining and tunneling
9	Geological divisions of India and plate tectonics

Suggested Books

S.No.	Name of Books/Authors
1	Press, F. and Siever, R., “Understanding the earth”, W.H. Freeman & Co.
2	Moore, J.S. and Wicander, R., “Physical Geology”, Brooks-Cole
3	Lowrie, W., “Fundamentals of Geophysics”, Cambridge University Press

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **03**
SUBJECT CODE : **GT- 302**
COURSE TITLE: **PHYSICAL GEOLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS
OBJECTIVES: To provide basic understanding of general geology and physical geology.

Course Contents:

S.No.	Contents
1	Different hypotheses of earth's origin
2	Earth's interior and constitution
3	Basic concepts of isostasy and its importance
4	Earthquakes: Terminology, classification, global distribution, frequency of occurrence; Earthquakes causes and hazards
5	Volcanoes: Terminology, classification, global distribution, frequency of occurrence; Volcanic eruption and hazards
6	Continental drift, linear magnetic anomalies and mid-oceanic ridges
7	Basic concepts of plate tectonics, types of plate boundaries, orogenesis
8	Causes and types of mass movements of earth's surface

Suggested Books

S.No.	Name of Books/Authors
1	Holmes, A., "Physical Geology", Ronal
2	Marshak, S., "Essentials of Geology", John Wiley & Sons
3	Press, F. and Siever, R., "Understanding the Earth", Freeman
4	Chernicoff, S., Fox,. H.A. and Tanner, L.H., "Earth: Geologic Principles and Histories", Houghton Mifflin

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **03**
SUBJECT CODE : **GT- 303**
COURSE TITLE: **STRUCTURAL GEOLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS
OBJECTIVES: To introduce with the basic concepts of tectonic structures in rocks.

Course Contents:

S.No.	Contents
1	Geological significance and recognition of unconformities; morphology of folds
2	Geometric classifications of folds
3	Genetic classifications of folds
4	Mechanism and causes of folding
5	Strain distribution in different types of folds
6	Outcrop patterns of different types of folds
7	Geometric and genetic classification of faults, effects of faulting on outcrops, large scale faults and their tectonic significance
8	Geometric and genetic classification of joints
9	Foliation, their descriptive terminology, origin and relation to major structures
10	Different types of lineation, their origin and their relation to major structures
11	Different types of shear zones and their development

Suggested Books

S.No.	Name of Books/Authors
1	Ramsay, J.G., "Folding and Fracturing of Rocks", McGraw-Hill
2	Hobbs,M B.E., Means, W.D. and Williams, P.F., "An Outline of Structural Geology", John Wiley & Sons
3	Ragan, D.M., "Structural Geology: An Introduction to geometrical Techniques", John Wiley & son
4	Pollard, D.D. and Fletcher, R.C., "Fundamentals of Structural Geology", Cambridge University Press.
5	Billings, M.P.: Structural Geology, Prentice Hall India.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **03**
SUBJECT CODE : **GT- 304**
COURSE TITLE: **CRYSTALLOGRAPHY AND MINEROLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS
OBJECTIVES: To introduce with the basic concepts of crystallography and mineralogy

Course Contents:

S.No.	Contents
1	Classification of crystal systems, seven crystal systems
2	Miller indices and crystal forms
3	Crystal defects, polymorphism, isomorphism, pseudomorphism, exsolution and twinning
4	Physical properties of minerals
5	Different groups of minerals: Silicates, carbonates, sulphates, oxides and other mineral groups; Genesis, distribution, occurrence and association of different mineral groups.
6	X-ray diffraction; theory, instrumentation, Bragg's law
7	Introduction to optical microscopy; isometric minerals, uniaxial and biaxial minerals, optic figures, optical properties of minerals.

Suggested Books

S.No.	Name of Books/Authors
1	Bloss, F.D., "Crystallography and Crystal Chemistry", Mineralogical Society of America
2	Bloss, F.D., "An Introduction to the Methods of Optical Crystallography", Mineralogical Society of America Monograph
3	Vainshtein, B.K., "Modern Crystallography 1: Fundamentals of Crystals, Symmetry, and Methods of Structural Crystallography (Modern Crystallography)", Springer
4	Klein, C., Cornelius, S.H., and Dana, J.D., "Danas Manual of Mineralogy", John Wiley & Sons.
5	Deer, W.A., Howie, R.A. and Zussman, J., "An Introduction to the Rock-Forming Minerals", ELBS.
6	Read, H.H., "Rutley's Elements of Mineralogy", Springer

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **03**
SUBJECT CODE: **GT- 305**
COURSE TITLE : **PALAEONTOLOGY-I**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS
OBJECTIVES: To introduce basic concepts in Paleontology: invertebrate, vertebrate and plant fossils.

Course Contents:

S.No.	Contents
1	Fundamentals: Definition, objectives and scope, nature of fossil record and their uses, the organic world, classification of animals, their habits and habitats, evolution of life through the ages, migration, dispersal and extinction of life.
2	invertebrate Paleontology: Morphology, classification, evolutionary trends, geological history and geographical distribution of brachiopod, pelecypods, gasteropods, cephalopodan, trilobita, echinoidea, coelenterate and graptolodiea
3	Basics of Palynology and its applications; elements of Vertebrate Paleontology- broad classification of groups.
4	Paleobotany: Introduction, Gondwana Flora
5	Micropaleontology: Introduction, techniques of processing of samples, brief morphology and classification of foraminifers, ostracods, radiolarians and conodonts
6	Applied Aspects: Age determination and correlation, pale ecological interpretations with case histories, fossils as a tool in petroleum exploration

Suggested Books

S.No.	Name of Books/Authors
1	Walton, J., "An Introduction to the Study of Fossil Plants", Adam & Charles Black
2	Woods, H., "Paleontology Invertebrate", CBS Publications
3	Benton,M.J., "Vertebrate Paleontology", Chapman & Hall
4	Colbert, R.L., "Paleontology", John Willey & Sons
5	Shrock & Twinhofel – Invertebrate Paleontology.
6	McGowran, B., "Biostratigraphy: Microfossils & Geological Time", Cambridge University Press.
7	Brozier, “Microfossils”

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **03**
SUBJECT CODE : **GT- 306 (Based on GT-304)**
COURSE TITLE: **CRYSTALLOGRAPHY AND MINERELOGY LAB.**
MARKS: **PRACTICAL : 75, SESSIONAL: 25, TOTAL: 100**
EXAMINATION DURATION: 03 HOURS

List of Practicals: Study of crystal forms in different crystal systems; Identification of hand specimen using physical properties; Study of properties of minerals under microscope; Identification of Minerals using X-ray diffraction; Determination of specific gravity of Minerals and classification on that basis.

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COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **03**
SUBJECT CODE : **GT- 307 (Based on GT-303 & GT-305)**
COURSE TITLE: **PALEONTOLOGY AND STRUCTURAL GEOLOGY LAB.**
MARKS: **Practical : 75, Sessional: 25, Total: 100**
EXAMINATION DURATION: 03 HOURS

List of Practicals: Megascopic study of important invertebrate, vertebrate and plant fossils; Microscopic study of important invertebrate and vertebrate fossils and palynomorphs.

Contour, stratum contour, dip and strike problem; Completion of outcrop pattern; Geological maps-cross-section through different types of structures and geological history; Identification of folds and faults in models and geological structures in hand specimen.

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COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 401**
COURSE TITLE: **GEOMORPHOLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS
OBJECTIVES: To introduce with different types of land forms and their related processes.

Course Contents:

S.No.	Contents
1	Geomorphology as a branch of geology and its relation to other branches
2	Weathering, erosion and deposition, effects of climatic factors on different types of rocks
3	Erosion by running water, stages of river development, concept of base level of erosion, ox-bow lakes, karst topography, fluvial landforms
4	Wind erosion, desertification, formation of dunes and other depositional processes by wind, aeolian landforms
5	Ice, glaciers and ice sheets, moraines, classification of glaciers, glacial landforms
6	Coastal processes, marine landforms
7	Quantitative geomorphology
8	Terrain evaluation and its applications

Suggested Books

S.No.	Name of Books/Authors
1	Holmes, A., "Physical Geology", Ronald Press
2	Thornbury, W.D., "Principles of Geomorphology", Balkema
3	Ritter, D.F., Kochel, R.C., Miller, J.R., "Process Geomorphology", Waveland
4	Huggett, R., "Fundamentals of Geomorphology", Routledge
5	Bloom, A., "Cenozoic Geomorphology", Eastern Economy

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 402**
COURSE TITLE: **GEOCHEMISTRY-I**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

OBJECTIVES: To introduce the basic principle of Geochemistry.

