MANONMANIAM SUNDARANAR UNIVERSITY
CENTRE FOR GEOTECHNOLOGY

Syllabus for M.Sc Applied Geophysics (CBCS)
2019– 2020 onwards (Fulltime)

Regulations

Duration	**:**	Two academic years (Four semester course)
No.of seats	**:**	20 Seats
Eligibility	**:**	B.ScinPhysics/Chemistry/Mathematics/Computer science/Geology/Geophysics/ Statistics/Electronics and communication/Electronics/Applied Electronics/IT, Degree in any Branch of Engineering and other equivalent courses.
Examination	**:**	There will be internal assessments comprising oftests, seminars and assignments and one end-semester examination during each semester. A minimum of 50% marks in a course is prescribed for a pass. The candidate who has not secured a minimum of 50% marks in a course will be deemed to have failed in that course.
Necessity, Objective and outcome of theCourse:		This course is necessary to understand the subsurface of the earth using the various physical principles. The applied geophysics course trains the students in all geophysical methods like Electrical, Gravity and Magnetic, Seismology, Seismic, well logging, etc.,. The students will be able to understand the applications of geophysical methods for exploration of Groundwater, mineral and Oil and Gas sectors. The students can evaluate the data acquisition procedures, process and interpret the geophysicaldata.
EligibilityforTeaching Appointment	**:**	As stipulated in UGC norms, specialization in Geophysics / Applied Geophysics / Exploration Geophysics / Mineral Exploration / Marine Geology / Marine Geophysics / Applied Geology

SCHEME OF EXAMINATIONS

M.Sc., APPLIED GEOPHYSICS (CBCS)

Paper	Subject	Credit	Int.	Ext.	Total	Teaching Hours
Semester I						
Paper I	Physics of the Earth	4	25	75	100	4
Paper II	Seismology	4	25	75	100	4
Paper III	Computer Applications in Geosciences	4	25	75	100	4
Paper IV	General Geology	4	25	75	100	4
Paper V	The Dynamic Earth (form e-phatasala**)** or Mineral exploration (Elective Major)	3	25	75	100	3
Paper VI	Practical – I	2	50	50	100	4
Semester II						
Paper VII	Elective-Non major - Natural Hazards - Part-1 (Swayam/NPTEL – online course)	3	25	75	100	3
Paper VIII	Geophysical Signal Processingand Inversion	4	25	75	100	4
Paper IX	Groundwater Geophysics	4	25	75	100	4
Paper X	Electrical and Electromagnetic prospecting	4	25	75	100	4
Paper XI	Gravity and Magnetic Prospecting	4	25	75	100	4
Paper XII	Meteorology & Climatology(from e-phatasala)or Disaster management - (Elective Major)	3	25	75	100	3
Paper XIII	Practical - II	2	50	50	100	4
Semester III						
Paper XIV	Elective – Non major -Remote Sensing and GIS (Swayam/NPTEL – online course)	3	25	75	100	3
Paper XV	Borehole Geophysics	4	25	75	100	4
Paper XVI	Marine Geophysics	4	25	75	100	4
Paper XVII	Environmental GeoTechnology	4	25	75	100	4
Paper XVIII	Seismic Prospecting	4	25	75	100	4
Paper XIX	Practical – III	2	50	50	100	4
Semester IV						
Paper XX	Dissertation and Viva Voce	24	50	50	100	48

TotalCredits: 90 Credits
TotalMarks : 2000marks

SEMESTER QUESTION PAPER MODEL

CodeNo. **Sub Code**

M.Sc. DEGREE EXAMINATION
Applied Geophysics (CBCS)

Semester
(For those who joined in July 2016 – 2017 onwards)
(SUBJECT)

Time :ThreeHours **Max. 75 Marks**

Section – A
Answer all questions
All questions carry equal marks (10 X 1= **10 Marks**)

TEN QUESTIONS (1 - 10)

Section – B
Answer all questions
All questions carryequalmarks (5 X 5= **25Marks**)

FIVE QUESTIONS (11 - 15)
(a OR b)

Section – C
Answer all questions
All questions carryequalmarks (5 X8= **40Marks**)

FIVE QUESTIONS (16- 20)
(a OR b)

Physics of the Earth

L T P C
4 0 0 4

Preamble: This paper focuses on understanding of the solar system, , geomagnetic field, continental drift and platetectonics.

Unit-I:
History of development and scope of geophysics, hypotheses for the origin of solar system, Kepler's law of planetary motion, planet and satellites of the Solar system and their characteristics, Internal constitution of the earth, Characteristics of Crust, Mantle and Core, lithosphere, and asthenosphere. **(12L)**

Unit-II:
Geochronology, Radioactive decay.Dating of rocks - potassium-argon – rubidium strontium-uranium-lead-carbon 14 methods, age of the Earth.Importance of heat flow, thermal history of the earth, sources of heat generation and temperature distribution inside the earth, Radiometric dating principles and ages of rocks andtheearth. **(12L)**

Unit-III:
Origin of geomagnetic field, secular variations and westward drift, geomagnetic time scale, geomagnetic storms, Earth's current, sun spot, solar flares, lunar and solar variations, Palaeomagnetic studies of rock samples and their applications in geophysics, polar wandering, reversals of geomagnetic field. Geomagnetic time scale Gravity and Figure of the Earth, international gravity formula and rotation of the earth.Concept of isostasy, Airy, Heiskanan and Pratt-Hayfordhypotheses. **(12L)**

Unit-IV: Concept of Tectonics:
Continental drift and the origin of Plate Tectonic theory- Pangea, Gondwanaland and the supercontinent hypothesis-Tectonics on a Sphere-Palaeomagnetism and past plate motions with emphasis on the history of modern oceans. Components of the oceanic lithosphere – ridges, transform faults, trenches andoceanicislands. **(12L)**

Unit-V: Continental drift and Plate tectonics:
Geosynclines, Isostacy, Island arcs, Deep sea trenches, Continental drift, Sea floor spreading and Plate tectonics.Plate subduction and convergent plate tectonics.Orogeny and orogenic cycles – Epeirogeny and evolution of plateaus.Structural and tectonic features of India–Quaternary tectonics. **(12L)**

References

1. Planet Earth by Press andSiever
2. Fundamentals of Geophysics byLowrie
3. The Solid Earth byFowler
4. Introduction to seismology by PeterShearer
5. Introduction to Geophysics by Howell:
6. Physics and Geology, by Jacobs andRussel
7. Physics of the earth, byStacey
8. The interior of the earth, by M.H.P.Bott
9. Topics in Geophysics, by P.J.Smith

Seismology

L T P
C4 0 0
4

Preamble: This paper explains and elaborates the concept of seismology. This is very much helpful to identify the earthquake intensity.

