CHOICE BASED CREDIT SYSTEM IN P.G.COURSES
M.Sc Geophysics

Scheme of Instructions and Examination
Effective from the Academic Year 2011-2012

CENTRE OF EXPLORATION GEOPHYSICS
DEPARTMENT OF GEOPHYSICS
OSMANIA UNIVERSITY
HYDERABAD 500 007

OSMANIA UNIVERSITY
CHOICE BASED CREDIT SYSTEM IN P.G.COURSES
CENTRE OF EXPLORATION GEOPHYSICS,
DEPARTMENT OF GEOPHYSICS, HYDERABAD-7.
M.Sc Geophysics, I Year I Semester
Scheme of Instructions and Examination
(Effective from the Academic Year 2011-2012)

Theory : I-SEMESTER.

S.No.	Subject Code	Subject Theory	Instruction Hrs/Week	Exam. Duration	Max Marks		Total Marks	Credits
					Internal Asses.	Semester Exam		
1	GP101T	Applied Mathematics	4	3	20	80	100	4
2	GP102T	Basic Geology	4	3	20	80	100	4
3	GP103T	Electronics & Instrumentation	4	3	20	80	100	4
4	GP104T	Physics of the Earth	4	3	20	80	100	4
		Total:	**16**				**400**	**16**

Practicals

S.No.	Subject Code	Subject Theory	Instruction Hrs/Week	Exam. Duration	Marks Total	Credits
5	GP151P	Applied Mathematics	3	2	50	2
6	GP152P	Basic Geology	3	2	50	2
7	GP153P	Electronics & Instrumentation	3	2	50	2
8	GP154P	Physics of the Earth	3	2	50	2
9	GP155F	Surveying and Geological Field Work	4		50	2
		Total:	**20**		**250**	**10**

Note: 1. Practical Examination will be conducted at the end of each Semester. Every Practical Examination will be of 50 marks.

2.Field Work: At the end of the I year 1st Semester the students will submit a Field Report on the Field work in Surveying and Geological field work (GP 155 F) conducted in 1st Semester. The field reports are assessed by conducting a viva-voce consisting of a Committee (External Examiner, HOD, Chairman BOS and concerned teacher), the marks are awarded for their performance.

3. The **student will have to pay a sum of Rs.1,500/-per annum** to the University at the time of admission and at the beginning of II year III rd Semester along with University Fee for field training.

Course: GP 101 T M.Sc. Geophysics I Year I-Semester

No. of Weeks: 15

Subject: APPLIED MATHEMATICS

Unit – I

VECTORS

Double & Triple integrals, application,
Line integral
Green's theorem in a plane, surface integral
Divergence theorem
Stokes Theorem
Laplacian differential Operators in Cylindrical & Spherical System,
Geophysical examples.

TENSORS

Introduction
Definition
Contraction, Direct product
Quotient rule
Pseudo tensors
Dual Tensors
Studies of some Geophysical examples.

ANALYTIC FUNCTIONS

Functions of a complex variable. Mappings Limits. Theorems on Limits
Continuity Derivatives. Differentiation Formulas. The Cauchy Riemann Equations
Sufficient conditions. The Cauchy – Riemann Equations in polar Form.
Analytic Functions Harmonic Functions. Some Geophysical examples.

Unit – II

RESIDUES.

The residue theorem. The principal part of a function Poles quotients of Analytical functions. Evaluation of improper real integrals, improper integrals Involving Trigonometric functions integration around Branch point.

SPECIAL FUNCTIONS

The Gamma function
The Beta function
Relation between Beta & Gamma function
The Bessel function

Recurrence formulae for $J_n(x)$
Expansion of $J_o(x)$ & $J_1(x)$
Values of $J_{1/2}(x)$ & $J_{1/2}(x)$
Generation function for $J_n(X)$ Some Geophysical examples.

UNIT -III

LAPLACE TRANSFORM

Introduction Definition
Transforms of elementary function.
Properties of Laplace transforms
Inverse transform
Transforms of derivation
Transform of integrals
Multiplication by t
Division by t
Convolution theorem
Application to differential equation
Simultaneous linear differential equation
Periodic function. Some Geophysical examples.

HANKEL TRANSFORM

Introduction
Elementary properties of Hankel transform
The Hankel inversion theorem.
Hankel transforms of derivatives of function
Hankel transform of some Elementary function.
Elementary function. Some important results of Bessel function.
Hankel transform of

$$\frac{d^2f}{dx^2} + \frac{1}{x}\frac{df}{dx} - \frac{n^2f}{x^2}$$

UNIT – IV

FOURIER SERIES & FOURIER INTEGRAL TRANSFORM.
Fourier series
Introduction Euler's Formulae
Condition for Fourier expansion
Change of interval.
Odd and Even function
Half-Range series
Boundary value problem using Fourier
Fourier integral transform series.

Fourier's Integral theorem
Fourier Transform
Fourier Cosine transform
Fourier Sine transform
Fourier transforms of derivatives.
Calculation of Fourier transforms of some simple functions.
Some Geophysical examples.

Recommended books

1. Murray R-SPIGEL, May 1981, Advanced Calculus, Mc Graw Hill, International Book Company, Singapore.
2. R.V. Churchill, 1963 Fourier series and boundary value problem, Mc Graw Hill Koga Kusha Ltd., Tokyo.
3. Murray R-SPIGEL, 1965, Laplace transforms, Schaum;s out line series Mc. Graw Hill, International Book Company, New York.
4. L.A. Pipes, 1970, Applied Mathematics for Engineers & Physicists, Mc. Graw Hill, Koga Kusha Ltd., Tokyo.
5. B.S. Grewal, 1999, Higher Engineering Mathematics, Khanna Publishers Delhi.
6. Ervin Kreyszig, 1979, Advanced Engineering Mathematics, John Wiley & Sons.
7. Harry Lan, 1950, Vector and Tensor Analysis, Mc. Graw Hill, Book Company Inc., Tokyo.
8. Vasista, 1995, Integral Transform, Krishnaprakasham Mandir, Meerut-UP.
9. Lann. Sneddon, 1979, The use of Integral transform Tata Mc. Graw Hill Book Co.
10. George Arfkin, 1970, Mathematical Methods for Physicists Academic Press.
11. R.V. Churchill, J.W. Brown, R.F. Verhey, 1974, Complex variables and Applications -Mc. Graw Hill Book Company.
12. Charles, B. Officer, 1974, Introduction to theoretical Geophysics, Springer – Verlag Publ. Comp.

Course No. GP 102 T M.Sc. Geophysics I Year I Semester

Subject: BASIC GEOLOGY

Unit-I

(PHYSICAL GEOLOGY)

Introduction: Definition of Geology -Basic principles of Geology – its relationship with other sciences Different branches of Geology – Aim and applications of Geology. Origin of the earth -brief review of different theories.

Weathering of rocks: Agents and Types of weathering.

Rivers: Source and surface flow of water-erosion, transportation and development of land forms by deposition – V-shaped valleys, river capture phenomena. rapid, water fall, alluvial fan, meander, ox bow lake, flood plain.

Mountain: Types, causes of mountain building, horst, graben.

Volcanoes: Parts of typical volcano, products of volcano, types of volcanic eruptions,

Unit – II

(CRYSTALLOGRAPHY AND MINERALOGY)

Crystallography:

Definition of a crystal – Amorphous and crystalline states. Morphology of crystals:
Face, edge, solid angle, interfacial angle.
Form: Simple, combination, closed, open pinacoid, prism – pyramid and dome.
Symmetry Elements: Plane of symmetry, axis of symmetry, center of symmetry
Crystallographic axes, parameters, indices, crystallographic notation, parameter systems of Miller, law of rational indices, classifications of crystals into 7 systems.