Course Contents:

S.No.	Contents
1	Objective and history of geochemistry. Geochemical classification of elements. Cosmic abundance of elements and stability.
2	Application of thermodynamics, solution and mineral equilibria- their significance in Geology.
3	Principles of ionic substitution in minerals; element partitioning in mineral/rock formation. Physico-chemical factors in sedimentation. Trace elements. Geochemical cycle.
4	Geochemistry of Uranium, Thorium, Rubidium and Strontium. Principles of U-Pb, Rb-Sr, K-Ar, 14C methods in dating.
5	Significance of stable isotope geochemistry in Geology; isotope fractionation in nature.
6	Stable isotopes of Oxygen, Carbon and Hydrogen and their determination.
7	Geochemistry of hydrosphere and biosphere.

Suggested Books

S.No	Name of Books/Authors
1	Introduction to Geochemistry by Mason, B. and Moore, C.B., 1991, Wiley Eastern.
2	Introduction to Geochemistry by Krauskopf, K.B., 1967, McGraw Hill.
3	Principles of Isotope Geochemistry by Faure, G., 1986, John Wiley.
4	Geochemistry.Wedepohl,K.H.Holt, Rinehart and Winston Inc. USA.
5	Geochemistry. Brownlow, A.H. Prentice-Hall.
6	Inorganic Geochemistry. Henderson, P. Pergamon Press.
7	Geochemical Thermodynamics. Nordstrom, D.K. and Munoz, J.L Blackwell.
8	Hand Book of Exploration Geochemistry. Govett, G.J.S. Elsevier.
9	Encyclopedia of Geochemistry. Marshal, C.P and Fairbridge, R.W. Kluwer Academic.
10	Using Geochemical data. Rollinson, H. Longman Scientific & Technical NY.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 403**
COURSE TITLE: **BASIC PETROLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS
OBJECTIVES: To provide basic knowledge of rock types, their origin, textures and structures.

Course Contents:

S.No.	Contents
1	Fundamental concepts in igneous petrology
2	Concepts of magma, fractional crystallization, liquid immiscibility, magma mixing and assimilation
3	Igneous structures, textures and their field relationships
4	Classification of igneous rocks
5	Types of metamorphism, agents of metamorphism
6	Metamorphic textures and structures
7	Concept of metamorphic facies and grade
8	Classification of metamorphic rocks
9	Classification and formation of sedimentary rocks
10	Texture and structures of different types of sedimentary rocks
11	Petrological characteristics of sedimentary rocks

Suggested Books

S.No.	Name of Books/Authors
1	Raymond, L.A., "Petrology: The Study of Igneous, Sedimentary and Metamorphic Rocks", McGraw Hill College.
2	Best, M.G., "Igneous and Metamorphic Petrology", Wiley-Blackwell
3	Yardley, B.W.D., "Introduction to Metamorphic Petrology", Longman Scientific and Technical
4	Tucker, H.E., "Sedimentary Petrology", Wiley-Blackwell
5	Pettijohn, F.J., "Sedimentary Rocks,", Harper-Collins
6	Vermon, R.H., and Clarke, G., "Principles of Metamorphic Petrology", Cambridge University Press

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 404**
COURSE TITLE: **ENERGY MINERAL RESOURCES OF INDIA**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS
OBJECTIVES: To acquire the students with the major energy mineral resources of India.

S.No.	Contents
1	Brief overview of Energy consumption patterns of the world with emphasis of India, linkage of industrialization with energy consumption.
2	Sources of renewable and non-renewable energy, suitability of different parts of India for harnessing different types of renewable energy.
3	A brief overview of Energy Mineral resources of India and their contribution to the total energy demands of the country, identification of key energy minerals.
4	Definition of coal and sapropel, process of coalification- Rank and grades of coal; chemical characterization- proximate and ultimate analyses; lithotypes microlithotypes and macerals of coals; Technological properties of coal, coking, gasification and hydrogenation.
5	Coal forming epochs in geological past; present day peat bogs and swamps; geological and geographical distribution of coal deposits in India; important Gondwana Coal fields and Tertiary lignite deposits- their salient characteristic, origin and tectonic controls on deposition of Gondwana coals of India.
6	Kerogen sediments, its composition and origin; transformation of organic matter, maturation, thermal cracking, metagenesis and katagenesis; nature of migration of oil and gas; characteristics of reservoir rocks and traps. Major oil and gas fields of India; India's oil and gas reserves- position in the world and future prospects.
7	Radioactivity and nuclear energy; important atomic mineralstheir mode of occurrence and association; U and Th deposits of India, production, reserves and future scenario. Nuclear power production and its potential in India. Peaceful uses of nuclear energy and nuclear environments hazards.

Suggested Books

S.No.	Name of Books/Authors
1	Text book of Coal Petrology. Stach, E., Mackowsky, M.T.H., Taylor, G.H. Chandra, D.Teichmuller, M and Tiechmuller, R. , 1982.Gebruder Borntraeger, Stuttgart.
2	Text book of coal (Indian Contex). Chandra, D., Singh R.M. and Singh. M.P. Tata book Agency, Varanasi.
3	Coal and Organic Petrology. Singh, M.P. (Ed), Hindustan Publication Ltd. New Delhi.
4	Introduction to Petroleum Geology. Holson, g.D and Tiratsoo, E.N., 1985, gulf Publication Houston, Texas.
5	Geology of Petroleum. Laverson, A.i.
6	Economic mineral deposits. Bateman, A.M.
7	Ore Deposits of India. Gokhale and Rao, Thomson Press, Delhi.
8	Economic mineral resources. Krishnaswami S
9	Introduction to Petroleum Geology. Hobson, G.D.
10	Petroleum Geology, North, F.K.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 405**
COURSE TITLE: **COMPUTATIONAL AND STATISTICAL METHODS IN GEOLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

OBJECTIVES: To provide basic concepts of computing techniques and statistical methods applicable to geological problems.

Course Contents:

S.No.	Contents
1	Role of mathematical and numerical techniques in Geo-sciences, measuring systems
2	Computer System Hardware: CPU, Memory, Input/ Output devices, information storage media
3	Software: Languages useful for scientific programming, operating system concepts, DOS and its use
4	FORTRAN-77: Data types, expressions and statements, interactive statements, input/output statements subroutine and functions, data sharing among subprograms/programs. Examples of programming to handle statistical & numerical problems
5	Numerical integration by Simpson's method, trapezoidal method
6	Matrix operation, matrix inversion by Gauss Jordon Method, least square fit to the given data. Programming in Fortran for above methods.
7	Statistical techniques: Mean mode, median, cumulative frequency distribution, skewness & Kurtosis, graphical representation on histograms and curves
8	Statistical probability; definition and simple case examples; Bionomial, Poisson and normal distributions, concepts of mathematical expectations; Regression analysis; Linear regression, correlation and correlation coefficients.