Unit-I : Introduction to seismology:

Introduction to seismology, Introduction to earthquake phenomena, concept of focus, focal depth, epicenter, great Indian earthquakes, intensity and magnitude scales and energy of earthquakes, foreshocks and aftershocks, elastic rebound theory, seismicity of India, Himalayas and global seismicity, seismic microzonation, seismic zoningof India. **(12L)**

Unit – II: Wave motion

Fundamentals of wave motion. Seismic waves types. (Body waves. Surface Waves,). Seismic wave propogation.Huygen's principle and Fermat's principle.Free oscillations of the Earth, the internal Structure oftheEarth. **(10L)**

Unit – III: Introduction to seismology:

Introduction of earthquake focal mechanism.Types of Earthquakes- Tectonic, Volcanic, Collapse and explosion, Micro earthquakes. Reservoir induced earthquakes. **(12L)**

Unit IV: **Seismometry:**

Introduction, Principle of Seismometer, Historical seismographs.Long period seismometers and Short period seismometers.Vertical motion seismometer and Horizontal motion seismometer.Broad Band seismometer, Analog recorders.Digital recorders.Selection of seismograph stations.Globalseismicnetwork. **(13L)**

Unit V: Seismogram Interpretation:

Earthquake intensity Magnitude, Frequency, Energy released in an earthquake. Epicenter determination.Analysis of earthquake focal Mechanism.Earthquake location- Graphical method of locating local earthquakes and Location of earthquake by Geiger method.Earthquake prediction and precautions. **(13L)**

(Total: 60L)

References:

1. Fundamentals of Geophysics, WilliamLowrie
2. Telford, W.M., Goldart, L.P., Sheriff, R.E. and Keys, D.A., 1981. AppliedGeophysics, Cambridge University Press,Cambridge.
3. Introduction to Seismology, PerryByrle
4. The Mechanics of Earthquakes-faulting,Scholtz.C.H.
5. An introduction to the theory of seismology, Bullen.K.E.
6. Quantitative seismology: theory & methods, Aki. K. and Richrds.P.G
7. Haakon Fossen (2010), Structural Geology, Universiteteti Bergen,Norway,
8. David D. Pollard, Raymond C. Fletcher (2005), Fundamentals of StructuralGeology,
9. David Gubbins (1990), Seismology and PlateTectonics.

Computer Applications in Geosciences

L T P C
4 0 0 4

Preamble: This paper focuses on Computer programming and software application in geosciences.

Unit-I: Fundamentals of Operating systems and Introduction to Language:

Operating system (DOS, Windows, LAN, WAN, Linux, Unix) – Languages. Computer and Programming concepts: Algorithms and Flow charts – Programming fundamentals – (Constants variables, Operatorsand Expressions) **(13L)**

Unit-II: Introduction to programming:

Introduction to C and C++; Programming statements – (Branching and Looping, Arrays, Functions and Procedures) – File Handling; Problems solving with computers using C/C++; Application of C & C++inGeosciences. **(11L)**

Unit-III:Introduction to MATLAB and Commands:

Introduction to MATLAB – Commands – Vectors, Matrices and Arrays, Basic arithmetic operations,Basic concept of numerical analysis; M-file introduction; Programming in MATLAB; Floating point arithmetic and error finding; Different MATLAB toolboxes and its application for Geosciences. Data format handling; Data import and export in MATLAB; Saving and exporting the files. **(12L)**

Unit-IV: Programming with MATLAB:

Program to Plot- subplot- double axis plot – Axis command- tick marks and labels; Curve plotting using basic 2D and 3D program as a tool in Earth science; Types of plot in MATLAB - Parametric plot, Contour plot, Field plot, polar plot; Curves and surfaces in three dimension; Programming in MATLAB using Loops; Basics of using the Fourier transform; Power spectrum; Time frequency analysisinMATLAB. **(12L)**

Unit-V:Geo-Statistics

Definition, Frequency distributions, Cumulative Frequency distribution and measures of central tendencies – (Mean, Median and Mode);Spatial data- Definition and Characteristics Types: Point pattern, continuous surfaces, Area with counts and aggregate rates, Spatial Analysis; Spatial dependence, Stationarity and Isotropy; Anisotropy; Region of stationarity; Spatial correlation; Auto correlation;Corelogram; Measures of dispersion – (Range, Mean deviation, Quintile deviation variance andStandard Deviation) **(12L)**

(Total: 60L)

References:

1. William, Palm Introduction to Matlab forEngineers
2. Amos Gilat, MATLAB; An introduction withapplications
3. Marc E. Herniter, 2003, Programming in MATLAB, Thomson Asia pre Ltd,Singapore
4. Brian R.Hunt, Ronald L Lipsman, Jonathan M. Rosenberg, 2008, A Guide to MATLAB for Beginners and Exerienced User, Cambridge University Press,Cambridge.
5. Mike Meyers & Scott Jernigan,2004, Operating SystemsTataMcgraw-Hilledition,
6. Andrew.S. Tanenbaum., 2010, Modern Operating system, PHT learning Private Limited, NewDelhi.
7. Sizeh, B, 1987: Use and Abuse of Statistical Methods in the Earth Science, Oxford University Press, Oxford.
8. Davis, A. C., (1973), Statistics and data analysis in Geology, Wiley &Sons.
9. Isaake, E. & Srivastava, R., An introduction to Applied Geostatistics, Oxford University Press,NewYork,1989.
10. Kitanidis P.K., Introduction to Geostatistics, Applications in Hydrogeology, Cambridge University Press, 249 pages, 1997.

General Geology

L T P
C4 0 0 4

Preamble: This paper explains about geology and its fundamentals. And also describe aboutsediments and various types of rocks.

Unit I:Crystal and minerals:

Crystal systems, Chemistry of minerals, atomic bonding.Structural classification of Sillicate minerals and their compositional variations, rock-forming and economic minerals- Major silicate mineral groups (quartz, feldspar, pyroxene, amphibole, mica, olivine and garnet) and their diagnostic properties- Basicoptical mineralogy. **(12L)**

Unit II:Introduction to Igneous rocks:

Introduction – Types of Rocks – Igneous Rocks: forms of Intrusive and extrusive igneous bodies – structures and textures – its classification- Properties of magma. Bowen's reaction series- Magmatism in relation to tectonic settings, radioactivity & datingof rocks. **(10L)**

UNIT III:Introduction to Metamorphic & Sedimentaryrocks:

Metamorphism, agents of metamorphism, types of metamorphism, metamorphic reactions, metamorphic textures and structures. Classification of metamorphic rocks based on chemical composition and minerology. Grades and zones of metamorphism.Metamorphic facies. Formation of sediments & sedimentary rocks: their compositions, textures & structures; origin & classification of conglomerate, sandstone, shale & limestone; sedimentary environments &facies; characteristics of non-marine, transitional &marine environments. **(14L)**

Unit IV: **Folds, Faults and Joints:**

Folds - parts of a folds, nomenclature of folds: Anticline, syncline, symmetrical fold, asymmetrical fold, overturned fold, recumbent fold, isoclinal fold. Faults - Terminology of fault plane; nature of movement along faults: Translational and rotational movements, relative movements, Effects of disturbed strata. Throw and heave; Classification: Geometrical classification, Genetic classification. Classification based on absolute movements. Joints -Definition, geometric and genetic classification. **(12L)**

Unit V:Principles of stratigraphy:

Law of order of superposition.law of uniformitarianism and law of faunal succession. Standard stratigraphic scale and Indian Geologic Time scale. Imperfections in Geological record.Geological divisions. Precambrian Stratigraphy: Mineral Wealth of Cuddapahs, Vindhyans, Kurnool group. Paleozoic Stratigraphy: Paleozoic rocks of Peninsular India, Mesozoic Stratigraphy: economic importance of Gondwana formations of India, Coastal Gondwana of India, Gondwana formations of Tamilnadu- Cretaceous of Tiruchirapalli - Deccan traps; Cenozoic Stratigraphy. **(12L)**

(Total: 60 L)

References:

1. Mukerjee, P.K. A Textbook of Geology, World Press,1997.
2. Rutley, F. Elements of Mineralogy, CBS,1991.
3. Tyrrel , G. W. The Principle of petrology – Chapman and Hall Ltd , London ,1998.
4. Winter. J. D. Igneous and metamorphic petrology,2001.
5. Pettijohn, F.J. Sedimentary rocks, III Ed., Harper & Row,1975.
6. Sengupta, S.M. Introduction to Sedimentology, Oxford & IBH,1994.
7. Krishnan, M.S. Geology of India and Burma, CBS Publ. & Distr.,1982.
8. Billings, M.P. Structural Geology, PrinticeHall,1974.
9. Ravindra Kumar, Fundamentals of Historical Geology and Stratigraphy of India, Wiley Eastern. 1985.

The Dynamic Earth (Elective major)

L T P
C3 0 03

Preamble: This paper describes about various processes of the dynamic earth like Glaciers, weathering, Mass Wasting, Fluvial and Aeloian and land forms.

Unit I:Coastal Processes and Landforms

Introduction Coastal Zones; Waves and Tides; Geomorphology of Coasts; Divisions of Coastal Zones; Five Major Zones; Features of Shoreline; Beach cycles; Features of a coastline;Forces acting on shorelines, Sea Waves -Classification;Processes of coastal erosion, Mechanisms of Erosion, Depositional Landforms, Depositional Beaches, Spits and bars, Tombolo, Barrier Islands, Barrier spits, Capes, Mudflats,Deltas. **(9L)**

UNIT II:Weathering Process

Introduction: Geomorphic processes, Weathering, Factors influencing weathering, Impacts and Types of weathering, Topography and climate, Rock Type, Rock Structure, Erosion, Time, Physical weathering processes, Mechanisms of Physical weathering,Spheroidal weathering, Chemical weathering processes - Effectiveness, Rate and Impacts of chemical weathering, Processes of chemical weathering, Biological weathering processes, Rates of weathering, Behavior of Geologic materials, Temperature andrainfall,Unloading. **(9L)**

Unit III: Mass Wasting Processes

Mass-wasting and its causes, Types of mass-movements, Triggers of mass-wasting, Factors influencing mass-wasting, Importanceofmass-movements. **(8L)**

Unit IV:Fluvial and Aeolian Processes and Landforms

Fluvial - Introduction, Streams and Drainages, Stream Valleys, Valley -Development, Deepening, Widening, Lengthening; River and its stages, River course, Process of Lower, Middle and Upper Courses; Erosional work of streams, Rate of erosion and types of erosion; Transportation work of streams; Erosional landforms and Depositional landforms;Aeolian - Introduction – Geological agents; Wind and its characteristics, Geological process, Erosional landforms, transportation effect and depositionallandforms. **(9L)**

Unit V: Glaciers

Introduction, Sphere of ice & snow – Cryosphere and Glaciology, Glaciers and Glacial systems – Snow line, Parts, Characteristics and Classification of glaciers, Mountain or Valley Glaciers, Continental Glaciers, Distribution of Glaciers, Formation of Glaciers, Movement of glaciers, Features of Glaciers, Geological action of Glaciers, Ice ages, Glacial Budget, Glaciers and Global climate, Importance of Glaciers. **(10L)**

References:

1. e-PGphatasala website (epgp.inflibnet.ac.in).

Mineral Exploration (Elective Major)

L T P
C3 0 03

Preamble: This paper describes about mineral exploration. And also explains the various geophysical techniques used in mineral exploration.

Unit I: Principles of mineral prospecting and exploration:

A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies Principles of mineral prospecting and exploration - conceptualization, methodology and stages; sampling, subsurface sampling including pitting, trenching and drilling, core and non-core drilling, sampling and assaying. Gravity, electrical, magnetic, airborne and seismic methods of exploration, planning of bore holes and location of bore holesonground. **(11L)**

Unit II:Guides for locating ore deposits:

Structural, lithological, stratigraphic and physiographic guides. Surface and Sub-surface exploration: use of diamond drilling in exploration; Resource, reserve definitions; mineral resource in industries - historical perspective and present. methods of ore reserve estimations; recoverable reserves and anticipated life ofthedeposits. **(9L)**

Unit III:Application of Geophysical techniques:

Geomorphological and remote sensing techniques and Geobotanical and geochemical methods.Application of geostatistical techniques inMineralExploration. **(8L)**

Unit IV: Mining methods:

Surface and underground mining methods; factors in selection of open cast and underground mining methods. coal mining methods: room and pillar method, long wall method. Environmental aspects of Mining activities.Petroleum exploration; geological, reservoir rocks, geochemical and geophysical methodsofexploration. **(9L)**

Unit V: Principles of mineral economics: Strategic, critical and essential minerals. Mineral production in India.Changing pattern of mineral consumption.National mineral policy.Mineral concession, rules, marine mineral resources and LawofSea. **(8L)**

(Total: 45L)

References:

1. Sharma, P.V., 1986: Geophysical Methods in Geology.Elsevier
2. Sharma. P.V., 1997: Environmental and engineering Geophysics, Cambridge University Press
3. Stanislave, M., 1984: Introduction to Applied Geophysics, ReidelPubl
4. Turaga, S.P., 2006. Drilling Fluids, their composition, function and properties, Centre for Rural Development and Environmental Studies (Pub.),Secunderabad.
5. Govett, G.J.S.(Ed) 1983: Handbook of Exploration GeochemistryElsevier.
6. Mckinstry, H. E., 1962: Mining Geology. II Ed. Asia PublishingHouse
7. Hunt, J.M., Petroleum Geochemistry and Geology, 1996, 2nd Edn. W. H. Freeman, SanFrancisco.

Practical - I

L T P
C0 0 4 2

Preamble: This practical paper gives the knowledge about Geological and mineral exploration, Electrical and Electro Magnetic prospectingproblems.

Practicals are selected from the following list

1) Megascopic and microscopic identification of common silicate and oreminerals
2) Megascopic identification of commonrocks
3) Computation of Resistivity profiling curve with a Two Electrode spread over a verticalconta
4) Computation of Resistivity profiling curve with a three Electrode spread over a verticalcontact.
5) Computation of Resistivity profiling curve with a four electrode spread over a verticalcontact.
6) Analytical and Graphical construction of VES curves.
7) Application of curve matching techniques in interpretation of VEScurves
8) Computer interpretation of VES data
9) Computation and interpretation of S.P. anomaly over asphere.
10) Any other relatedpracticals

(Total: 60L)

II Semester

2019-20/MSU/49th SCAA/Univ.Depts./PG/M.Sc.(App.Geophys)/Sem.-II/Part-IV/Supportive-1/Ppr-7/

Natural Hazards - Part-1- Elective (Non Major)

L TP C
3 0 03

Preamble: This paper describes about the various types of natural hazards and this papers is offered through onlineprogram.