Mineralogy:

Definition of mineral – Classification of mineral into rock forming and ore forming minerals.
Physical Properties of Minerals: Colour, streak, transparency, luster, luminescence, Fluorescence, Form, hardness, cleavage, fracture, specific gravity, magnetic properties.

Optical properties of minerals: Elementary concepts of optics, simple harmonic motion, amplitude, period, wave length, phase, polarized light, isotropic and anisotropic. Substances, reflection, refraction, Nicol prism and its construction, concepts of crossed Nichols, petrological microscope, its mechanical and optical parts, behavior of isotropic and anisotropic minerals under crossed Nichols, pleochroism, absorption, interference Colours and extinction.

Mode of mineral formation: Occurrence and association of minerals, chemical properties of minerals – isomorphism – solid solution – polymorphism, mineral formation and silicate structure.

Descriptive Mineralogy: Study of physical, chemical and optical properties and mode of Occurrence of following minerals:

Olivine, Augite, Hypersthene, Hornblende. Actinolite, Orthoclase, Microcline, Albite, Quartz, Biotite, Muscovite, Garnet (Almandine), chlorite, Calcite, Talc, Tourmaline, Beryl corundum, Kyanite and Magnetite.

Unit-III

(IGENEOUS PETROLOGY)

Introduction: Definition of rock, chemical composition of the curst, classification of Rocks-igneous sedimentary and metamorphic rocks.

IGNEOUS PETROLOGY:

Classification into plutonic, hypabyssal and volcanic rocks. Forms of igneous rocks. Lava flows, sill, lacolith, lopolith, dyke, cone, sheet ring dyke, Volcanic neck, Phacolith, Botholith, structures: vesicular, amygdaloidal, block and ropy lava, pillow:

Textures: Definition of texture, microstructure, allotromorphic, hypidiomorphic, Panidiomorphic, ophitic, intergranular, porphyritic, poikilitic, intersectral and intergranular, Classification of igneous Rocks

Origin of Igneous Rocks: Bowen;s reaction principle, differentiation and assimilation.

Descriptive study of following igneous rocks: Granite, granodiorite, syenite, porphiritic granite, Pegmatite gabbro, dunite, peridotite, dolerite, rhyolite, obsidian and basalt.

Unit-IV

(SEDIMENTARY AND METAMORPHIC PETROLOGY)

Sedimentary Petrology:
Introduction, mode of formation source, Transportation and deposition, classification of Sedimentary rocks, Structures and textures of sedimentary rocks,
Brief description of the following sedimentary rocks:

Conglomerate, breccia, sandstone, greywacke, shale, limestone, dolomite, Shelly and limestone.

Metamorphic Petrology:
Introduction: Definition, Types and agents of metamorphism; structure and textures of metamorphic rocks – grades and zones of metamorphism.

Brief description of the following metamorphic rocks: Quartzite, marble, slate, phyllite, schist, gneiss, charnockite and Khondalite.

LIST OF RECOMMENDED BOOKS;

1. Arthur Holmes, 1978, Principles of physical Geology.
2. Rutleys, 1991, Elementary of Mineralogy – Revised by Gribble, C.D. CBS, Publishers and Distributors.
3. Tyrrell, G.W. 1975, The Principles of Petrology B.I. Publications.
4. Hueng, W.T., Petrology 1962, Mc Graw Hill Co.,
5. Wingley, B.F. 1995, The Evolving Continent New York. John Wiley and Pars.

6. Canilic, K.C., 1977, Plate tectonics and Crustal evolution – (*) Butterworth Heinemann.

Course No. GP 103T M.Sc. Geophysics I Year I Semester

Subject: ELECTRONICS AND INSTRUMENTATION

Unit – I

DEVICES:
Characteristics of, JFET, UJT, SC R &.CMOS Transistors.

Amplifiers:
Single stage RC coupled amplifier and its frequency response. The concept of feed back. Positive and Negative feedback. Advantages of Negative feedback. Emitter follower and Darlington Pair.

Unit – II

Introduction to digital gates (AND, OR, NOT & NAND) Combination logic - basic building blocks, Qualitative treatment of Multiplexers, Demultiplexes, Encoders and decoders.

Sequential logic: Basic RS flip-flop, D, T, JK flip-flop, Qualitative treatment of counters and shift registers.

Memory: Read only Memory (ROM) &, Random Access Memory (RAM).

Unit-III

Operational amplifiers:
Characteristics of ideal operational amplifiers. Feed back equation.

Applications: Inverting (amplifiers); Non-inverting amplifiers, Integrator, Differential for summing amplifier, Differential amplifier, DC Voltage follower, Pulse width discriminator.

Basic concepts of instrumentation:
A descriptive treatment of instrument as a part of system. Linear systems, Static and Dynamic characteristics error and uncertainty in measurements.

Unit – IV

Equipment:

Cathode ray Oscilloscope (Qualitative treatment) and CRO Probes. Count rate meters, amplitude discriminator and Timers. Basic Principles of series regulated power supply, (Block diagram approach using voltage regulated IC's) Principles of inverter and converter Circuits.

Data indicators and recording.

Analog versus digital measurement, voltmeters Potentiometer recorder,

Numerical displays, LED and LCD, Concept of magnetic tape recording.

Books Recommended:

1. Millman and Halkias Electronic devices and Circuits, International student Edition, Mc Graw-Hill International Book Company, 1972.

2. D. Patranabis., Principles of industrial instrumentation.

3. W.D. Cooper, Electronic instrumentation and Measurement techniques, Prentice Hall of India Pvt. Ltd., New Delhi 1979.

4. Anthony S. Maneva, Solid state electronic circuits for Engineering Technology (Mc Graw – Hill, Kogakusha, Ltd., International student edition 1983.

5. Jacob Millman & Christors C, Halkias 1983 Integrated electronics, analog And digital circuits and systems. International student edition Mc Graw – Hill, Kogakusha Ltd

6. Malvino and Leach, Digital principles and Applications.

Course No. GP 104 T M.Sc. Geophysics I Year I Semester

Subject: PHYSICS OF THE EARTH

Unit – I

Introduction to Geophysics: Geophysics and its importance among earth Sciences.

Solar system: Earth as a member of the solar system, basic facts relating to The earth's position in the solar system.

Geospheres: Scope of study of various Geospheres, Atmosphere, Ionosphere, Asthenosphere, lithosphere-hydrosphere and Biosphere.
Meteorology, Oceanography and Hydrology.

Atmosphere: Constituent, vertical structure, weather analysis and fore casting.

Unit.-II.

Gravity field: Gravity field and its variations on the surface, internal and external Field, Geoid, spheroid and Ellipsoid of the earth. Shape and size of the earth.

Geomagnetic field, Magnetic elements and description of the magnetic field, Origin and Reversals of the magnetic field.

Paleomagnetism: Natural Remnant Magnetisation, Measurement of direction and intensity of NRM. Continental drift and polar wonder curves.
Geothermics: Heat sources, Geothermal flux distribution over continents and oceans.

Geochronology: Rock dating methods, U-Th, K-Ar, Rb-Sr, C-14, Fission-Track and magnetic dating.

Unit-III

Petrophysics: Different physical and Engineering properties of rocks Laboratory measurements of the physical properties of rocks namely Density, Seismic wave velocities, magnetic susceptibility, Electrical resistivity, thermal conductivity, porosity and permeability.

Unit-IV

Seismology: Natural and Artificial seismology and its relation to other Earth System sciences. Classification of Earth quakes, Causes and propagation of Different seismic wave and fundamental laws.

Introduction to Seismograph: Principle and brief description of mechanical type seismograph. Milneshaw, wood Andersen seismograph, electromagnetic seismograph and broadband seismograph.

Various methods for determination of focal depth and epicentral location. Interior Of the Earth and Earth quake prediction. Concepts of Geodynamics.