Suggested Books

S.No.	Name of Books/Authors
1	Borradaile, G.J., "Statistics of Earth science Data", Springer
2	Atkinson, K. and Han John, W., "Elementary Numerical Analysis", John Wiley & Sons
3	Yang, W.Y., Cao, W. and Chung, T.S., "Applied Numerical Methods", John Wiley & Sons
4	Press, W.H., Teukolsky,S.A., Vellerling, W.T. and Flannery,B.P., "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press
5	Davis, J.C., "Statistics and Data Analysis in Geology", 3rd Ed., John Wiley & Sons.
6	C. Xavier, "FORTRAN 77 and Numerical Method".
7	Grover, P.S., "Programming and Computing with FORTRAN 77 to 90", Allied Publishers
8	Rajaraman, V., "Computer Oriented Numerical Methods", Prentice Hall of India
9	Bhirud, L.L., "Computer Programming for Science and Engineering

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 406**
COURSE TITLE: **FIELD TRAINING-I**
MARKS : **150 (To be awarded jointly by the internal and external examiner after conducting viva-voce examination on field training reports).**

OBJECTIVE: **GEOLOGICAL FIELD TRAINING- I**

Course Contents:

S.No.	Contents
1	Study of topo-sheets and geological maps
2	Determination of location on maps
3	Measurement of dip and strike of planar surfaces
4	Measurement of lineation
5	Measurement of stratigraphic columns
6	Geological mapping
7	Plotting and analysis of field data

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 407**
COURSE TITLE: **PETROLOGY LAB**
MARKS: **PRACTICAL: 75 : SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of Practical: Study of different rock types in hand specimen; Microscopic study of mineral assemblages of different igneous, metamorphic and sedimentary rocks.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **04**
SUBJECT CODE : **GT- 408 (Based on GT-405)**
COURSE TITLE: **COMPUTER LAB**
MARKS: **PRACTICAL: 75 : SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of practicals : Exercises based on application of computational and statistical analysis of geo-scientific data.

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COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **05**
SUBJECT CODE: **GT-501**
COURSE TITLE: **ECONOMIC AND ORE GEOLOGY**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To impart basic understanding of different types of mineral deposit and processes of their formation.

DETAILS OF COURSE:

Sr. No.	Contents
1	Historical background, distribution, morphology and disposition of ore bodies, Trace elements and their source characterization.
2	Physical characteristics, structure and texture of ore minerals
3	Classification of ore bodies, stable isotopes and physic chemical conditions of ore formation.
4	Endogenic processes of ore formation; Early and late magnetic segregation and injection, immiscible liquid segregation, different types of hydrothermal ore formation, volcanic exhalative process, metamorphic and metamorphosed processes, role of fluids of fluid inclusions.
5	Exogenic processes of ore formation; Mechanical accumulation, sedimentary precipitates, residual concentration, oxidation and supergene enrichment.
6	Geology of important economic deposits of India: Bauxite, iron, manganese, copper, lead, zinc, gold, chromites, diamond, coal and petroleum.
7	Importance of mineral deposits in national economy.

Suggested Books

Sr. No.	Name of Books/Authors
1	Bateman, A.M. and Jensen, M.L., "Economic Mineral Deposits", John Wiley & Sons, 3rd Ed.
2	Guilbert, J.M. and Charles F.P. Jr., "The Geology of Ore Deposits", Waveland
3	Bannerjee, D.K., "Mineral Resources of India", The World Press
4	Evans, A.M., "Ore Geology and Industrial Minerals": An Introduction", Blackwell Science, 3rd Ed.
5	Mookherjee, A., "Ore Genesis: A Holistic Approach", Allied Publishers.
6	Smirnov, V.I., "Geology of Mineral Deposits" MIR Publishers

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **05**
SUBJECT CODE: **GT-502**
COURSE TITLE: **PLATE TECTONICS**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To impart in-depth understanding of plate boundaries type and different process at these boundaries.

DETAILS OF COURSE:

Sr. No.	Contents
1	Introduction: Review of various hypothesis of the earth's origin, earth's interior and constitution
2	Seismology: Types and propagation of seismic waves, propagation paths, interior structure of the earth based on seismological observations
3	Earth's Crust: Oceanic and continental types of earth's crust: Composition, mineralogy, major structural features of the earth.
4	Plate tectonics: Historical background, types of place margins and sense of displacements of plates
5	Creative Plate Margin: Composition, seismic structure and evolution
6	Conservative Plate Margin: Transforms faults and plate motions, seismicity, structure and evolution
7	Destructive Plate Margins: Surface manifestations, geophysical and geological characteristics, sedimentological, metamorphic and magmatic characteristics.
8	Orogenesis: Plate tectonics and mountain building processes
9	Indian Plate: Configuration and characters of Indian plate margins; Himalayan orogeny and tectonic models.

Suggested Books

Sr. No.	Name of Books/Authors
1	Brown, G.C., Hawkesworth, C.J. and Wilson, R.C.I. (Eds.), "Understanding the Earth", Cambridge University Press.
2	Kearey, P. and Vine, F.J. "Global Tectonics", Blackwell.
3	Condie, K.C., "Plate Tectonics and Crustal Evolution", Butterworth-Heinemann.
4	Cox, A. and Hart, R.B. "Plate Tectonics: How it Works", Wiley-Blackwell.
5	Gansser, A., "Geology of the Himalayas", John Wiley & Sons.
6	Davies, G.F., "Dynamic Earth: Plates, Plumes and Mantle Convection", Cambridge

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **05**
SUBJECT CODE: **GT-503**
COURSE TITLE: **IGNEOUS PETROLOGY**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS
OBJECTIVE: To provide in-depth knowledge of igneous rocks including their geochemical characteristics and petrogenesis

DETAILS OF COURSE:

Sr. No.	Contents
1	Processes involving modification of primary magma
2	Fractional crystallization and crustal contamination
3	Phase diagrams
4	Classifications of igneous rocks
5	Geochemical characteristics of igneous rocks as petrogenetic indicators
6	Rb-Sr Isotope evolution in igneous rocks
7	Sm – Nd systematics as petrogenetic indicators
8	Magmatism and global tectonic processes
9	Magmatism at constructive plate margin, mid oceanic ridges, ocean floor magmatism
10	Magmatism at destructive plate margin, subduction zone magmatism, island arc systems
11	Intraplate magmatism, carbonatites
12	Continental flood basalts, alkaline rocks

Suggested Books

Sr. No.	Name of Books/Authors
1	Willson, M., "Igneous Petrogenesis: A Global Tectonic Approach", Unwin-Hyman
2	Winter, J., "An Introduction to Igneous and Metamorphic Petrology", Prentice Hall.
3	Hall, A., "Igneous Petrology", John Wiley & Sons.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **05**
SUBJECT CODE: **GT-504**
COURSE TITLE: **SEDIMENTOLOGY**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS
OBJECTIVE: To provide in-depth knowledge of sedimentary textures and structures and sedimentary processes including depositional environments.

DETAILS OF COURSE:

Sr. No.	Contents
1	Weathering under different climatic conditions and sediment transport by various agents
2	Classification and genesis of various sedimentary textures; Siliciclastic sediments; Paleocurrent analysis; Importance in provenance analysis
3	Classification of sedimentary structures; Occurrence and distribution of foreland basins and deltas.
4	Composition and classification of different types of sedimentary rocks and their genetic importance
5	Diagnosis of sedimentary rocks, physico-chemical considerations
6	Depositional environments, classification of facies
7	Models for genetic environments of sandstone, conglomerate, breccia, mudstone, limestone, evaporate, iron deposits, phosphates, cherts, siliceous sediment and volcanoclastic sediments
8	Plate tectonics and sedimentary basins; Analysis of coal, oil and petroleum, basins

Suggested Books

Sr. No.	Name of Books/Authors
1	Blatt, H., Middleton, G.V. and Murray, T.G., "Origin of Sedimentary Rocks", Prentice – Hall.
2	Boggs, S., "Principles of Sedimentology and Stratigraphy", 4th Ed., Prentice – Hall.
3	Leeder, M.R., "Sedimentology and Sedimentary Basins", Prentice Hall.
4	Reading, H.G., "Sedimentary Environments – Processes, Facies and Stratigraphy", Wiley-Blackwell.
5.	Pettijohn, F.J., “Sedimentary rocks, CBS Publishers.
6.	Prothero, D.R. and Schwab, F., “Sedimentary Geology”, W.H.Freeman and company

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **05**
SUBJECT CODE: **GT-505**
COURSE TITLE: **GEOPHYSICAL PROSPECTING**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY: 3 HOURS
OBJECTIVE: To introduce basic concepts of geophysical methods and their applications in solving geological problems.