CIVIL ENGINEERING

PROF. JAVED MALIK
Department of Earth Sciences
IIT Kanpur

TYPE OF COURSE : New| Elective | UG/PG
INTENDED AUDIENCE : UG/PG students of Science/Engg
COURSE DURATION : 8 weeks (28 Jan'19 - 22 Mar'19)
EXAM DATE : 31 Mar 2019

PRE-REQUISITES : Basic knowledge of Earth Science or Natural Disasters is recommended.

COURSE OUTLINE :

The course introduces students to natural disasters and their phenomenon, ground deformations, land-level changes, event recurrence intervals, associated environmental and depositional changes, sedimentation patterns, and all the related hazards. Some of the well-known natural disasters are earthquakes, landslides, floods, tsunamis, volcanic eruptions, storms, and cydones etc. which cause different types of natural hazards in the associated environment and landscape. This course will emphasize their mechanism, origin, and impacts in the associated regions such as mainland, hilly terrain, floodplain/alluvial plain, and coastal regions etc., and also focus on the approaches for mitigating and minimizing hazards along with related hazard assessment.

ABOUT INSTRUCTOR :

Prof. Javed Malik earned his Ph.D in 1998 from M.S. University Baroda, Vadodara, Gujarat (Geology), did Post-Doctorate (Japan Society for Promotion of Science) from (1999-2001) Hiroshima University, JAPAN. He joined IIT Kanpur in 2001 and his areas of Specialization are Active Tectonics, Paleoseismology and Paleo-tsunami

COURSE PLAN :

Week 01 : Natural Hazards and Disasters ,Natural Hazards and Disaster,Human Impact on Natural Disaster,Predicting Catastrophe,Mitigating Hazards
Week 02 : Mitigating Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards,Earthquakes and their causes
Week 03 : Earthquakes and their causes,Earthquakes and their causes,Ground Motion and Failures,Ground Motion and Failures,Ground Motion and Failures
Week 04 : Tsunami: Gaint Tsunamis,Tsunami: Gaint Tsunamis,Tsunami: Generation and Movement,Tsunami: Generation and Movement,Tsunami: Generation and Movement
Week 05 : Tsunami Hazard Assessment,Tsunami Hazard Assessment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment
Week 06 : Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes, Type of downslope movement, associated hazard,Land Subsidence and associated hazard,Land Subsidence and associated hazard
Week 07 : Floods and Human Interaction,Flood Frequency and Recurrence Interval,Flood Frequency and Recurrence Interval,Human intervention and mitigation,Human intervention and mitigation
Week 08 : Storms: Tropical Cyclone,Storms: Tropical Cyclone,Hurricane, Tornado, Storm damage and safety, Wildfires: Fire Process and Secondary effects,Wildfires: Fire Process and Secondary effects

Reference:

1. Swayam/ NPTEL onlinecourse

Geophysical Signal Processing and Inversion

L T P
C4 0 0
4

Preamble: This paper describe about Geophysical Signal Processing and Inversion. This paper is very much useful for students to interpret the geophysicaldata.

Unit I:Fundamental concepts:
Continuous and discrete signals, operation on signals, linear and time invariant systems, digitization, sampling interval and aliasing, Dirac delta function and impulse response of a linear system,impulse response function, Z-transform, properties of Z-transform, wavelets, minimum delay, maximum delay and mixeddelaywavelets. **(13L)**

Unit II: Fourier series:
Fourier series, Orthogonal function and Dirichlet conditions, Fourier transform, properties and applications of FT, Fourier transform of a symmetrical rectangular pulse, reciprocity, Interpretation of geophysical data usingFouriertransform. **(12L)**

Unit III: Introduction to convolution:
Convolution, methods for convolution, properties of convolution, autocorrelation, crosscorrelation, and their applications, time domain and frequency domain concepts.Deconvolution. **(11L)**

Unit IV:Filters:
Butterworth, chebyshev and elliptic, Low-pass, high-pass and band-pass digital filter designs, Gibb's phenomenon, Recursive filters.Wiener inverse filtering and its mathematical details, homomorphic applications of deconvolution filtering. Windowing - Triangular, Hanningand Hamming window, Bortlett window, Parzen window, Daniell window, practical applications of windows. **(14L)**

Unit V:Inversion Theory:
Introduction, Fundamentals of Inversion, Linear Inversion, Non Linear Inversion, Incorporating prior information, Parametric Inversion, Assessing the uncertainty in inverted models. **(10L)**

(Total: 60L)

References:

1. Silvia &Robinson:Deconvolution of Geophysical Time Series in the Exploration for Oil and NaturalGas
2. Robinson &Trietel : Geophysical SignalAnalysis
3. Kanasevich : Time Sequence Analysis inGeophysics
4. Bath : Spectral Analysis inGeophysics
5. Oppenheim &Schafer : Digital Signal Processing
6. Papoulis: The Fourier Integral and its Applications
7. Bracewell, R. The Fourier Transform and its applications McGrawHill
8. W. Menke, Geophysical data analysis: Discrete inverse theory, AcademicPress,
9. International Geophysical series, Vol. 45,1989.
10. J. A. Scales, M. L. Smith and S.Trietel, Introductory Geophysical InverseTheory,
11. Samizdat Press, Golden Colarado, USA,2001
12. D. Gubbins, Time series analysis and Inverse theory for Geophysicists,Cambridge
13. Univ. Press,2004.

14. A. Tarantola, Inverse Problem Theory, Elsevier Publishers, New York,1987.

Groundwater Geophysics

L T P
C4 0 0
4

Preamble: This paper describe about Groundwater Geophysics. This paper elaborately discuss about type of water and its flow. And also describe the geological and hydrogeological methods in groundwaterexploration.

Unit I: Water onearth:

Types of water — meteoric, juvenile, magmatic and sea water; Hydrological Cycle and its components; Evaporation formulae and theories of surface flows,estimation of flood flow, method of unit hydrograph, their applications, Water balance; Water-bearing properties of rocks — porosity, permeability, specific yield and specific retention; Vertical distribution of water; Zone of aeration and zone of saturation; Classification of rocks according to their water-bearing properties; Aquifers; Classification of aquifers andaquiferparameters. **(13L)**

Unit II: Theory of groundwater flow:

Water Resources flow - Partially saturated soils, Darcy's law in unsaturated medium, derivation of Darcy's law from Navier-stokes theorem, different forms of unsaturated flow equation, nature of the physical parameters in unsaturated flow, infiltration theories, concepts of diffusion, dispersion and redistribution in groundwater, groundwater hydrographs, application of finite difference and finite element techniques,simulationmethod. **(12L)**

Unit III: Groundwater levels:

Fluctuation of water table and piezometric surface, water table contour map. Groundwater Quality; properties of water, quality criteria for different uses, graphical representation of groundwater quality data, groundwater quality in different provinces in India, groundwater contaminants: natural andanthropogeniccontaminants. **(13L)**

Unit IV: Groundwater modeling:

Geochemical, mathematical and analog models, tracer techniques, Saline water intrusion. Over exploitation of groundwater and groundwater mining, groundwater problems in urban areas, climate change impact on groundwater resources. Practical aspects of flow of groundwater to wells, analysis of pumping test, conservation and utilization of water and its management.Groundwater management andgroundwaterlegislation. **(12L)**

Unit V: Various methods in Groundwater exploration:

Geological and hydrogeological methods of groundwater exploration; Geophysical exploration methods - geo-electrical, seismic, gravity and magnetic methods.Role of remote sensing ingroundwaterexploration. **(10L)**

(Total: 60L)

References:

1. Groundwater by RaghunathH.M
2. Groundwater hydrology by ToddD.k
3. Groundwater hydrology by M.Karamouz
4. Remote sensing and Geospatial information system by A.M. Chandra & S.KGhosh
5. Outlines of Geophysical Prospecting – A Manual for Geologists by M.B. RamachandraRao
6. Applied Geophysics, Cambridge University Press, Cambridge Telford, W.M. Geldart, L.P. Sheriff, and Keys, D.A.1981.