Recommended Books:

1. P.V. Sarma, 1976, Geophysical Methods in Geology, Elsevier.
2. Howell, 1959, Introduction to Geophysics, Mc Graw Hill Book Co. New York.
3. R.E. Sheriff, 1989, Geophysical Methods. Prentice Hall Engle Wood Cliffs. New Jerssy.
4. I.K. Kaul, S. Senugupta and A.K. Bhattacharya, 1990, General and Applied Geophysics, (An introduction), Associate of, Geophysics.
6. F.D. Stacey, 1977, Physics of the Earth, John Wiley and Sons, New York.
6. Rezhevisky and Novik, 1971, Physical properties of Rocks, Mir Publications.
7. Richter, C.F. 1969, Elementary Seismology, Eurasia Publishing house, Pvt. Ltd. New Delhi.

Course No. GP 151 P M.Sc. Geophysics I Year I Semester

PRACTICALS

APPLIED MATHEMATICS

1. Solution of steady state distribution of temperature in a slab – Laplace's Equation in an infinite strip INS (P 93 – 95).

2. Error function – Application of Laplace transform INS (p. 155-161)

3. Edge detection problem using Fourier Cosine and Fourier sine transform (INS p. 43-46)
4. Some problems on Gamma, Beta function.

5. Some problems on Tensors.

6. Problem on motion of a viscous fluid under a surface load – Using Hankel transform (INS P. 333-338)

7. Determination of fluid flow at the core surface from Geomagnetic observation understanding of mathematical aspect. (NJV/GN P.189-208.)

Course No. GP 152 P M.Sc. Geophysics I Year I Semester

PRACTICALS

Subject: BASIC GEOLOGY

Crystallography:

Study of the following crystal models.

1. Cube
2. Octahedron
3. Dodecahedron
4. Tetragonal prism with pinacoid
5. Tetragonal pyramid
6. Hexagonal prism with pinacoid
7. Hexagonal pyramid
8. Orthorhombic prism with pinacoids
9. Monoclinic pinacoids
10. Triclinic pinacoids

Mineralogy: Study of the following rock forming minerals:

A Megascopy	B Microscopy
1. Olivine	1. Quartz
2. Augite	2. Orthoclase
3. Hypersthine	3. Microcline
4. Enstatite	4. Plagioclase
5. Hornblende	5. Biotite
6. Quartz	6. Muscovite
7. Muscovite	7. Hornblende
8. Biotite	8. Augite
9. Garnet	9. Olivine
10. Orthoclase	10. Garnet
11. Microcline	
12. Plagioclase	
13. Tourmaline	
14. Epidote	
15. Corundum	
16. Apatite	
17. Calcite	
18. Beryl	
19. Gypsum	
20. Talc	

PETROLOGY; The study of following Rock Types

MEGASCOPY OF ROCKS

1. Granite (Pink & Grey)
2. Syenite
3. Pegmatite
4. Gabbro
5. Basalt
6. Dolerite
7. Pyroxinite
8. Lime stone
9. Shale
10. Sand stone
11. Gneiss
12. Schist
13. Marble
14. Charnockite
15. Khondalite

THIN SECTIONS OF ROCKS

1. Granite
2. Gabbro
3. Dolerite
4. Basalt
5. Sand stone
6. Lime stone
7. Gneiss
8. Schist
9. Charnockite
10. Marble

Course No. G 153 P M.Sc. Geophysics I Year I Semester

PRACTICALS

Subject: ELECTRONICS AND INSTRUMENTATION

1. Handling and operation of power supply, Multimeter and oscilloscope.
2. RC Coupled amplifier.
3. Emitter follower.
4. IC 555 as timer.
5. Experiments with IC 741 Operational amplifier.
6. RS, D,T ,& JK flip-flop

Course No. GP 154 P M.Sc. Geophysics I Year I Semester

PRACTICALS

Subject: PHYSICS OF THE EARTH

1. Computations on the shape and size of the earth.

2. Analysis of radiometric data. Determination of ages of rocks.

3. Statistical Analysis of physical properties of Rocks.

4. Laboratory measurements of physical properties of rocks.

a) Density
b) Seismic wave velocity
c) Magnetic susceptibility
d) Electrical resistivity
e) Porosity

5. Interpretation of Earthquake records.

Course: GP 155F M.Sc. Geophysics I Year I-Semester

No. of Hours: 4 No. of Weeks: 15 Total No. 60 hrs

Subject: SURVEYING GEOLOGICAL FIELD PRACTICE

1) Introduction: Definition; principles; types and various applications of surveying; Field and office work; Scale. of a map or plan. Study of Topo Sheets

2) Linear Measurements: Distance measurements, , sources of errors and corrections in linear measurements. Chain surveying, field work and plotting, obstructions in chain surveying, measurement of offsets.

3) Direction measurement: Bearing and its types, determination of magnetic bearing, prismatic compass, declination, compass survey.

4) Levelling :Determination of levels: Levelling-definition, principle, method and classification. Instruments levels and leveling staff, their construction, use and adjustment, sources of errors and precautions. Contours and contouring: methods and uses.

5) Surveying with GPS: Determination of positions: Total station-principles; GPS-principle and its uses.

OSMANIA UNIVERSITY CHOICE BASED CREDIT SYSTEM IN P.G.COURSES
CENTRE OF EXPLORATION GEOPHYSICS, DEPARTMENT OF GEOPHYSICS, HYDERABAD-7. M.Sc Geophysics, I Year II Semester Scheme of Instructions and Examination(Effective from the Academic Year 2011-2012)

Theory: II-SEMESTER.

S.No.	Subject Code	Subject Theory	Instruction Hrs/Week	Exam. Duration	Max Marks		Total Marks	Credits
					Internal Asses.	Semester Exam		
1	GP201T	Applied Geology	4	3	20	80	100	4
2	GP202T	Seismic Methods	4	3	20	80	100	4
3	GP203T	Magnetic Methods	4	3	20	80	100	4
4	GP204T	Electromagnetic Methods	4	3	20	80	100	4
		Total:	**16**				**400**	**16**

Practicals

S.No.	Subject Code	Subject Theory	Instruction Hrs/Week	Exam. Duration	Marks	Credit
5	GP251P	Applied Geology	3	2	50	2
6	G252P	Seismic Methods	3	2	50	2
7	GP253P	Magnetic Methods	3	2	50	2
8	GP254P	Electromagnetic Methods	3	2	50	2
9	GP255F	Field Work (Geological and Geophysical-1)	4	-	50	2
		Total	**20**	**-**	**250**	**10**

Note:

1. Practical Examination will be conducted at the end of each Semester. Every Practical Examination will be of 50 marks.

2. Field Work: At the end of the I year 2nd Semester the students will submit a Field Report on the Field work in Geological and Geophysical Field work-1 – (GP255 F) conducted in the 2nd Semester. The field reports are assessed by conducting a viva-voce consisting of a Committee as (External Examiner, HOD, Chairperson BOS and concerned teacher), and the marks are awarded for their performance.

3. **The student will have to pay a sum of Rs.1,500/-per annum** to the University at the time of admission and at the beginning of II year III rd Semester along with University Fee for field training.

4. It is mandatory for the students to undertake geological field training programme organized at a suitable location for a week's duration during/end of the IInd Semester.

Course No: GP 201 T M.Sc. Geophysics I Year II Semester

Subject: APPLIED GEOLOGY

Unit – I

(STRUCTURAL GEOLOGY)

Definition of Structural Geology: objectives of structural geology-primary and secondary structures; bed, bedding planes, outcrop, attitude of beds, strike, dip and apparent dip.

Folds: parts of a folds, nomenclature of folds: Anticline, syncline, symmetrical fold, asymmetrical fold, overturned fold, recumbent fold, isoclinal fold.