DETAILS OF COURSE:

Sr. No.	Contents
1	Introduction: Overview and importance of various geophysical methods in geological studies
2	Gravity Method: Basic principles, gravity anomalies, gravimeters, data acquisition procedures, data reduction and processing, interpretation of Bouguer anomalies for basic geometrical shapes, depth rules; Applications.
3	Magnetic Method: Basic principles, magnetic anomalies, magnetometers, data acquisition procedures, data reduction and processing, interpretation of magnetic anomalies for basic geometrical shapes, depth rules: Applications.
4	Seismic Methods: Refraction, reflection and attenuation of seismic waves, geophones and hydrophones, recording instruments, seismic refraction method, travel time curves for flat and dipping interfaces, interpretation of refraction profiles, seismic reflection method, CDP shooting, geophone grouping, elementary ideas about processing and interpretation of seismic reflection data: Application.
5	Electrical Method: Apparent receptivity, sounding and profiling, different electrode configurations, field procedures, resistivity meters, data interpretation using curve matching method, electrical section; Application
6	Electromagnetic Methods: Basic concepts, dip angle techniques, measurement of amplitude and phase, various transmitter and receiver loop configurations, response curves, airborne electromagnetic method; Applications.

Suggested Books

Sr. No.	Name of Books/Authors
1	Telford, W.M., Geldart, L.P. and Sheriff, R.E., "Applied Geophysics", Cambridge University Press.
2	Kearey, P. Brooks, M. and Hill, I., "An Introduction to Geophysical Exploration:, Blackwell.
3	Parasnis, D.S., "Principles of Applied Geophysics", Champan and Hall.
4	Dobrin, M.B. and Savit, C.H., "Introduction to Geophysical Prospecting". McGraw-Hall.

COURSE: M.Tech. Applied Geology 5 Year Integrated Course
SEMESTER: 05
SUBJECT CODE: GT-506 (Based on GT-501 & GT-503)
COURSE TITLE: PRACTICAL
MARKS : PRACTCAL 75 , SESSIONAL: 25, TOTAL : 100
EXAMINATION DURATION: PRACTICAL : 3 HOURS

List of practical

1. Locating different important mineral deposits on outline map of India /world.
2. Megascopic study of ore specimens/industrial minerals.
3. Microscopic study of important ore minerals.
4. Preparation of polished ore specimen.
5. Microscopic studies of acidic, basic and ultramafic igneous rocks and their petrogenesis
6. Geochemical variation diagram studies
7. CIPW normative calculations based on geochemical data.

COURSE: M.Tech. Applied Geology 5 Year Integrated Course
SEMESTER: 05
SUBJECT CODE: GT-507 (Based on GT-504 & GT-505)
COURSE TITLE: PRACTICAL
MARKS : PRACTCAL 75 , SESSIONAL: 25, TOTAL : 100
EXAMINATION DURATION: PRACTICAL : 3 HOURS

List of practical

1. Gain size analysis using sieves and its statistical analysis
2. Determination of roundness of elastic particles using comparison chart method.
3. Statistical analysis of orientation data
4. Thin section study of sandstones and limestones
5. Recognition of major clay minerals from x-ray diffractograms
6. Determination of facies cyclotherms from a vertical log.
7. Geophysical practicals & exercises

KURUKSHETRA UNIVERSITY KURUKSHETRA
DEPARTMENT OF GEOLOGY

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **06**
SUBJECT CODE: **GT-601**
COURSE TITLE: **STRATIGRAPHY**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To provide basic understanding of principles of stratigraphy, stratigraphic contacts geological time scale and stratigraphic sequences of India.

DETAILS OF COURSE:

Sl. No.	Contents
1	Definition and scope of stratigraphy
2	Principles of superposition, original horizontality and uniformitarianism
3	Geological time scale, purpose, scope and development
4	Stratigraphic classification and nomenclature of units, lithostratigraphy, biostratigraphy, chronostratigraphy and geochronology
5	Stratigraphic contacts , conformity and unconformity
6	Definition, scope and kinds of correlation
7	Introduction to facies, transgression and regression
8	Broad outline of some of the major stratigraphic sequences of India, Archean Proterozoic, Paleozoic, Mesozoic, Cenozoic stratigraphic units of India.

Suggested Books

Sr. No.	Name of Books/Authors
1	Lemon, R.L., "Principles of Stratigraphy", Meril Publishing
2	Boggs, S., Jr. "Fundamentals of Historical Geology and Stratigraphy of India", Wiley
3	Kumar, R., "Fundamentals of Historical Geology and Stratigraphy of India.
4	Krishan, M.S., "Geology of India and Burma", CBS Publications
5	Wadia, D.N., "Geology of India", Tata Mc-Graw Hill.
6	Ramakrishnan, M. and Vaidyanathan, R., "Geology of India", Vol. I and II, Geological Society of India.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **06**
SUBJECT CODE: **GT-602**
COURSE TITLE: **STRUCTURAL GEOLOGY-II**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To provide in-depth knowledge of techniques of structural analysis for understanding of deformation in rocks

DETAILS OF COURSE:

Sr. No.	Contents
1	Stress in homogeneous and inhomogeneous media and analytical techniques
2	Geometry and analysis of fractures, joints and faults
3	Homogeneous strain and techniques of strain analysis including Fry method, grain centre method and Rf/Φ method
4	Geometry of folds and their classification schemes
5	Mechanism of folding and internal strain accommodation.
6	Shear zones and techniques of their analysis; Examples
7	Analysis of foliation and lineation in rocks: Geometry, mechanics and significance
8	Techniques of structural analysis in areas of superposed folding.
9	Different types of deformation mechanism

Suggested Books

Sr. No.	Name of Books/Authors
1	Suupe, J., "Principles of Structural Geology", Prentice-Hall.
2	Twiss, R.J. and Moores, E.M., "Structural Geology", W.H. Freeman & Co.
3	Davis, G.H. and Reynolds, S.J., "Structural Geology of rocks and regions", John Wiely &Sons, Inc.
4	Ghosh, S.K. 1993, "Structural Geology: Fundamental and Modern developments", Pergamon.
5	Ramsay, J.G., Lisle, R.J., "Techniques of Modern Structural Geology", /Volume 3: Applications of Continuum Mechanics in Structural Geology (Modern Structural Geology) –Academic Press.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **06**
SUBJECT CODE: **GT- 603**
COURSE TITLE: **METAMORPHIC PETROLOGY**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To provide in-depth knowledge of phase rule, classification of metamorphic rocks and metamorphic assemblages

DETAILS OF COURSE:

Sr. No.	Contents
1	Various types of metamorphism, metamorphic rocks and facies
2	Texture, structure and classification of metamorphic rocks
3	Phase rule, metamorphic reactions and phase equilibria in metamorphic rocks
4	Graphical representation of various mineral assemblages in different P-T conditions
5	Phase diagrams and petrogenetic grid for metamorphic assemblages in various grades of metamorphism
6	Thermodynamics of metamorphic reactions and mineral assemblages in different metamorphic isograds
7	Concept of facies and different types of metamorphic facies
8	Mineral assemblages for different rock types in zeolite, prehnite, pumpellyite, greenschist, amphibolite, granulite, eclogite, and bluechist facies
9	Mineral paragenesis and chemographic relations in metamorphism of calcareous, mafic and ultramafic rocks.

Suggested Books

Sl. No.	Name of Books/Authors
1	Spear, F.S. "Metamorphic Phase Equilibria and Pressure-Temperature-Time Paths". Mineralogical Society of America Monograph
2	Yardley, B.W.D., "An Introduction to Metamorphic Petrology", Longman-ELBS
3	Winter, J.D. "An Introduction to Igneous and Metamorphic Petrology", Prentice-Hall.
4	Best, M.G., "Igneous and Metamorphic Petrology", Blackwell

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **06**
SUBJECT CODE: **GT- 604**
COURSE TITLE: **APPLIED GEOCHEMISTRY**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To introduce geochemistry as a tool for understanding various earth processes

DETAILS OF COURSE:

Sr. No.	Contents
1	Chemical composition of earth, distribution of elements in igneous, sedimentary and metamorphic rocks, internal divisions and differentiation of earth
2	Crystal chemistry, silicate structures, isomorphism, polymorphism, substitution, surface chemistry, sorption, ion exchange, colloids in igneous, sedimentary and metamorphic conditions.
3	Chemical equilibrium, equilibrium kinetics, chemical thermodynamics, enthalpy, free energy, phase equilibria, activity, reaction rates, oxidation reduction processes.
4	Aqueous solutions, carbonate equilibria, silicate equilibria
5	Sedimentation and diagnosis-organic and inorganic geochemistry
6	Radiogenic and stable isotopes, different isotopic systematics, geochronology, petrogenesis.
7	Analytical techniques for rock, sediments and water compositions
8	Geochemical techniques for mineral exploration in different geological environments, geochemical surveys and data analysis

Suggested Books

Sl. No.	Name of Books/Authors
1	Kraushopk, K.B., and Bird, D.K., "Introduction to Geochemistry", McGraw-Hill.
2	Albarede, F., "Geochemistry: An Introduction", Cambridge University Press
3	Walther, J.V., "Essentials of Geochemistry", Johns & Bartlett.
4	Gill, R., "Modern Analytical Geochemistry", Addison Wesley.
5	Holland, H.D. (Ed.), "Treatise of Geochemistry", Elsevier.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **06**
SUBJECT CODE: **GT- 605**
COURSE TITLE: **MINERAL EXPLORATION**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To introduce basic concepts of mineral exploration including delineation of ore reserves.