Electrical and Electromagnetic Prospecting

L T P
C4 0 04

Preamble: This paper focuses an understanding of the Electrical and Electromagnetic prospecting and students are expected to know the electrical and electromagnetic prospecting influence in various fields like oil, minerals,etc.

Unit-I:Basic principles of electrical methods of prospecting:

Classification of methods.Electrical properties of rocks, minerals, influence of mineral composition, moisture and salinity, Temperature on resistivity- Current flow in a homogeneous media - Current flow across layers of differing resistivities.

(12L)

Unit- II:Resistivity methods of prospecting: concepts of true and apparent resistivities.

Field methods - Vertical Electrical Sounding (VES), Resistivity Profiling.Resistivity imaging: some fundamental concepts. Methods in resistivity imaging, field surveys and uses. Resistivity data analysis and Interpretation –Applications.

(12L)

Unit-III:Electromagnetic method:

Vertical loop (VLEM) - Horizontal loop - (HLEM)-Very Low Frequency (VLF) - Audio Frequency Magnetics (AFMAG) - TimeDomain systems - Terrain Conductivity.Magneto Telluric (MT) and Transient Electromagnetic (TEM) methods of geophysical exploration.

(12L)

Unit-IV:Electrochemical methods:

Origin and nature of electro chemical processes (spontaneous polarization) in the earth.Exploration of sulphide ore bodies. Typical responses of SP over sphere and rod like bodies. Induced polarization (IP) method: Introduction, Source of IP, membrane, and electrode polarizations,TimedomainandfrequencydomainmeasurementofIP,ApplicationofIPmethods.

(12L)

Unit-V: **Applications:**

Electromagnetic Principles of GPR - GPR Systems and Design, Data Processing, Modeling and Analysis in Environmental Applications, GPR application in Water Resources Research, Mineralogical, Stratigraphy andArcheologicalScience. **(12L)**

(Total:60L)

References:

1. Parasnis, D.S., 1973. Mining Geophysics,Elsevier.
2. Keller, G.V. Electrical Methods in Geophysical Prospecting, Frischnett,Pergamon
3. Patra, H.P. and Mallick, K. Principles of GeoelectricSoundings
4. Telford, W. K and Geldart, L.P., Sheriff, R. F and Keys D.A Applied Geophysics Cambridge UniversityPress.
5. Harry M. Jol., 2008. Ground Penetrating Radar: Theory andApplications
6. E.I Parkhomenko – 1967 Electrical properties of Rocks – Plenum Press, NewYork.
7. Keller and Frischkeicht , 1966, electrical methods in Geophysical prospectingPergaon
8. Stansilav Mares et al.. 1984, Introduction to Applied Geophysics , D.Reidel
9. D.S Parasnis, 1977, Introduction to Applied Geophysics, Published by Chapman &Hall , London.
10. Patra and Bhattacharya 1969 , Direct Current,Geoelectrical Sounding,Elseivier

Gravity and Magnetic Prospecting

L TP C
4 0 0 4

Preamble: This paper describes about Gravity and magnetic prospecting and elaborates the Gravity prospecting instruments and interprets the gravity and magnetic data in oil/gas, mineral and groundwater exploration.

Unit – I: Introduction to gravity and Magnetic:

Basic equations and Earth's gravity field – Measurement of gravity: Absolute gravity and Relative gravity - Basic equations and units of magnetic field - Susceptibilities and densities of various rocks and minerals - factors affecting density and susceptibilities - density and susceptibility determination. Normal gravity field Clairaut'stheorem; Shape oftheearth. **(13L)**

Unit – II:Gravity and Magneticinstruments:

Stable and unstable gravimeters, borehole and airborne gravimeters. Magnetic prospecting instruments: flux gate, proton precession and Rubidium vapour magnetometers.**(10L)**

Unit – III:Processing of gravity data:

Reduction of gravity data, latitude effect, Free-air effect, Bouger correction, topographic correction and various types of gravity anomaly; regional and residual separation, concept of isostasy and isostatic anomaly, principle of equivalent stratum, Excess mass calculations. The gravity anomaly over simplegeometricshapes. **(14L)**

Unit – IV:Processing of magnetic field:

The magnetic field over simple geometric shapes - Relation between gravity and magnetic potentials, curve matching techniques.Transformation of gravity and magnetic anomalies in frequency domain, spectral representation offielddata. **(12L)**

Unit – V: Gravity and magnetic anomalies and applications:

Quantitative interpretation of gravity and magnetic anomalies over simple geometric shapes.Applications of gravity and magnetic prospecting in oil/gas, mineral and groundwater exploration – Applications in geological / structural mapping. Forward modelling and inversion of arbitrary shaped bodies and 2-D, 3-D interfaces. Interpretations infrequencydomain. **(11L)**

(Total: 60L)

References:

1. Stanislav Mares et al., 1984.Introduction to Applied Geophysics, D. REidel Publishing Company, Dordrecht/Bostont.
2. Telford, W.M., Goldart, L.P., Sheriff, R.E. and Keys, D.A., 1981. Applied Geophysics, Cambridge University Press,Cambridge.
3. B.S.R. Rao and I.V.R. Murthy. 1978. Gravity and Magnetic Methods of Prospecting, Arnold-Henninman Publishing Company,Delhi.
4. S.H. Ward (Ed.). 1967. Mining Geophysics, Vol. I and Vol. II., SEG Publication, Tulso, Oklahoma,USA.
5. Grant, F.S. and West, G.F. 1964. Interpretation Theory in Applied Geophysics, McGraw Hill Publication, NewYork.
6. D.S. Parasnis. 1973. Mining Geophysics, Amsterdam, Elsevier Publishers, TheNetherlands.
7. L.L. Nettleton. 1976. Gravity and Magnetics in Oil Prospecting, McGraw Hill Publication, NewYork.
8. V.L.S. Bhimasankaram and V.K. Gaur. 1978. Lectures and Exploration Geophysics, AEG Publications, CEG, Osmania University,Hyderabad.
9. I.V. Radhakrishna Murthy and D.C. Mishra. 1989. Gravity and Magnetic Anomalies in space and frequency domain, AEGPublications.
10. Edwin S. Robinson and CahitCoruh. 1988. Basic Exploration Geophysics. John Wiley and Sons, New York/Toronto/Brisbane/Singapore.
11. I.V. Radhakrishnan, 1998, Gravity and magnetic Interpretation in Exploration Geophysics:Memoin 40 Geological Society ofIndia.