RECOGNITION OF FOLDS IN THE FIELD: Direct observation, inferred folds, plotting attitude of beds on a map, aerial map pattern, drilling, mining and Geophysical methods , Determination of top of beds by primary features. Ripple marks, cross bedding, graded bedding, sole markings, local unconformities and related features.

JOINTS: Definition, geometric and genetic classification.

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.

RECOGNITION OF FAULTS IN THE FIELD: Discontinuity of structures, repetition and omission of strata's, features characteristics of fault plane, silicification and mineralization, physiographic criteria.

UNCONFORMITIES: Types of unconformities, local unconformity, angular unconformity, nonconformity and disconformity.

Introduction to the theory of plate Tectonics.

UNIT-II

(STRATIGRAPHY AND INDIAN GEOLOGY)

Introduction and Principles of STRATIGRAPHY : Standard Geological time scale, Principles of correlation:

Physiographical sub-divisions of India.
A brief study of area, distribution Lithology and economic importance of the following geological groups of India.

Dharward
Cuddapah
Kurnool
Gondwana
Deccan Traps.

Unit-III

(ECONOMIC GEOLOGY)

Introduction : Ore minerals, gangue, ore and ore deposits.
Synergetic and epigenetic mineral deposits.

Ore genesis : A brief outline of the following types of deposits and their characteristics features.

Magmatic deposits: Formation of Chromite, magnetite and diamond deposits.

Hydrothermal deposits: Formation and migration of hydrothermal solutions. Causes of precipitation of ore minerals. Cavity filling and replacement deposits. Classification of hydrothermal deposits. Hydrothermal alteration. Formation of Copper, Lead Lime, Gold and barite deposits.

Sedimentary deposits: Source, solution transportation and deposition.
Residual Concentration: Formation of bauxite deposits.

Unit-IV

(PETROLEUM GEOLOGY)

Petroleum Geology: Chemical composition and physical properties of petroleum crude, origin of petroleum, migration of oil and gas, gas hydrates .Reservoir rocks-classification, hydrocarbon traps, Petroliferous basins of India.

RECOMMENDED BOOKS:

1. Billings, M.P.1974, Structural Geology, Printice Hall.
2. Krishnan, M.S. 1982 Geology of India and Burma CBS Publishers.
3. Carotic, K.C. 1977, Plate Tectonics and Crustal Evaluations, Butterworth – Heinemann.
4. Best, Myron G., 1986 Igneous and Metamorphic Petrology CBS Publishers and Distributors.
5. Jenson, M.L. and Bateman, A.M. 1981, Economic Mineral Deposits – John Wiley & Sons.
6. Kreiter, V.M. 1965, Geological Prospecting and Exploration, Mir publications.
7. Krishnaswamy S., 1972, India's Mineral Resources – Oxford & IBII Publishing Co.,
8. Dutt, N.V.B.S., 1986., Geology and Mineral Resources of Andhra Pradesh., N.R.D.C.S., Ltd.

Course No. GP 202 T M.Sc. Geophysics I Year / II Semester

Subject: SEISMIC METHODS

Unit – I

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,

Unit – II

Basics of Seismic data Acquisition systems, Explosive and Non Explosive sources Seismic operation on Land and sea, Grouping of Geophones and shot points, Recording formats.[SEG B,SEG C,SEG D &SEG Y], Different Types of Display of Digital and Magnetic Recordings, Wiggle Trace, Variable Area and Variable Density Records Telemetric Seismic systems, Common Depth Point technique, 2D, 3D and 4D Seismics, Vertical Seismic Profiling, Deep Seismic Sounding

Unit – III

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, Wave Equation Migration, Time and Depth Migration, Determination of Average Seismic Velocities, Synthetic Seismograms. Tomography

Processing and interpretation of Refraction Seismic data – Methods based on first and later arrivals, Hidden layer.

Unit – IV

Application of Seismic methods in Hydrocarbon, Mining , Groundwater and Engineering studies. Mapping of Geological Structures (Faults, Reef, Pinchouts, Anticlines), Depositional Sequence and Pit Falls of Seismic Interpretations, Seismic Stratigraphy and Sequence Analysis, Seismic Facies Analysis, Reflection Character Analysis, Bright Spots, Seismic Lithologic Modelling, Vp/Vs and Lithology, AVO Analysis.

Recommended Books:

1. Dobrin M.B. Savit C.H. 1988 Introduction to Geophysical Prospecting. Mc. Graw Hill Book Company, Singapore.

2. Telford, W.M., Geldart, L.P. Sheriff, R.E. and Keys, D.A. 1981, Applied Geophysics, Cambridge University Press, Cambridge.

3. Sheriff, R.E. and Geldart, L.P. 1987 Exploration Seismology, Vol. I, Cambridge Univ. Press, Cambridge.

4. Sheriff, R.E.and Geldart, L.P. 1987 Exploration Seismology, Vol. II, Cambridge Univ. Press, Cambridge.

5. AnsteyN.A., 1971, Seismic Prospecting Instruments Vol, II. Gebrudev Borntraege Berlin, Stuttgart.

6. Evenden, B.S.and Stone, D.R., 1971, Seismic Prospecting Instruments, Gebrudev Borntraege, Berlin, Stuttgart.

7. Sheriff R.E. 1989, Geophysical Methods, prentice Hall, Englewood cliffs, New Jersey.

8. Att. Balch and M.W. Lee, 1984, Vertical Seismic Profiling. Technique, Applications and case histories, D. Reidal Publishing Company, Boston, USA.

9. Robinson, E.A., 1988, Migration of Seismic data SEG Publication.

10. Verma, R.K. 1986, Offshore Seismic Exploration Gulf Publishing Co.,

11. Gurvitch, II, Seismic Prospecting, Mir Publications

12. Yilmaz, O, 1987, Seismic Data Processing, SEG Publication

Course No.GP 203 T M.Sc. Geophysics I Year II Semester

Subject: MAGNETIC METHODS.

Unit – I

Principles of Magnetic prospecting Magnetic field of the earth & its Variation in space and time. Concept of Magnetic potential and field Poission's relation. Magnetic elements. Factors contributing to the main Magnetic fields of the earth. Magnetic properties of rocks and minerals –Para–dia & ferro magnetism. Natural Remnant magnetization. Archaeo-magnetism

Unit-II

Brief introduction to the working principles of modern Magnetometers. (Fluxgate ,Proton Pression & Rubidium vapour)
Magnetic survey procedures on land, marine and air borne. Satellite magnetic data. IGRF . Scales of Surveys, Accuracy, Corrections to magnetic data.

Unit -III

Qualitative analysis of magnetic data. Regional-Residual separation by different methods .Derivatives and Continuation techniques, calculation of second derivatives, Reduction to pole

Unit – IV

Quantitative analysis of magnetic data. Concepts of forward modeling and indirect interpretation. Magnetic anomaly expressions over simple magnetic bodies. Structure calculation and Spectral analysis for depth estimation, Ambiguity in magnetic interpretations.

Application of magnetic method in

i) Regional, Geological and Structural problems
ii) Mineral& Hydro carbon Exploration and
iii) Groundwater and Engineering problems.

RECOMMENDED BOOKS:

1. S Mares et al., 1984, Introduction to Applied Geophysica D. Reidel Publishing Company, Dordrechv Boston. 581p.

2. Telford, W.M. Goldart. L.P. Sheriff, R.E. and Kevs. D.A. 1981 Applied Geophysics,Cambridge University Press Cambridge, U.K. 860 P.

3. B.S.R. Rao and IVR Murthy, 1978, Gravity and Magnetic Methods of Prospecting Arnold – Henniman Publishing Company, Delhi. 390 P.

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 Mc Graw Hill Publication, New York.