DETAILS OF COURSE:

Sl. No.	Contents
1	Overview of various stages and data/tools of exploration
2	Geological indicators for mineral deposits, lithological and structural controls of mineralization
3	Basic concepts of geological and geochemical prospecting
4	Different techniques in mineral exploration: Drilling, sampling, bench mapping underground mine mapping, geological plans and sections
5	Delineation of subsurface ore bodies of different geometric shapes
6	Ore reserve estimation and grade calculation for different types of ore deposits.
7	Computer software applications in mineral exploration

Suggested Books

Sl. No.	Name of Books/Authors
1	Moon, C.J., Whateley, M.K.G. and Evans, A.M., "Introduction to Mineral Exploration", Blackwell Science, 2nd Ed.
2	Talapatra, A.K., "Modelling and Geochemical Exploration of Mineral Deposits", Capital Publishing.
3	Rejendran, S., Srinivasamoothy, K. and Aravindan S., "Mineral Exploration: Recent Strategies", New India Pub.
4	Edward E. and Hausel, W.D., "Diamond Deposits: Origin, Exploration, and History of Discovery" Society for Mining, Metallurgy & Exploration (SME).
5	Naldrett, A.J., "Magmatic Sulfide Deposits: Geology, Geochemistry and Exploration" Springer-Verlag.

COURSE: M.Tech. Applied Geology 5 Year Integrated Course
SEMESTER: 06
SUBJECT CODE: GT- 606 (Based on GT- 601 & GT- 602)
COURSE TITLE: PRACTICAL
MARKS : PRACTICAL : 75, SESSIONAL : 25, TOTAL : 100
EXAMINATION DURATION: PRACTICAL : 3 HOURS

List of Practicals

1. Techniques of strain analysis: determination of finite strain of deformed objects using long- to short axis, center-to-centre, Fry and Rf/ Φ methods.
2. Determination of finite strain from deformed fossils.
3. Dip isogon method of fold analysis.
4. Determination of strain in ductile shear zones and analysis of brittle fault zones.
5. Structural analysis of folded terrains.
6. Practicals & exercises on stratigraphy

COURSE: M.Tech. Applied Geology 5 Year Integrated Course
SEMESTER: 06
SUBJECT CODE: GT- 607 (Based on GT- 603, GT- 604 & GT- 605)
COURSE TITLE: PRACTICAL
MARKS : PRACTICAL : 75, SESSIONAL : 25, TOTAL : 100
EXAMINATION DURATION: PRACTICAL : 3 HOURS

List of Practicals

1) Microscopic/petrographic studies of metamorphic rocks such as,
   i. Phylite ii. Garnet-biotite-staurolite-mica-schists
   iii. Kyanite-sillimanite-mica schists iv. Pelitic gneisses
   v. Migmatite vi. Tremolite-actinolite schists
   vii. Amphibolite viii. Basic graulite
   ix. Calc-silicates and x. Marbles

2 Sampling of rocks, sediments and water for geochemical analysis.
3 Digestion of rock samples, preparation of solutions for analysis.
4. Analysis of major and trace elements in silicate rocks.
5. Preparation of standards for geochemical analysis.
6. Preparation of various solutions with differing ionic strength.
7. Basic principles and demonstration of analytical instruments.
8 Exercises on geochemical data interpretation
9. Regional exploration data analysis
10. Exercises related to trenching, pitting and drilling data.
11. Interpretation of field exploration data and ore reserve estimation.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **06**
SUBJECT CODE: **GT- 608**
COURSE TITLE: **FIELD TRAINING - II**
MARKS : **150 (To be awarded jointly by the internal and external examiner after conducting viva-voce examination on field training reports).**

OBJECTIVE: ADVANCED GEOLOGICAL FIELD TRAINING

DETAILS OF COURSE:

Large scale mapping on 1:10.00 and 1:10 scale using GPS, Brinton compass and Late, plane table, telescopic alidade & theodolite. Visit to at least any one of more of the following applied geological projects:-

Mineral/Petroleum/Coal and lignite/groundwater exploration, drilling, and development projects; visit to engineering geological sites such as dams, tunnels, high ways, rail roads, bridges, power houses; cement, bricks and tiles industries, marble and granite mining, cutting and polishing; coal washeries, coke-oven plants, steel plants, metalliferous mines ore concentration and smelling plants etc.

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DEPARTMENT OF GEOLOGY

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **07**
SUBJECT CODE: **GT- 701**
COURSE TITLE: **Remote Sensing Technology**
MARKS: **THEORY: 100, SESSIONAL : 50**

EXAMINATION DURATION: THEORY : 3 HOURS

Objective of Course: Introduce the principles of satellite based remote sensing and its application in the field of Earth Sciences.

Details of Course:

S. No	Contents
1.	Introduction
2.	EM spectrum
3.	Propagation of radiation through the atmosphere and interaction
4.	Aerial Photographs, their characteristics
5.	Aerial Photographs: Scale, Height determination and relief displacement
6.	Stereoscopes and photo-mosaics
5.	LISS, MSS, CCD, Thermal scanners
8.	Principle of image interpretation
9.	Fundamentals of digital image processing
10.	Image characteristics of geological structures and various rock type
11.	Microwave Remote sensing
12.	Applications in Active Tectonics
13.	Application in Disaster Management, glaciology and natural resources

Suggested Books:

S. No	Name of Books/ Authors
1.	Drury, S. A., Image Interpretation in Geology, 2nd Edition, London:Allen and Unwin
2.	Gupta, R. P., Remote Sensing Geology, 2nd Edition, Springer-Verlag Berlin Heidelberg, New York.
3.	Lillesand T. M, and Keifer, R. W., Remote Sensing and Image Interpretation, 4th Edition, Wiley, New York.
4.	Miller, V. C., and Miller, C. F., Photogeology, McGraw-Hill, New York
5.	Sabins, FF Jr., Remote Sensing-Principles and Interpretation, 3rd Edition, Freeman & Co, New York.

COURSE: **M.Tech. Applied Geology 5 Year Integrated**
SEMESTER: **07**
SUBJECT CODE: **GT- 702**
COURSE TITLE: **SURVEYING**
MARKS: **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS
OBJECTIVE: To impart basic understanding of different types of Survey methods, their working and significance.

DETAILS OF COURSE:

Sl. No.	Contents
1	Fundamental Principles of Surveying: Definition, objects, classification, fundamental principles, methods of fixing stations.
2	Measurement of distances: Direct measurement, instruments for measuring distance, chaining of line, errors in chaining and tape corrections.
3	Compass Traversing: Methods of traversing, instruments for measurement of bearings-prismatic and surveyor's compass, bearing of lines, local attraction. Levelling: Definition of terms used in levelling, types of levels and staff, temporary adjustment of levels, principles of levelling, booking of staff readings and methods of booking, examples. Contouring: characteristics of contours lines, locating contours, interpolation of contours. Theodolite: temporary adjustment of Theodolite, measurement of horizontal angles-repetition and reiteration method. Theodolite traversing: checks in traversing and adjustment of closed traverse with small examples. Total Station-Principal and working
4	Plane Table Surveying: methods of plane table surveying, radiation, intersection, traversing and resection, two point and three point problems.
5	Tacheometry: principle of tacheometric surveying- systems of tacheometric surveying-stadia and tangential system of tacheometry, determination of tacheometric constants, examples
6	Trigonometrical Levelling: Geodetical observation, refraction and curvature, axis signal correction, difference in elevation between two points. Triangulation: Triangulation systems, classification of triangulation figures, selection of triangulation stations, field work of triangulation, triangulation computations.