Meteorology & Climatology

L T P
C3 0 0
3

Preamble: This paper explains about various components of Meteorology and Climatology

Unit I: Thermal Structure of the Atmosphere

Introduction, History and trend of research on the exploration of atmospheric structure; Evolution of Atmosphere; Thermal Structure of Atmosphere – Troposphere, Stratosphere, Mesosphere,Thermosphere,Exosphere. **(8L)**

Unit II: Different factors

Factors Affecting Atmospheric Temperature at Troposphere - Composition of the Atmosphere; Insolation, Humidity, Altitude, Type of Biome, Instruments in Study of Atmospheric Layers, Human and Natural Influences on the Changing Thermal Structure of the Atmosphere, Structures of Atmosphere inotherPlanets **(8L)**

Unit III: Basics of Climatology:

Introduction –Climatology,Climatic components, Ancient Science, Chronology - Work of Indians, Climatology and Ecology, Global climate and cyclical processes, Climatology and Atmosphere, Importance of atmosphere, Study of Atmosphere, Climatology and Global Energy, Solar Radiation - factors influencing insolation, Nature of Radiation, Energy Balance, Study of Weather and Climate, Elements of Weather and Climate, Temperature, Atmospheric Temperature, Uneven Distribution of Temperature, Processes, Climatology & Global Pressure, Distribution of Air Pressure. **(12L)**

Unit IV:The Outlineof Climotology:

Climatology and Atmospheric circulation, Types of Circulation, Forces Controlling Circulation, Atmospheric Pressure and Motion, Dynamics of the Atmosphere, Local and Seasonal Winds, Circulation features, Moisture in the Atmosphere, Atmospheric Humidity and Condensation, Climatology Analyses Humidity, Fogs, their origin and Types of Fogs, Clouds, their origin and Types, Monsoons and Climatology, Seasons, Precipitation &itsDistribution, **(10L)**

Unit V: Concepts of Atmosphere:

Atmospheric Disturbances, Extreme Events in Atmosphere, Cyclones, Hurricanes, Thunderstorms, Tornadoes, World Climatic Types, Classification of Climates, Climatic Types and Biomes, Climatic Change, Weather Forecast, Methods in Weather Forecast, Satellite Climatology, Tropical Climatology, Paleoclimatology, Leading Role of Climatologists, Climatic maps and charts **(9L)**

(Total: 45L)

References:

1. E-phatasala website (epgp.inflibnet.ac.in)

Disaster Management

L T P
C3 0 0
3

Preamble: This paper explains about various disaster Management and its concepts and elaborately discussed the disasters and Environmental impacts on disaster. And also describe the Disaster law and policy.

Unit–I: Introduction to Disaster:

Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem**.**

(8L)

Unit-II: Types of hazards and Human activity:

Study of Environmental Impacts Induced By Human Activity; History of Disasters and Types of Hazards: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches. Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, WarandConflicts. **(8L)**

Unit-III: Study of Seismic Zones:

Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics. Types of News Media, Structure and Trends, News Media during Crisis, Impact of Media on Policy.

(9L)

Unit IV :**Disaster Management Concepts**:

Meaning of disaster, elements and Scope of disaster management, Approaches to disaster management, Disaster Management Cycle, Disaster Law and Policy related to disaster prevention, emergency response, compensation & insurance, human rights, and community recovery, relief policy and procedure; exploring the legal issues, Disaster Law and Policy, features: legal analysis of issues emerging from disastrous events the causes of disasters and their relationship to laws, designed to protect health, safety, andthe environment. **(10L)**

Unit V :**Acts and policies:**

Map policy of India, Remote Sensing Policy, RTI Act, Privacy Act, Groundwater Act, Mines & Mineral Act, Atomic Mineral Act, Oil & Natural Gas Act (including coal), Environmental Pollution and Prevention Act, Wildlife Act, Forest Act, Western Ghats Ecosystem act, National Biodiversity Act, National Marine Biodiversity act, Marine Environmental Act, Integrated Coastal Zone Regulation, Offshore Mining Regulation, Law of the Sea, Maritime Law; National Data sharing &accessibilitypolicy. **(10L)**

(Total: 45L)

References:

1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press,U.K.
2. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank,Manila.
3. Central Water Commission, 1987, Flood Atlas of India, CWC, NewDelhi.
4. Central Water Commission, 1989, Manual of Flood Forecasting, NewDelhi.
5. Sharma, Kadambari C, Avina 2010 Disaster Management in India JnanadaPrakashan [P&D], NewDelhi
6. Mishra A 2012 New Dimensions of Disaster Management in India: Perspectives Approachesand Strategies (Set of 2 Vol) Serials publications, NewDelhi
7. Disaster Law and Policy, Wolters Kluwer Law & Business/Aspen Publishers,2010
8. The Disaster Management Act (2005) National Act, Rules and Notifications) along with State DM

Practical - II

L T P
C0 0 4 2

Preamble: This practical paper describes about solving the problems and data interpretation about Gravity, Magnetic, Seismic and Geophysical signal processing and inversion.

Practicals are selected from following list

1. Reduction of field gravitydata
2. Construction of gravity profiles on some simple geometricalmodels
3. Computations pertaining to basement depth estimation fromgravity
4. Ore – lode estimation from gravity anomaly using gausstheorem
5. Construction of travel time of direct and refracted and reflected waves (Horizontallayer)
6. Construction of travel time curves of direct and refracted and reflected waves (Dippinglayer)
7. Processing and interpretation of given refraction and reflectionseismograms
8. Velocityanalysis
9. Signal and noise statistics from seismictraces
10. Study of the seismic refraction/reflectionunit
11. Processing and interpretation of acquired shallow depth seismic refractiondata
12. Noise estimation using Auto and crosscorrelations
13. Hilberttransform
14. Amplitude and phase characteristic of digitalfilter
15. Any other relatedpracticals

(Total: 60L)

Semester III

2019-20/MSU/49th SCAA/Univ.Depts./PG/M.Sc.(App.Geophys.)/Sem.-III/Part-III/Supportive-2/Ppr-14/

Remote Sensing and GIS - Elective (Non Major)

L T P C
3 0 0 3

Preamble: This paper describes about fundamentals of Remote Sensing and GIS. This paper is very much useful to the students for using of remote sensing and GIS concept in various fields. It is offered throughonline.

Instructor Name : PROF. RISHIKESH BHARTI (IIT Guwahati - Civil Engineering **)**

COURSE DURATION : Jul-Sep 2019 **CORE / ELECTIVE :** Core **UG / PG:** Both

PRE-REQUISITES : No

INTENDED AUDIENCE : PG Students

INDUSTRIES APPLICABLE TO : Rolta India, RMSI Private Limited, ArcGeosystems

COURSE OUTLINE : This course will introduce the students to the state-of-the-art concepts and practices of remote sensing and GIS. It starts with the fundamentals of remote sensing and GIS and subsequently advanced methods will be covered. This course is designed to give comprehensive understanding on the application of remote sensing and GIS in solving the research problems. Upon completion, the participants should be able to use remote sensing (Satellite images and Field data) and GIS in their future research work.