6. D.S. Parasnis 1973, Mining Geophysics, Amsterdom, Elsevier Publishers, The Netherlands, 354 P.

7. L.L. Nettleton, 1976, Gravity and Magnetics in Oil Prospecting Mc Graw Hill Publication, New York. 464 P.

8. V.L.S. Bhimasankaram & V.K. Gaur, 1978, Lectures and Exploration Geophysics AEG, Publications, CEG, O.U. Hyderabad.

9. I.V.Radhakrishna Murthy 1998, Gravity and Magnetic Interpretation in Exploration Geophysics. Geological Society of India, Bangalore. 363 P.

10. I.V.Radhakrishna Murthy & D.C. Mishra – 1989, Gravity and Magnetic Anomlies in space and Frequency domain. AEG. Publications.

11. Edwin S. Robinson and Cahit Coruh, 1988 Basic Exploration Geophysics John Wiley & Sons, New York Toronto/Brisbane/Singapore, 562 P.

Course no. GP 204 T **M.Sc. Geophysics I Year II Semester**

No. of Weeks: 15

Subject: ELECTROMAGNETIC METHODS

Unit-I

Principles of Electromagnetic Prospecting:
Primary field, Secondary field, Total field,
Anomaly field, amplitude, phase, real and imaginary components,
Description of elliptic polarization, relation
between the major and minor axis of ellipse of polarization
with real and imaginary components of secondary field.
EM wave propagation in conductive medium-skin depth.
Classification of Electromagnetic methods:
Methods using artificial sources (consisting of two groups)
(1)Harmonically varying field, (2) transient fields, of which
the first can be sub-divided into (a) Low frequency and
(b) Radio frequency method and Natural field methods (Magneto
telluric group of methods and AFMAC). Sub-classification based
on application (ore prospecting, oil and gas investigations) and
source employed. Different variants (surface, sub-surface and
airborne).

Unit-II

Methods using Man-made fields:

A. Surface low frequency methods: Effect of the change in the Frequency on the primary field, conductivity and magnetic permeability on the secondary field , discussion using the response of a conducting permeable sphere in uniform E.M. field. Effect of over burden and ore bearing rocks on the response of local conductor (only discussion)

(a) Description of dipole induction profiling (horizontal loop or Slingram Method). Principles of the equipment, field procedure, quantitative Interpretation of anomalies for plate shape bodies.

(b) Tilt Angle Technique – Schematic representation of results over conductive bodies (as given in Mining Geophysics by Parasnis.)

c)Turam Method – principles of equipment, field procedures, some qualitative interpretation techniques (as given in the book Electrical Methods in Geophysical Prospecting by Keller and Frischnet').

Unit-III

B. Surface Transient Methods:
Comparison with harmonic methods, description of different configurations, principles of equipment, general field procedures, simple, interpretation techniques.

C. Surface High Frequency Methods.
General principles, equipment, field procedure and interpretation of
(a) Radiowave mapping,
(b) Radiowave absorption
(c) Ground-penetrating radar

D. Airborne EM Methods – Principles, advantages and disadvantages, General description of INPUT, VLF & Resolved component measuring system.

E General Principles of Borehole EM Methods:
Advantages and Capabilities

F. Principles of EM Sounding by using (a) Harmonic field (b) Transient field, Principles of equipment, field procedure, description (without mathematical treatment) of theoretical curves and interpretation.

Unit-IV

Methods using Natural Fields:
a)AFMAG Method-Surface and Airborne versions (as given in the book Electrical Methods in Geophysical Prospecting' by Keller & Frinchnell

b)Magnetotelluric method: Sources of MT signal, , impedance tensor ..Theory of electromagnetic wave propagation in horizontally layered earth and response over multi layered earth. Principles of Equipment & Field procedure. Data processing and analysis auto and cross spectra . .Processing & interpretation of MT data over a two /multi layered earth, strike, rotation , polar diagram, tipper, skew, ellipticity, TE and TM modes .Application of MT methods..

Remote Reference & Magneto-Telluric Profiling and their applications :

(c) Telluric Current Method – Basic equations governing telluric field, field procedure, principles of equipment, processing of records by method of ellipses and interpretation of telluric parameters and maps.

Applications of EM prospecting in geological mapping, mineral and Groundwater exploration.

RECOMMENDED BOOKS:

1. Parasnis, D.S., 1973, Mining Geophysics – Elsevier.

2. Keller, G.V. Electrical Methods in Geophysical Prospecting – Frischnett, Pergamon.

3. Patra, H.P. & Mallick, K., Principles of Geoelectric Soundings Vol. II – Elsevier.

4. Telford, W.K., Geldart, L.P., Sheriff, R.F. and Keys, D.A. Applied Geophysics – Cambridge Univ. Press.

Course No. GP 251 P M.Sc. Geophysics I Year II Semester

PRACTICALS

Subject: APPLIED GEOLOGY

Structural Geology:

1. Calculation of true thickness of strata.
2. Calculation of true and apparent dips.
3. Three point problem.
4. Completion of outcrops in the geological maps.
5. Drawing cross sections of the geological maps with inclined strata, folds, faults, unconformities and their interpretation.

Economic Geology:

Megascopic study of the following ore minerals with special reference to their Diagnostic physical properties, composition, mode of formation, distribution and industrial applications.

1. Magnetite
2. Hematite
3. Galena
4. Chalcopyrite
5. Sphalerite
6. Muscovite
7. Barite
8. Chrysotile(asbestos)
9. Bauxite
10. Talc
11. Gypsum
12. Kyanite
13. Pyrolusite
14. Psilomelane
15. Graphite.

Course No. GP 252 P M.Sc. Geophysics I Year/II Semester
PRACTICALS

Subject: SEISMIC METHODS

(A) Computation

1. Construction of travel time curves of direct and refracted waves (Horizontal layer)
2. Construction of travel time curves of direct and refracted waves (Dipping layer)
3. Construction of travel time curves of reflected waves. (Horizontal layer).
4. Construction of travel time curves of reflected waves (Dipping layer).
5. Processing and interpretation of given refraction seismograms.
6. Processing and interpretation of given reflection seismograms.
7. Velocity analysis.
8. Signal and noise statistics from seismic traces.

(B) Practicals:

1. Study of elements of seismic channel.
2. Study of the Seismic refraction reflection unit.
3. Acquisition of shallow depth seismic refraction data.
4. Processing and interpretation of acquired shallow depth Seismic refraction data.

Course No. GP 253 P M.Sc. Geophysics IYear II Semester
PRACTICALS

Subject: MAGNETIC METHODS

1. Reduction & Corrections of field magnetic data.
2. Preparing magnetic anomaly contour map from field data..
3. Regional-Residual separation by different methods in magnetics.
4. Construction of magnetic profile on some simple geometric models.(Sphere, Cylinder & Faults)
5. Computations pertaining to basement depth estimation from magnetic data by Peters half slope method.

6. Interpretation of magnetic anomaly profile across a dyke.
7. Upward & Downward Continuation of Magnetic fields.

Course No.:GP254P M.Sc.Geophysics I Year II Semester PRACTICALS
Subject: ELECTROMAGNETIC METHODS

1. Normal field due to an underground loop source.
2. Frequency characteristics of the secondary field due to a conductive Sphere.
3. Response due to a spherical conductor in UL method.
4. Computation of Geometric factor due to a Spherical conductor in drill Hole version of Transient EM method.
5. Computation of Geometric factor due to cylindrical conductor in drill hole version Transient EM method.
6. Processing of VLF EM data using Fraser Filter.
7. Interpretation of Transient EM data – Calculation of generalized induction parameter.
8. Computation of normalized response due to a conducting sphere in transient pulse induction method.
9. Computation of normalized response due to a conducting cylinder in transient pulse induction method.

Course: GP 255 F **M.Sc. Geophysics I Year II-Semester**

No. of Hours: 4 No. of Weeks: 15 Total No. 60 hrs

Subject: GEOLOGICAL AND GEOPHYSICAL FIELD WORK-I

1) Measurement of Dip, Strike using clinometer and Brunton compass

2) Study of out crops . Identification of Rocks & their Structures. i.e. Faults, Folds Joints, fracture detection etc.