Suggested Books

Sl. No.	Name of Books/Authors
1	Surveying Vol.I by B.C.Punmia
2	Surveying Vol.I by T.P.Kanitkar
3	Surveying Vol.2 by B.C. Punmia
5	Surveying Vol2 by T.P. Kanitkar

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **07**
SUBJECT CODE: **GT- 703**
COURSE TITLE: **MICROPALAEONTOLOGY AND PALYNOLOGY**
MARKS : **THEORY : 100, SESSIONAL: 50**
EXAMINATION DURATION: THEORY : 3 HOURS

OBJECTIVE: To impart basic understanding significance of different aspects of Micropalaeontology and Palynology

S.N.	Contents
1	Micropalaeontology, its definition and scope, surface and sub-surface sampling, processing of samples for preparation of mineral matter walled and organic walled microfossils. Taxonomic diversity of microfossils.
2	Detailed Morphology, Geological distribution and Ecology of Foraminifera, Ostrocoda, Conodonts, Radiolarians, Silicoflagellates, Chitinozoans and Diatoms.
3	Study of morphology, classification, ecology and geological history of Charophytes and Phytoplanktons.
4	Morphology of fossil spores, pollen grains and acritarchs. use of microfossils in biostratigraphy and palaeoenvironmental interpretations.
5.	Applications of microfossils and palynofossils in coal and petroleum exploration, palynofacies and hydrocarbon analysis and source rock evaluation.

Suggested Books

S. No	Name of Books/ Authors
1.	Introduction to Palaeoecology. McGraw Hill, Ager,D.V.
2.	Principles of Palaeoecology. McGraw Hill, Ager, D.V.
3.	Palaeoecology, Longman, Kennety, P and Ross,C.A.
4.	Aspects of Palynology – Tsudy
5.	Essentials of Palynology – P K K Nair
6.	Palaeoecology: Concepts and Application. John Wiley. Dodd, J.R. and Stanton, R.J.Treatise on Marine Ecology & Palaeoecology, Vol. 2 (Palaeoecology) Mem. Soc. America. Ladd, H.S.,

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **07**
SUBJECT CODE : **GT- 704**
COURSE TITLE: **Hydrogeology**
MARKS: THEORY: 100, SESSIONAL : 50
EXAMINATION DURATION: THEORY : 3 HOURS

Objective of Course: Provide understanding about the hydrogeological properties of water bearing formations and chemical parameters of water

Details of Course:

S. No	Particulars
1	Hydrologic cycle, residence time, reservoirs, flux, ground water and hydrologic cycle, Hydrologic processes at the earth's surface
2	Basic principles of groundwater flow, Darcy flux, hydraulic conductivity, problem exercises
3	Geology and ground water, aquifers, confined and unconfined beds, basic geologic and hydrogeological investigations, surface and sub-surface investigations
4	Key reactions of ground water chemistry, saturation, equilibrium kinetics, free energy, oxidation-reduction processes, ion exchange, electric double layer theory
5	Ground water chemistry, data representation, water quality and pollution sources
6	Isotopes in ground water, principles and uses, water level fluctuations

Suggested Books:

S. No	Name of Books/ Authors
1	Fundamental of Ground Water/F.W.Schwartz and H.Zhang
2	Ground water Hydrology/D.K.Todd
3	Physical and Chemical Hydrogeology/P.A.Domencio and F.W.Schwartz
4	Environmental Isotopes in Hydogeology/I.Fritz
5	Geochemistry, Groundwater and Pollution//C.A.J.Appelo and D.Postma
6	Groundwater Science/ C.R.Fitts
7	Environmental Hydrology/A.d.Ward and S.W.Trimble

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **07**
SUBJECT CODE : **GT- 705**
COURSE TITLE: **PETROLEUM GEOLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**

EXAMINATION DURATION: THEORY : 3 HOURS

Objective of Course: Provide information about the source rock, reservoir rock hydrocarbon migration, type of traps.

Details of Course:

S. No	Particulars
1	Source Rocks: Definition of source rock, Nature and type of source rock, The process of diagenesis, catagenesis and metagenesis in the formation of source rocks. Hydrocarbon Source rock evaluation: Palynofacies and Types of Dispersed Organic Matter (DOM), Thermal Alteration Index (TAI).
2	Reservoir Rocks: classification and nomenclature of reservoir rocks, Classic Reservoir Rocks, Carbonate Reservoir Rocks, Unconventional, fractured and miscellaneous reservoir rocks. Marine and non marine reservoir rocks.
3	Hydrocarbon migration: Primary and secondary migration- Migration and accumulation of hydrocarbons, Factors effecting primary and secondary migration.
4	Entrapment of hydrocarbons: Mechanics of entrapment of hydrocarbons - entrapment and accumulation of hydrocarbons; Types of traps: Structural, stratigraphic and combination type of traps.
5	Unconventional Resources : Oil Shale, Shale gas, Tar Sands, Gas hydrates. Major oil and gas fields of India; India's oil and gas reserves – position in the world and future prospects.

Suggested Books:

S. No	Name of Books/ Authors
1	Levorsen, A.I. Geology of Petroleum, 2nd Edn. W.H. Freeman C. San Francisco
2	Hunt, J.M., Petroleum Geochemistry and Geology, 2nd Edn. W. H. Freeman, San Francisco
3	North, F.K., Petroleum Geology, Unwin Hyman (Pub.), Boston, USA
4	Richard, C. Selley, Elements of Petroleum Geology, Academic Press, London
5	Chapman, R.E. Petroleum Geology. 1983, Developments in Petroleum Science, Ser. 16, Elsevier, Amsterdam
6	G.D.Hobson (Ed.). Developments in Petroleum Geology, Applied Science Publishers, London.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **07**
SUBJECT CODE : **GT- 706 (Based on GT- 701, GT- 702)**
COURSE TITLE: **PRACTICAL**
MARKS: **PRACTICAL: 75 : SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of practicals : Exercises based on the studies of remote sensing technology and surveying to work with geological data and their application.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **07**
SUBJECT CODE : **GT- 707 (Based on GT- 703, GT- 704, GT- 705)**
COURSE TITLE: **PRACTICAL**
MARKS: **PRACTICAL: 75 : SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of practicals : Exercises based on the knowledge of micropaleontology, palynology, hydrogeology and petroleum geology .

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COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **08**
SUBJECT CODE : **GT- 801**
COURSE TITLE: **Environmental Geosciences**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: To let students be exposed to for environmental mitigation and management and current practices with examples.

Details of Course:

S. No	Particulars
1	Environmental concepts and role of geosciences society
2	Land use planning and landscape aesthetics
3	Waste disposal, solid waste, land fill site selection, radio active
4	Natural hazards, landslides, volcanoes, earthquakes, droughts, cyclones, floods and mitigation
5	EIA and Environmental law

Suggested Books:

S. No	Name of Books/ Authors
1.	Alexander, D. " Natural Disasters", UCL Press Ltd, Uni Colege Londs
2.	Environmental geomorphology by Coates Dr. Sate Univ of NY Binghamtoin
3.	Mitigation of Natural hazards and disasters: international perspectives, Haque, C. Emdad, Sprinmger, Dordrecht
4.	Keller, EA Environmental geosciences, prentice hall, New Jersey

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **08**
SUBJECT CODE : **GT- 802**
COURSE TITLE: **COAL GEOLOGY AND TECHNOLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: To impart basic understanding about physical, petrological and technological properties of coal.