ABOUT INSTRUCTOR : Rishikesh Bharti is a faculty member at the Department of Civil Engineering, Indian Institute of Technology Guwahati. He has been teaching Advanced Remote Sensing, Geohazard Science and Engineering, Advanced Techniques in Geoscience, Engineering Geology to the B.Tech, M.Tech and PhD students at IIT Guwahati. Hydrogeomorphology, Geospatial modelling, Snow and Glacier Studies, Spectroscopy of natural & manmade materials and Advance remote sensing (Hyperspectral and thermal) for the earth and planetary exploration are his major research interests. He hope participants will enjoy and learn the proposed course. The details of his research can be found at Website: http://www.iitg.ac.in/rbharti/.

COURSE PLAN

Week 1:Remote Sensing Data and Corrections

Week 2:Satellite Image Corrections

Week 3:Digital Image Processing-I

Week 4:Digital Image Processing-II

Week 5:Thermal and Microwave

Week 6:Imaging Spectroscopy-I

Week 7:Imaging Spectroscopy-II & GIS-I

Week 8:GIS-II and Application

Reference:

1. Swayam/ NPTEL online course

Borehole Geophysics

L T P C
4 0 0 4

Preamble: This paper describes the various types of Logging and its interpretation in various field like groundwater, mineral and oil/gas industry.

Unit I: Introduction to well logging:
Porosity, permeability, fluid saturation, drilling fluids and its properties, invasion process and various profiles, classification of formation evaluation methods, objective of well logging methods, logging operational field system anditsprocedure. **(11L)**

Unit II: Electrical Logging: Spontaneous Potential (SP) logging: Spontaneous potentials in boreholes and its sources, SSP and its measurements, SP curves and its interpretation, factors affecting the shape and amplitude of SP curve, Non-focussed, focussed and induction logging,principle of sonde, Interpretation of Electric Log Data : Determination of resistivity of interstitial water Rw, porosity and water saturation Sw of clean and shaly sandstones, determination of Rw of clean sandstone from SP curve, estimationofpermeability. **(15L)**

Unit III:Radioactive logging:
Gamma ray logging, details of the radiation logging, density or gamma-gamma logging, principle of the neutron-gamma logging, neutron-epithermal-neutron logging, neutron-thermal-neutron logging, interpretation and applications of radiation logging for evaluation of reservoir characteristics. **(12L)**

Unit IV: Other types of logging:
Acoustic velocity (Sonic) logging, Cement Bond Log (CBL), Litho-density Tool (LDT), thermal log, caliper or section gauge log, Casing Collar Locators (CCL), dip and direction logging, gravity logging, nuclear magneticresonancelogging. **(12L)**

Unit V: Application of well logging:
Resistivity-porosity cross plots, Porosity Cross plots: neutron – density, sonic density and sonic neutron density cross plots. Application of well logging to ground water, mineral and petroleum resource. **(10L)**

(Total: 60L)

References:

1. Lynch : FormationEvaluation
2. Wyllie : Fundamentals of Well LogInterpretation
3. Vaish : Geophysical Well Logging : Principles andPractices
4. Schlumberger : Schlumberger Log Interpretation / Principles /Applications
5. Schlumberger : Schlumberger Log InterpretationCharts
6. Serra : Fundamentals of Well-logInterpretation
7. Pirson : Hand book of Well log Analysis for Oil and Gas formationEvaluation
8. Deveton : Log analysis of Subsurface Geology : Concepts and ComputerMethods

Marine Geophysics

L T P C
4 0 0 4

Preamble: This paper describes the ocean, waves, tides and currents and also explains the physio-chemical characteristic of sea water and navigation in ocean.

Unit-I : Introduction to Marine Geology:

Waves, tides, currents, turbidity currents, long shore currents, rip currents, circulation, wave reflection, refraction and diffraction – Seiche and tsunamis – Causes of marine regression and transgression – Description of important regressions and transgressions in the geological past – Eustacy – – Abyssal plains and its various topographic features – ridges, seamounts, guyots, mud banks – Evolution and classification of sea coasts andshorelines. **(11L)**

Unit-II :Origin, morphology and distribution of ocean basins:

Mid-ocean ridge systems – Raised and sunken features – Palaeo-ocean basins. Littoral processes – Evolution of headlands and bays – Beaches, continental shelves, continental slopes, trenches and canyons - Marine Sedimentation – Sources and distribution of sediments – Transport of sea bottom sediment – Rate of deposition – Mineral resources of the oceans and the factors controlling their distribution. Stratigraphy and geochronometry of deep-sea deposits – phosphorite, glauconites, barium sulphateconcertions, polymetallic nodules –Beachplacers. **(13L)**

Unit-III :Physio-chemical characteristic of sea water:

Distribution of temperature, salinity and density for sea water – digenetic changes in oxic and anioxic environments – mobility of redox metals – sedimentary markers of palaeo environmental conditions – chemistry of oceanic rocks.Formation of subtropical gyres; western boundary currents; equatorial current systems; El Nino; monsoonal winds and currents over the North Indian Ocean; Somali current;southernocean. **(12L)**

Unit – IV: Marine gravity and magnetic:

Techniques of echo sounding, sound ranging side scan sonar,Finger, Boomer, sparker and pneumatic pulsar profiling. Gravity and magnetic survey over the oceans, Marine magnetic and gravity instruments, reduction of observations, identification of anomalies and interpretation of the data set.sea bed mapping, seabed sampling, dredging and coring, Navigation methods and Position location methods. **(12L)**

Unit V:MarineSeismic:

Airgun, water guns, Seismic reflection receivers- geophones, hydrophones. Array configuration and advangates..Single channel and multi-channel seismic reflections, Sonobuoys, ocean bottom seismometers (OBH) – Data acquisition and quality control- Seismic data processing.Application of geophysical methods in offshore exploration for oil and natural gas andotherminerals. **(12L)**

(Total: 60L)

References:

1. Shephard, F. P., 1973. Submarine Geology, Harper andRow.
2. Kurekian, K.K., 1990. Ocean, PrenticeHall
3. Seabold, E. and Berger, W.H., 1982. The Sea floor, SpringerVerlag.
4. King, C.A.M., 1975. Introduction to Marine Geology and Geomorphology. Edward Arnold,London.
5. Radhakrishnan, V., 1996. General Geology, V.V.P Publishers,Tuticorin.
6. Shepard, F.P., 1978 Geological Oceanography, Heinmann,London.
7. Jones, E.J.W.(1994).Marine Geophysics, John Wiley andsons.
8. Reynolds J.M.(1997) An Introduction to Applied and EnvironmentalGeophysics

Environmental GeoTechnology

L T P C
4 0 0 4

Preamble: This paper describes the environmental aspects with reference to Soil and its structure, Beach and beach erosion and Radioactive decay. This paper is very much helpful to know the environmental conditions around the world.