3) Preparation of Geological Map, showing Structures, Lithology & Other Geological features.

Note: Field work will be conducted in a suitable location.

Field Report in Surveying Field Practice & Geological Field Practice will be submitted at the end of 2nd Semester.

GEOPHYSICAL FIELD PRACTICE

1. **Seismic Methods**

(a) Testing of Geophones & Recording Equipment including Identity.

Refraction Seismic Field Surveys.

Note: Field work will be conducted in O.U. Campus only. The field work consists of Acquisition , Processing & Interpretation of data by the respective methods. Field Report on Geophysical Field Practice-1 will be submitted at the end of 2nd Semester.

2. **Magnetic Methods**

1) Acquaintance with Field Magnetometer & its Operation.
2) Measurement of Diurnal Variation
3) Establishment of Base station. Reduction of Magnetic data
4) Magnetic Profiling across a chosen Geological contact

3. **Electromagnetic Methods:**

(a) Acquaintance with VLF equipment & Profiling with VLF to detect fractures
(b) Profiling with GPR. and Application of GPR in Groundwater Studies

OSMANIA UNIVERSITY
CHOICE BASED CREDIT SYSTEM IN P.G. COURSES
CENTRE OF EXPLORATION GEOPHYSICS,
DEPARTMENT OF GEOPHYSICS, HYDERABAD-7.
M.Sc. GEOPHYSICS, II Year III Semester
COURSE with effect from 2011 and also final year students admitted to the course during 2010-11.
Scheme of Instruction and Examination

Theory: III SEMESTER

Sl. No.	Subject Code	Subject Theory Theory	Instruction Hrs/Week	Exam Duration	Max Marks		Total Marks	Credits
					Internal Asses.	Semester Exam		
1.	GP 301 T	Gravity Methods	4	3	20	80	100	4
2.	GP 302 T	Electrical Methods	4	3	20	80	100	4
3.	GP 303 T	Signal Processing & Geophysical Inversion	4	3	20	80	100	4
4.	GP 304 T	Theory of Fields	4	3	20	80	100	4
		Total:	16				400	16

Practicals:

Sl. No.	Subject Code	Subject Theory	Instruction Hrs/Week	Exam Duration	Marks Total	Credits
5.	GP 351 P	Gravity Methods	3	2	50	2
6.	GP 352 P	Electrical Methods	3	2	50	2
7.	GP 353 P	Signal Processing & Geophysical Inversion	3	2	50	2
8.	GP 354 S	SEMINAR	2		25	1
9.	GP 355 F	Geophysical Field Work – 2	4		50	2
		Total	16		225	9

Note:

1. Practical Examination will be conducted at the end of 3rd Semester. Every Practical Examination will be of 50 marks

2.Seminar: The student shall compulsorily deliver one seminar lecture (at end of III semester) from the core subject which will be evaluated internally within the department.

3.Field Work: At the end of 3rd semester II year , the students will submit a Field Report on the Field work Geophysical field practice – 2 (GP 355 F) conducted in 3rd semester. The Field Reports are assessed by conducting a viva- voce consisting of a committee (External Examiner, HOD, Chairman BOS and the concerned teacher) and the Marks are awarded for their performance.

4.Project Work: Students will be required to undertake a project work/dissertation during Fourth Semester. They must devote about 2-3 week's time either in the field and/or in laboratories for this purpose. The topic of their project work/dissertation will be decided towards the end of the Second Semester by the Head of the Department in consultation with the supervisor concerned. Provision of co-supervisor(s) will also be there. The related Lab. and/or field work may also be conducted during the summer vacation/intra/inter semester break.

Course No: GP 301T M.Sc. Geophysics II Year III Semester

Subject: GRAVITY METHODS

Unit-I

Principles of gravity prospecting, the gravitational field of the earth and its variation in space and time. Concept of gravity potential ,Poisson's & Laplace's. Equations International Gravity Formula Factors contributing to the variation of gravity on the surface of the earth.

Concept of anomaly & Definition of micro gravity anomaly.

Density of rocks and minerals and their variations – Laboratory methods of determining density of rocks.

Unit-II

Basic principles of Asiatic Gravimeters.(Lacoste-Romberg,Worden gravimeters).Gravity survey procedures on land, at sea and in satellite gravity .Scales of survey. Establishment of gravity base stations, Reduction of land gravity data . Determination of surface rock densities using Netelton and other empirical methods. Various corrections(Free air,Bouguer,Terrain etc) , Reduction of marine and airborne gravity data , Accuracy of Anomalies , Concept of absolute & relative Bouguer anomalies, preparation of Bouguer anomaly maps.

UNIT-III

Qualitative Analysis of gravity data – Key Variables in Gravity , Regional – Residual separation ,Various techniques i.e graphical & averaging methods-Least squares methods ,Green's Equivalent layer , Gravity anomalies over common geological features.. Continuation techniques ,calculation of second vertical gradients..

UNIT-IV

Quantitative analysis of gravity data, application of characteristics curves , logarithmic charts. Gravity anomaly expressions over simple geometric models. Concepts of 2D,$2^1/_2$ D and 3D models .Computation of anomalies over irregular bodies. Spectral methods in quantitative interpretation – limitation. Ambiguity in gravity interpretations.

Application of gravity methods in

(i) Regional geological and structural problems.
(ii) Mineral Exploration and Hydro carbons Exploration, application of micro gravity techniques(Structural traps, stratigraphic pinchouts, locating secondary faults.).
(iii) Groundwater and Engineering problems

RECOMMENDED BOOKS:

1. Stanislav Mares et al., 1984 , Introduction to Applied Geophysica. D.Reidel Publishing Company, Dordrecht/Boston. 581p.

2. Telford, W.M.,Geldart,L.P. Sheriff, R.E and Keys, D.A., 1981 Applied Geophysics,Cambridge University Press Cambridge, U.K. 860P

3. B.S.R.Rao and IVR Murthy, 1978, Gravity and Magnetic Methods of Prospecting Arnold –Henniman Publishing Company , Delhi. 390P

4. S.H.Ward (Ed.), 1967,Mining Geophysics, Vol .1 and Vol.II SEG Publication, Tulso, Oklahma, USA.

5. Grant F.S. and West G.F.,1964, Interpretation Theory in Applied Geophysics Mc Graw Hill Publication, New York.

6. D.S Parasnis, 1973,Mining Geophysics, Amsterdom.Elsevier Publishers, The Netherlands;354 P.

7. L.L.Nettleton, 1967,. Gravity and Magnetics in oil Propoecting McGraw Hill Publication, New York. 464 P.

8. V.L.S.Bhimasankaram & V.K.Gaur, 1978, Lecturers and Exploration Geophysics AEG, publications.CEO. O.U., Hyderabad.

9. I.V.Radhakrishna Murthy 1998, Gravity and Magnetic Anomalies Geophysics. Geological Society of India, Bangalore. 363 P.

10. I.V.Radhakrishna Murthy & D.C Mishra 1989, Gravity and Magnetic Anomalies in space and Frequencydomain, AEG, Publications.

11. Edwin S.Robinson and Cahit Coruh, 1988. Basic Exploration Geophysics John Wiley & Sons, New York Toronto/ Brisbane/ Singapore. 562 P.

Course No: GP 302 T M.Sc. Geophysics II Year III Semester

Subject : ELECTRICAL METHODS

Unit-I

Basic Principles of electrical methods of prospecting. Classification of methods.
Electrical properties of rocks and minerals, Influence of
(1) mineral composition (2) moisture and salinity (3) Temperature on resistivity.
DC methods of laboratory determination of resistivity. two electrode, four electrode and bridge methods.
Basics of theory of DC Propagation in resistivity methods. Flow of current through the earth media- Description of the potential and electrical field due to simple source of current (monopole, dipole and linear sources). Current distribution. . Solution of Laplaces equation in layered media.