Details of Course:

S. No	Particulars
1	Coal Formation: Accumulation of vegetable matter (insitu and drift theories of coal formation), Origin of peat, lignite, bitumen and anthracite.
2	Physical and petrological properties of coal: lithotypes, microlithotypes and macerals of coal.
3	Coal Bed Methane (CBM) - Elementary idea about generation of methane in coal beds and coal bed methane exploration; Coal as a source rock for oil and gas.
4	Technological properties of coal: Coal Gasification, Coal Liquefaction, Carbonisation.
5	Environmental impacts of coal mining and burning, mitigation measures to avoid or reduce those impacts.

Suggested Books:

S. No	Name of Books/ Authors
1	Text book of Coal Petrology. Stach's Text book of coal Petrology. Stach,E., Mackowsky,M.T.H., Taylor,G.H., Chandra,D., Teichmuller,M., and Teichmuller,R.
2	Textbook of Coal (Indian context), Tara Book Agency, Varanasi. Gebruder Borntraeger, StuttgartChandra, D., Singh, R.M. Singh, M.P. (2000).
3	International Committee for Coal and Organic Petrology (ICCP). The new inertinite classification (ICCP System 1994). Fuel 80, 459–471.
4	International Committee for Coal and Organic Petrology, (ICCP). The new vitrinite classification (ICCP System 1994). Fuel 77, 349–358.
5	Coal and organic Petrology, Hindustan Publishing Corporation, New Delhi. Singh, M.P.
6	Applied Coal Petrology. The Role of Petrologyin Coal Utilization. Elsevier, Academic Press. USA. 388 pp. Suárez-Ruiz, I., Crelling J.C. (Eds.).
7	Coal Geology and Coal Technology. Blackwell Scientific Publications, Melbourne, 345 pp. Ward, C.R. (Ed.).

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **08**
SUBJECT CODE : **GT- 803**
COURSE TITLE: **Mining Geology**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: This course is designed to give the post-graduate geology students an introductory idea about the various types of geological field operations, which are carried out in opencast/underground mines.

Details of Course:

S. No	Particulars
1	Principles of Mining Geology
2	Surface & Sub-surface methods of mining
3	Geological operations – bench mapping, underground mine mapping, preparation of geological plans and sections, drilling, core logging, sampling, explosives & blasting.
4	Role of a geologist in a working mine – production planning, quality control in production, mines safety measures, nature of environmental issues & remedies, mine waste & their management. Mines legislations
5	Elements to Mineral Dressing & mineral beneficiation
6	Mine Economic appraisals

Suggested Books:

S. No	Name of Books/ Authors
1	Principles of Mineral Dressing – A.M. Gaudin
2	Mining Geology – H.E. Mikinstry Printice Hall, New York
3	Mineral exploration - Indian Bureau of Mines IBM, Nagpur.
4	Elements of Mining – R.S. Lewis and G.B. Clark
5	Courses in Mining Geology – R.N.P. Arogyaswamy, Oxford IBH
6	Exploration and mining geology. W.C.Peters John Wiley & Sons, New York.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **08**
SUBJECT CODE : **GT- 804**
COURSE TITLE: **GIS Technology**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: Provide understanding about GIS Technology

Details of Course:

S. No	Particulars
1.	What is GIS? What GIS can do?
2.	Different Components of GIS
3.	Hardware and software requirements of GIS
4.	Concepts of thematic layers and topology
5.	Raster and vector data models; their associated advantages and disadvantages
6	Concept of Topology
7.	Digital Elevation Model (DEM) and their applications
8.	Triangulated Irregular Network (TIN)
9.	Raster and vector integration
10.	GIS analysis operations
11.	Precision and accuracy
12.	Errors in GIS, their detection and optimization
13.	GIS integration with remote sensing
14.	Concept of Global Positioning System (GPS)
15.	GPS applications in Earth Sciences

Suggested Books:

S. No	Name of Books/ Authors
1.	Introduction to Geographic Information Systems by Chang Kang-tsung (Karl)
2.	Geographic Information Systems: An Introduction by Tor Bernhardsen
3.	Geographic Information Systems: A Management Perspective by S. Aronoff
4.	Thinking About GIS: Geographic Information System Planning for Managers by Roger Tomlinson
5.	Integrating GIS and the Global Positioning System by Karen Steede-Terry
6.	Geographic Information Systems and Science (Paperback) by Paul A. Longley
7.	GPS Satellite Surveying, 2nd Edition by A. Leick
8.	Principles of Geographic Information System by Rolf A. de By (ITC, Netherlands)

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **08**
SUBJECT CODE : **GT- 805**
COURSE TITLE: **Engineering geology**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: Understanding fundamental concepts of Engineering Geology – basics of geo-mechanical properties of rocks – systematic investigation methods for major Engineering structures

Details of Course:

S. No	Particulars
1	Introduction to Engineering Geology – Master plan for river valley projects
2	Dams – parts, types, criteria for site selection, forces acting on dams
3	Tunnels – parts, classification, ground conditions, geological considerations
4	Engineering geological maps for major engineering projects
5	Engineering properties of rocks – laboratory and in-situ tests
6	Concept of rock mass classification – utilities – RMR scheme
7	Landslides – concepts, classification, techniques for analysis
8	Building materials – aggregate properties
9	Engineering Geological investigations related to highways, buildings, bridges & other structures

Suggested Books:

S. No	Name of Books/ Authors
1	Geology & Engineering – R.F. Legget & A. Hathway
2	Principles of Engineering Geology & Geotechnics - D.P. Krynine & W. R. Judd
3	Fundamentals of Engineering Geology – F.G. Bell
4	Principles of Engineering Geology – P.B. Attewell & I.W. Fermer
5	Engineering Geology – Q. Zaruba & E. Mencl

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **08**
SUBJECT CODE : **GT- 806 (Based on GT- 801, GT- 804)**
COURSE TITLE: **PRACTICAL**
MARKS: **PRACTICAL: 75 :SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of practicals : Exercises based on the studies of environmental geology and GIS technology in the light of geological problems.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **08**
SUBJECT CODE : **GT- 807 (Based on GT- 802, GT- 803, GT- 805)**
COURSE TITLE: **PRACTICAL**
MARKS: **PRACTICAL: 75 : SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of practicals : Exercises based on the application of coal geology, mining geology and engineering geology on geoscientific data analysis and interpretation.

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COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **09**
SUBJECT CODE: **GT- 901**
COURSE TITLE: **Well logging**
MARKS: **THEORY: 100, SESSIONAL : 50**

EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: To introduce well-logging tools, methods, interpretation procedures to Geology students

Details of Course:

S. No	Contents
1	Introduction
2	Geophysical wire-line logging tools
3	Electrical Logging
4	Focussed logging tools
5	Porosity tools
6	Permeability estimations and cross plots
7	Well logging case studies

Suggested Books:

S. No	Name of Books/ Authors
1	Formation evaluation by E.J. Lynch
2	Fundamentals of well log interpretation by O. Serra
3	Log Interpretation Principles/ Applications by Schlumberger
4	Handbook of Well Log Analysis by S.J. Pirsson

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **09**
SUBJECT CODE : **GT- 902**
COURSE TITLE: **Geoscientific Instrumentation & Analytical Techniques**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: This course is designed to give the post-graduate geology students an introductory idea about the various types of instrumentation & analytical techniques used to obtain numerous geological data.

Details of Course:

S. No	Contents
1	Sample and sampling in Geoscience
2	Preparation thin section and polished section making - Cutting, grinding and polishing; Powder sample preparation crushing & pulverizing;
3	Modal count techniques. Technique in photography – mega & micro.
4	Techniques in Microfossils slide preparation
5	Sample digestion procedure for geochemistry – Solution A & B
6	Sedimentology techniques: Sieves & sieve shaking; Sample etching & staining, heavy minerals & clay minerals methods, size & shape of sediments studies
7	Brief introduction to spectrophotometry:- Principles and geological application: Flame photometer, UV spectrophotometer, Atomic Absorption Spectrophotometry; ICP-Mass spectrometry; X-ray fluorescence spectrometry; Electron microscopy and electron-probe microanalysis; Cathodoluminiscence & thermoluminiscence spectrometry
8	Engineering Geology and Hydrogeology techniques & Instrumentation
9	Geophysical Instrumentations– principles, working and data acquisition

Suggested Books:

S. No	Name of Books/ Authors
1	Laboratory handbook of petrographic techniques. Hutchinson,C.S. John Wiley
2	Optical Mineralogy. Kerr,P.F.
3	Optical Mineralogy. Phillips,W.R. and Griffen,D.T. CBS, Delhi
4	Using geochemical data: Hugh Rollinson
5	Modern geotechnical engineering. Alam Singh
6	Practical manual of exploration & prospecting. Babu & Sinha
7	Hand book of mineral exploration and ore petrology Techniques and application R.Dhana Raju
8	Geophysical practice in minerl exploration and mapping. T.S. Ramakrishna

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **09**
SUBJECT CODE: **GT- 903**
COURSE TITLE: **ADVANCED STRATIGRAPHY, PALAEOGEOGRAPHY AND PALEOECOLOGY**
MARKS: **THEORY: 100, SESSIONAL : 50**

EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: To impart basic understanding of advanced stratigraphy and its relation with palaeobiography.