Unit-I: Aims of Environmental Geotechnology:
Environment cycles and their interaction with Geotechnology - Man made Environment – EnvironmentalGeotechnical problems. **(11L)**

Unit-II: Characteristics of soil:
Shrinkage, Swelling and Cracking characteristics of soil - Hydraulic conductivity - Infiltration, Percolation and Retention – Thermal conductivity and Resistivity of soil – Fundamentals of Soil;Soil structure vs Structure - Soil Interactions;Soil compaction – Dynamic consolidation – Stress-Strain-Strength characteristics of soil – Soil dynamicsLoad, factor of safety and allowable condition – Bearing capacity of Ground Soil – UnderwaterFoundation Problems. **(13L)**

Unit-III:Radioactive Decay Process:
Environmental Geotechnical Aspects of Radiation – Radioactive and toxic radon gas- Nuclear waste disposal – Utilization of nuclear energy for construction applications;Solid waste disposal - planning and siting of land-fills; radioactivewaste management. **(13L)**

Unit-IV: EARTH'S PROCESSES AND GEOLOGICAL HAZARDS:
Earth's processes; Concept of residence time and rates of natural cycles; Catastophic geological hazards with a view to assess the magnitude of the problem, prediction and perception of the hazards; Mineral Resources and Environment - Resource and Reserves; Environmental impact of exploitation, processing and smeltingof minerals. **(11L)**

Unit-V: ENERGY RESOURCES AND ENVIRONMENT:
Environmental effects associated with types of energy resource, viz. petroleum, natural gas, hydropower, nuclear, coal, solar and wind energy; Ocean pollution by toxic wastes; Human Use of Surface and Ground Waters; GroundWaterPollution. **(12L)**

(Total: 60L)

References:

1. Introduction to Environmental Geotechnology – Hasi – Yang Fang – CRC press,1997
2. N. ChennaKesavulu (2009) Textbook of EngineeringGeology.
3. Parbinsingh, (2008) Engineering and general Geology, Kataria& Sons.NewDelhi.
4. SathyaNarayanaswami, B.S (2000) Engineering Geology, Dhanpat Rai & Co.Pvt.Ltd, New Delhi.
5. Perry H. Rahn (1996) Engineering Geology: an environmentalapproach.
6. Fred G. Bell (2004) Engineering Geology and Construction, CRCPress.
7. Roberts, A., Geotechnology, Pergamon,1961.
8. Keller, E.A.: Environmental Geology: CBS Publisher, NewDelhi.
9. Valdiya, K.S.: Environmental Geology-Indian Context. Tata McGraw Hill Publ. Co., Bombay.
10. Coates, D.R: Geology and Society. Chapman &Hall,NewYork.
11. Bryant, E.: Natural Hazard. Camb. Univ.Press.

Seismic Prospecting

L T P C
4 0 0 4

Preamble: This paper describe about Seismic prospecting. This paper describes the basics of Seismic data acquisition, Seismic data processing and interpretation.

Unit – I :**Seismic source theory:**

Wave propagation, Historical Development and Background of Refraction and Reflection Methods, Difference between Refraction and Reflection Surveys, Propagation of Seismic waves in Linear and Nonlinear medium, N Layered case, continuous increase of velocity.Waveforms and their characteristics, Elastic wave velocities in rocks.Stress, Strain,elasticconstants. **(13L)**

Unit – II: Basics of Seismic data Acquisition systems:

Energy sources - explosive and non explosive sources, Zoepritz's equation Seismic operation on Land, Grouping of Geophones and shot points. Recording formats, Different types of Display of Digital and Magnetic Recordings, Wiggle Trace, Common DepthPointtechnique. **(13L)**

Unit – III:Processing of Seismic data:

Sequence of Digital Seismic data Processing, Seismic data reduction, static and dynamic corrections Analysis of Multiples and Ghost Reflections, Processing of Seismic Data Imaging, Time and Depth Sections, Seismic Inversion, Migration Techniques –WaveVelocities. **(12L)**

Unit – IV: Interpretation of Seismicdata:

Synthetic Seismograms, Processing and interpretation of Refraction Seismic data – Methods based on first and later arrivals, Hidden layer, seismic stratigraphy, introduction to 3D seismic. **(12L)**

Unit – V :Concepts of SASW and MASW:

Data acquisition and processing concepts of SASWand MASW.Application ofSeismicmethods in Hydrocarbon,Mining,Groundwater. **(10L)**

(Total:60L)

References:

1. Yilmaz, O, 1987, Seismic Data Processing, SEGPublication.
2. Dobrin M.B. Savit C.H. 1988 Introduction to Geophysical Prospecting. Mc. Graw Hill Book Company,Singapore.
3. Telford, W.M. Geldart, L.P. Sheriff, and Keys, D.A. 1981. Applied Geophysics, Cambridge University Press,Cambridge.
4. Sheriff. R.E. and Geldart. L.P. 1987 Exploration Seismology, Vol. 1. Cambridge Univ. Press, Cambridge.
5. Sheriff. R.E. and Geldart. L.P. 1987 Exploration Seismology, Vol. 1. Cambridge Univ. Press, Cambridge.
6. Anstey N.A., 1971, Seismic Prospecting Instruments Vol. II Gebrudev Borntraege Berlin, Stuttgart.
7. Evenden, B.S. and Stone, D.R., 1971, Seismic Prospecting Instruments, GebrudeyBorntraege, Berlin,Stuttagart.
8. Sheriff. R.E. 1989, Geophysical Methods, prentice Hall, Englewood cliffs. NewJersey.
9. Att. Balch and M.W. Lee, 1984, Vertical Seismic Profiling. Technique, Applications and casehistories, D. Reidal Publishing Company, Boston,USA.
10. Robinson, E.A., 1988, Migration of Seismic data SEGPublication
11. Verma, R.K. 1986, Offshore Seismic Exploration Gulf Publishing Co.,Gurvitch, II, Seismic Prospecting MirPublications.

Practical - III

L T P C
0 0 4 2

Preamble: This practical paper describes the solving the problems and analysis in the field of Marine geology and Marine Geophysics and well logging methods.

Practicals are selected from following list

1. Beach Profiling and SedimentBudgeting.
2. Computation of wave patterns and currentvelocity.
3. Sedimentological analysis – Grain size, Clayanalysis.
4. Micropaleontological analysis – Picking and mounting ofmicrofauna.
5. Compute the volumetric producible hydrocarbon reserves and estimate theformation pressure and geothermal gradient using well loggingdata.
6. Determination of formation water resistivity using SP logdata.
7. Compute and locate the hydrocarbon saturation using Ratiomethod.
8. Compute a borehole logging data to estimate porosity from densitymeasurements.
9. Computation of M-N* crossplot using lithology mappingtechniques.
10. Determination of water saturation, cementation factor and matrix parameters forporosity logs using Pickett crossplotmethod.
11. Determination of hydraulic conductivity onsoil.
12. Any other relatedpracticals

(Total: 60L)

Project and Viva Voce

L T P
C0 0 0
24

Preamble: This Project and Viva-Voce gives very much exposure to students who are studying M.Sc Applied Geophysics. They have to do the project work either in the department in various R&D laboratories / institutions like NGRI, WIHG, ISR, IIG and ONGC, etc.