Unit-II

Basics of Resistivity methods of prospecting: Concepts of True and Apparent resistivities. Two electrode, Three electrode Dipole, Schlumberger, Wenner arrays and their Geometric factors, Principle of reciprocity.

Electrical Profiling(EP): Basics of electrical resistivity profiling. Response of EP with, Two electrode , Three electrode, Dipole- Dipole, Schlumberger & Wenner arrays over a vertical contact. The unipole, combined and Schlumberger arrays and their use in different cases of prospecting, Double and multi separation profiling. Field procedure and illustration of results and interpretation.

Unit-III

Vertical Electrical Sounding (VES): Apparent Resistivity over a layered earth. Master curves for Schlumberger arrays- Types of two, three and multiplayer VES curves. Principles of Equivalence and Principle of suppression. Construction and interpretation of VES curves by graphical (Curve matching) and Computer technique(Resistivity transforms,principles of linear digital filtering-). Field procedures and examples of applications.

Buried electrode method : Principle of operation of charge body (buried electrode) method & its uses Resistivity imaging: Some fundamental concepts. Methods in resistivity imaging, field survey & uses.

UNIT-IV

Electrochemical Methods: Origin and nature of electro-chemical processes (spontaneous polarization) in the earth. exploration of sulphide ore bodies. Typical responses over sphere and rod like bodies. Field procedure for S.P. surveys and interpretation techniques .Geological applications

Induced Polarization (IP)Method: Introduction, sources of IP, membrane and electrode polarizations, Time domain and Frequency domain measurement of IP, chargeability, percent frequency effect and metal factors, apparent chargeability over layered earth. Field Procedure .Simple Interpretation Techniques . Applications of IP Methods.

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Books Recommended:

1. E.I. Parkhomenko – 1967 Electrical Properties of Rocks – Plenum Press, New York.
2. Keller and Frischkeicht, 1966, Electrical methods in Geophysical Prospecting Pergaon.
3. Telford W.N.,Geldart, L.P.Sheriff, R.F. and Keys, D.A., 1985 Applied Geophysics, Cambridge univ.Press.
4. Stanislav Mares et al.. 1984, Introduction to Applied Geophysics, D.Reidel Publishing.
5. D.S.Parasnis, 1977, Introduction to Apllied Geophysics, Published by Chapman & Hall, London.
6. Patra and Bhattacharya 1969, Direct Current Geoelectrical Sounding, Elsevier.
7. Koefeed C, 1980, Principles of Geoelectrical Soundings, Elsevier.
8. Ward S.H., 1969 Mining Geophysics, SEG.
9. Electrical Imaging surveys for environmental and engineering studies. By M.H.Loke

Course No.GP 303 T M.Sc, Geophysics II Year III Semester

Subject: SIGNAL PROCESSING AND GEOPHYSICAL INVERSION

Unit – I

Basics of Data Processing and Integral Transforms:

Stationary time series, concepts of signal and noise, continuous and discrete Data. Deterministic and statistical processes, auto and cross correlations. Fourier and Hartley transforms. Discrete transforms and FFT and FHT algorithms Z- transform. Properties, relation between Z and Fourier transforms, Hilbert transform, analytic signal, Amplitude, phase, instantaneous frequency and envelope of time series.

Radon, Walsh and Mellin transforms, their discrete transforms and properties.

Linear System:

Linearity, casualty and stability of a system, Impulse response, transfer function, (input and output relation) Convolution theorem in time and frequency domains.

Sampling Theory

Time and frequency sampling theorem, comb, function, Nyquist frequency, Alising and Gibb's phenomenon.

Unit – II

Spectrum

Spectrum in terms of correlation functions. Spectral calculation ofobserved data. Concept of maximum entropy.

Windowing:

Concepts of Windows Criteria for optimum window. Triangular, Rectrangular, Hanning, Hamming windows.

Filtering

Principles of digital filtering intime and frequency domains. Amplitude and Phase characteristic of digital filters., Low pass, high pass, and band pass. Velocity filters, and Weiner filter. Deconvolution and predictive Deconvolution techniques.

Application:

Applictions in gravity magnetic, seismic, electrical and electromagnetic methods

Unit – III

General discrete inverse problem – modal space data space, joint space. States of information – mathematical concept of probability, interpretation of a probability, perfect knowledge, total ignorance Shannon's measure of information content, Combination of states of information. Solving forward problem – Results of the measurements; a prior information on model parameters: joint prior information in the DXM spaces.

Unit – IV

Defining solution of inverse problem – Combination of experimental, a prior and theoretical information, and resolution of inverse problems. Solution of inverse problems – describing the a posteriori information in the model space, analysis of error and resolution, analytic solutions Monto carlo methods. Special cases – Gaussian hypothesis d= g(m); case f (d,m) = 0, generalized Gussian, lognormal probability density. Solution of inverse problems using the Bayesian paradigm.

BOOKS RECOMMENDED

1. Marcus Bath, 1974, Spectral Analysis in Geophysics, Elsevier.
2. A Populis, 1962, The Fourier integral and its applications, MC Graw Hill Publishers.
3. J.F. Clarbout, 1976, Fundamentals of geophysical data processing.Mc. Graw Hill Publishers.
4. E.R. Kanasewich, 1975, Time sequence analysis in geophysics, The University of Alberta Press.
5. E.A. Robinson and S. Treitel, 1983, Digital Seismic inverse methods, D. Reidel Publishing Co.
6. R.N. Bracewell, 1986, Fourier transform and its applications, Mc Graw Hill Publishers.
7. J.B. Thomas, 1969, An introduction to statistical communication Theory, John – Wiley Publishers,
8. A.V. Oppenheium and R. W. Schafer. Digital signal processing, Prentice hall of India.
9. Silvia, M.T. and Robinson, E.A. Deconvolution of geophysical time series in the exploration for Oil and Natural gas. Elsevier Scientific Publishing Co.
10. Tarantola A 1984, Inverse Problem Theory, Elsevier, Amsterdam.
11. Hjelt, S.E., 1992 pragmatic Inversion of Geophysical Data, Springer – Verlag.
12. M. Bernbii, P. Carrion, G. Jacoviti, F. Rocca, S.Treitel, 1987. Deconvolution and inversion. Blackwell Scientific Publication Oxford.
13. N.J. Vlar, E. Nolet, M.J.R. Wortel, S.A.P.L. Cloetingh, 1988, Mathematical Geophysics D. Reidal Pub. Co., Tokyo.

Course No. GP 304 T M.Sc. Geophysics II year III semester.

Subject: **THEORY OF FIELDS**

Unit-I

Mathematical and physical field, continuity, scalar and vectors , Static fields in free space, Columb's law, Field intensity, line of force, charge density, curl of vector, Stokes theorem, Gauss's law, Gauss's divergence theorem, Poisson's and Laplace's equation. Electrical dipole, Double layer.

Unit -II.

Conductors and Dielectrics: Nature of conductors and dielectrics, polar and non-polar dielectrics. Harmonic functions. Orthogonal curvilinear, spherical and cylindrical co-ordinates, Method of images, Green's theorem, Green's function, Green's equivalent stratum, Dirichlet and Neumann problems. Electric fields in conductors, Ohm's law in differential and integral forms, conductive current and displacements current, equation of continuity . Relation between resistance and capacitance

Unit-III

Magnetic flux, Magnetic vector potential, induction in magnetic media, Relation between gravity and magnetic potentials . The H-field, magnetic susceptibility and permeability, boundary conditions. ferromagnetism, magnetic poles ,magnetic scalar potential.

Unit-IV

Electromagnetic induction, law of inductions, Electric and magnetic energy densities, displacement currents, electromagnetic energy and Pointing theorem.