Details of Course:

S. No	Particulars
1	Controls on development of Stratigraphic records. Stratigraphic Principles and Nomenclature, Biostratigraphy: Controlling factors, Zonations and time significance and Chronostratigraphy. Magnetostratigraphy, Cyclostratigraphy. Paleo-bathymetry.
2	Sequence Stratigraphy: Definition, factors and controls of sequence stratigraphy. Basin analysis through sequence stratigraphy
3	Seismic startigraphy, Event Stratigraphy: Global Bio-events, extinctions and radiations, Global Geo-events, Pedostratigraphy, Palaeogeographic reconstructions, Palaeogeography of India during Gondwana duration, Palaeogene and Neogene.
4	Palaeobiogeography: concepts, recognition, factors controlling geographic distribution of species. Palaeoecology- Concepts of Palaeoecology, application of community analysis in palaeoenvironmental reconstruction, Mass extinctions, glacial cycles, global climate change. Temporal pattern of communities-evolutionary changes in fauna and flora with environments.
5	Classification, distribution, stratigraphic succession, climatic vicissitudes and economic significance of Gondwana sequence of India. Deccan Volcano-sedimentary, Tertiary stratigraphy of India with special emphasis on Hydrocarbon resources.

Suggested Books:

S. No	Name of Books/ Authors
1	Sequence stratigraphy, Oxford, Blackwell Science, Emery, D. & Myers, K.J., 1996
2	Geology of India and Burma : M.S. Krishnan
3	Introduction to Palaeoecology. McGraw Hill, Ager,D.V.
4	Seismic Stratigraphy-Applications to Hydrocarbon Exploration. Amer. Assoc. Petrol. Geol. Publ. : C.E. Payton. 1977
5	Coal and organic Petrology, Hindustan Publishing Corporation, New Delhi. Singh, M.P.
6	Principles of Sedimentology and Stratigraphy, Prentice Hall: Sam Jr. Boggs.
7	Fundamental of Historical Geology and Stratigraphy : Ravinder Kumar

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **09**
SUBJECT CODE : **GT- 904**
COURSE TITLE: **Geo-hazards and Disaster Management**
MARKS: **THEORY: 100, SESSIONAL : 50**
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: Students will be taught geological hazards and their role in disaster management to meet the demands of all the states in the country and to fill vacancies arising in each district of the country.

Details of Course

S. No	Contents
1	Definition of disasters, natural and man-made, Environmental concepts
2	Definition of Hazard, vulnerability and risk
3	Landslides, mitigation and management
4	Earthquakes, mitigation and management
5	Floods, mitigation and management
6	Coastal hazards, tsunamis and sea level changes
7	Droughts, desertification, soil erosion

Suggested Books:

S. No	Name of Books/ Authors
1	Krynine and Judd WR Engineering geology, McGraw-Hill Book Company, New York
2	Hoek and Bray, J Rock slope engineering, Spon Press; 3 edition
3	Thornbury Applied Geomorphology, John Wiley and sons,. Inc., New York.
4	Keller, EA Environmental geosciences, prentice hall, New Jersey.
5	Petak,WJ and Atkinsson, AD Natural Hazard risk assessment and public policy, Springer-Verlag. New York.
6	Roy .P.S, Van Western C.J, Jha V.J. Natural Disasters and Mitigation, IIRS, Dehradun.
7	Mitigation of natural hazards and disasters: international perspectives, Haque, C.Emdad, Springer, Dordrecht

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **09**
SUBJECT CODE: **GT- 905**
COURSE TITLE: **Organizational Behavior and Business Management**
MARKS: THEORY: 100, SESSIONAL : 50
EXAMINATION DURATION: THEORY : 03 HOURS

Objective of Course: Students will be taught geological hazards and their role in disaster management to meet the demands of all the states in the country and to fill vacancies arising in each district of the country.

Details of Course

S. No	Contents
1	Concept of organisational behaviour, nature of organisational behaviour, organisational behaviour and other similar fields of study – Psychology, Sociology, Anthropology, Political Science. Approaches to organisational behaviour. Challenges and opportunities for organisational behaviour
2	Perception: concept of perception, perceptual process, factors influencing perception. Learning: Concepts of learning, components of learning process, factors affecting learning. Leadership: Meaning of leadership, Leadership theories- Charismatic Leadership Theory, Trait Theory, Behavioural Theory. Motivation: Concept of motivation, motivation and behaviour, Theories of Motivation- Maslow's Need Hierarchy Theory.
3	Concept and forms of organisation structure. Concept of organisational culture, creating and sustaining organisational culture. Nature of organisational change, factors affecting organisational change, Resistance to Change, Overcoming resistance change.
4	Business: Concept, nature and objectives. Social responsibility of business. Environment: Meaning of environment, constituents of environment; Economic, Social, Political, Legal and technological environment. Management: Definition, nature and significance. Functions of Management; Planning, Organising, Staffing, Directing and Controlling.
5	Financial Management: objectives and functions of financial management. Personnel Management: Meaning, nature, importance and Functions of Personnel management. Human Resource Development- Meaning and concept. Marketing Management: Nature, scope and importance of marketing management. Modern marketing concepts. Role of marketing in economic development. Meaning, nature and scope of international marketing.

Suggested Books:

S. No	Name of Books/ Authors
1	Organisational Behaviour – Stephen P. Robbins (Pearson Education)
2	Organisational Behaviour- Fred Luthans (MacGraw Hill, New York
3	Organisational Behaviour – Jit S. Chandan (Vikas Publishing House Pvt. Ltd.)
4	Organisational Behaviour – L.M. Prasad (Sultan Chand & Sons, New Delhi)
5	Human Relations & Organisational Behaviour- R.S. Dwivedi (Oxford, IBH)
6	Personnel Management – C.B. Mamoria (Himalayan Publications, New Delhi)
7	Business Environment – Francis Charurilam (Himalaya Publishing House)
8	Management – Harold, Koontz and Cyrilo' Donell (Mc Graw Hill)
9	Principles of Personnel Management – Edwin B. Flippo (Mc Graw Hill)
10	Personnel Management and Industrial Relations – D.C. Sharma and R.C. Sharma)(SJ Publications, Meerut)
11	Basic Marketing – Cundiff and Still (PHI, India)

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **09**
SUBJECT CODE : **GT- 906 (Based on GT- 901, 902, GT- 904)**
COURSE TITLE: **PRACTICAL**
MARKS: **PRACTICAL: 75 : SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of practicals : Exercises based on the application of well logging, instrumentation and analytical technique in geology, geohazards and disaster management.

COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER : **09**
SUBJECT CODE : **GT- 907 (Based on GT- 903, GT- 905)**
COURSE TITLE: **PRACTICAL**
MARKS: **PRACTICAL: 75 : SESSIONAL : 25 : TOTAL : 100**
EXAMINATION DURATION: PRACTICAL : 03 HOURS

List of practicals : Exercises based on the subjects of advanced Stratigraphy , Paleogeography & palaeoecology and organizational behavior and business management in the geosciences applications and related industries

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COURSE: **M.Tech. Applied Geology 5 Year Integrated Course**
SEMESTER: **10**

Course No.	Course Title	Total
GT-1001	Project work	150
GT-1002	Dissertation	150
GT-1003	Viva voce	150
		450