Maxwell's equations and electromagnetic waves, The wave equation, the waves in conducting media, Vector and scalar potentials of an electromagnetic field. Electromagnetic radiation from an oscillating dipole.

Recommended Books

1. Introduction to theory of fields by V. L. S. Bhimasankaram, G.A, Soloviev and S.V. Seshagiri Rao 1973.
2. Theory of Elasticity by Soloviev. G.A.
3. Geophysical Field theory and method. Gravitational, electric and magnetic fields. Academic press. Alexander A. Kaufman, 1992.

Course No. GP 351 P M.Sc. Geophysics IIYear III Semester

PRACTICALS

Subject: GRAVITY METHODS

1. Computations regarding determining average density of surface rocks from Gravity data.
2. Reduction of field gravity data.
3. Preparing gravity anomaly contour map from field data.
4. Regional-Residual separation by (a) Graphical method & (b)Grid methods .
5. Construction of gravity profiles on some simple geometrical models.(Sphere, Horizontal Cylinder & Fault)
6. Computations pertaining to basement depth estimation from Gravity.
7. Interpretation of gravity anomaly profile across a dyke.
8. Upward & Downward continuation of Gravity fields.

Course No. GP 352 P M.Sc. Geophysics II Year III Semester

PRACTICALS

Subject: ELECTRICAL METHODS

1. Calculation of normal field due to a point source and dipole source.
2. Calculation of normal field between two points source.
3. Computation of Resistivity profiling curve with a Two Electrode Spread over a vertical contact.
4. Computation of Resistivity profiling curve with a Three Electrode Spread over a vertical contact.
5. Computation of Resistivity profiling curve with a Four Electrode Spread over a vertical contact.
6. Graphical construction of VES curves.
7. Analytical construction of VES curves.
8. Application of Curve matching techniques in interpretation of VES curves.
9. Computer interpretation of VES data.
10. Computation and interpretation of S.P. anomaly over a sphere.
11. Computation and interpretation of S.P. anomaly over a slab.

Course No.GP 353 P M.Sc. Geophysics II Year III Semester

PRACTICALS

Subject: SIGNAL PROCESSING AND GEOPHYSICAL INVERSION

Computations on:

1. Noise estimation using Auto and Cross Correlations.

2. Hilbert Transform.

3. Mellin Transform.

4. Amplitude and Phase Characteristics of Digital Filter.

5. Weiner filter.

6. Estimation of the epicentral coordinates of a seismic event.

7. Using least – square regression find the solution for experimental points assuming Gaussian uncertainities.

8. Two variables y and t are related through a linear relationship $y = at + b$ determination of parameters a and b using experimental points

   (y_i and ti).

9. Some problems of error estimation.

10. Some problems on stability analysis.

Course: GP 356 F M.Sc. Geophysics II Year III-Semester

No. of Hours: 4 No. of Weeks: 15 Total No. 60 hrs Per week

Subject: Geophysical Field Practice-2

I Gravity Methods:

1) Acquaintance with Field Astatic Gravimeter their Operation & Procedure of Measurement

2) Measurement of Static & Dynamic Drift.

3) Calibration of the Gravimeter

(a) Tower Experiment

(b) Tilt Method.

4) (a) Establishment of Base Stations. Tying of Base Stations.

(b) Reduction and correction of Gravity Data

II. Electrical Methods

Electrical Resistivity surveys

(a) Profiling

(b) Vertical Electrical Sounding

Using Symmetrical Schulmberger 4- Electrode Configuration.& Radial VES

(c) SP Potential Profiling over a Geological target & Radial SP

Note: Field work will be conducted in O.U. Campus only. The field work consists of Acquisition , Processing & Interpretation of data by the respective methods. At the end of the III semester II year , the students are required to submit 2 copies of Field Training Report on Geophysical Field Practice-2 to the Head, OU .The field reports are assessed by conducting a viva-voce consisting of (External examiner,HOD, Chairman BOS and the concerned teacher) a committee and the marks are awarded for their performance

OSMANIA UNIVERSITY

CHOICE BASED CREDIT SYSTEM IN P.G. COURSES

CENTRE OF EXPLORATION GEOPHYSICS,

DEPARTMENT OF GEOPHYSICS, HYDERABAD-7.

M.Sc. GEOPHYSICS, II Year IV Semester

COURSE with effect from 2011 and also final year students admitted to the course during 2010-11.

Scheme of Instruction and Examination

Theory: IV SEMESTER

Sl. No	Subject Theory	Sub.Code	Instruction Hrs/week	Exam Duration	Max Marks		Total Marks	Credits
					Internal Asses.	Semester Exam		
1.	Remote Sensing Geophysical Applications	GP 401 T	4	3	20	80	100	4
2.	Well Logging	GP 402 T	4	3	20	80	100	4
3.	**Electives :#** a) Integrated Geophysics b) Mineral Exploration c) Geophysical Instrumentation	GP 403 T	4	3	20	80	100	4
4.	1. Groundwater , Environmental & Engg. Geophysics 2. Hydrocarbon Exploration	GB/GP 404 T	4	3	20	80	100	4
	TOTAL		16				400	16

Practicals

Sl. No	Sub.Code	Subject Theory	Instruction Hrs/week	Exam Duration	Marks Total	Credits
5.	GP 451 P	Remote Sensing Geophysical Applications	3	2	50	2
6.	GP 452 P	Well Logging	3	2	50	2
7.	GP 453 P	Electives: a) Integrated Geophysics b) Mineral Exploration c) Geophysical Instrumentation	3	2	50	2
8.	GP 454 P	Project Work	9		100	5
9.	GP 455 S	Seminar	2		25	1
10	GP 456 F	Field work/Field Training	4		50	2
		Total No. of hrs/week	25		325	14

Note:

1. Electives: To be offered depending on the availability of facilities
2. Practical Examination will be conducted at the end of each Semester. Every Practical Examination will be of 50 marks.
3. Seminar: The student shall compulsorily deliver one seminar lecture (at end of IV semester) from the core subject which will be evaluated internally within the department.
4. Field Work/Field Training: During the Fourth Semester, the students will undergo Geophysical Field Training (GP 456 F) for familiarization at specialized centers for about 2 weeks field work. At the end of II year 4th semester the students will submit a Comprehensive Field Report on the Field work/Field Training (GP 456 F) conducted in 4th semester. The Field Reports are assessed by conducting a viva- voce by a committee consisting of (External Examiner, HOD, Chairman BOS and the concerned teacher) and the Marks are awarded for their performance. The students are required to submit 2 copies of Field Training Report to the Head, Department of Geophysics, OU.

No. of weeks: 15.

Subject: REMOTE SENSING AND GEOPHYSICAL APPLICATIONS

Unit-I

Principles of Remote Sensing:

Electro magnetic Radiation (EMR) and its spectrum. Source of EMR and governing laws; interaction of EMR with atmosphere and surface of the earth. Atmospheric windows; spectral signature and spectral reflectance, spectral responses of vegetation, water, soil etc.

Remote Sensing Observation Platforms. Characteristics of remote sensing sensors: (spectral, spatial, temporal and radiometric resolutions).

Unit-II

Aerial Photography:

Principal and Types of Aerial Photography, Ground coverage and Resolution. Principles of Photogrammetry, Aerial Mosaics, Photo scales. Difference between photography and Image.

Satellites: Types of satellites.

Data reception. Characteristics of the IRS , Remote sensing satellites.

Microwave sensors. SLAR and SAR systems.

Unit-III

Image Interpretation:

Principles of image interpretation, Visual image interpretation – image elements, geo-technical elements and visual interpretation aids.

Digital processing – Image enhancement, Image classification and image processing systems. Advantages and limitations of visual and digital interpretation for geological studies.

Application of remote sensing in Geological and structural mapping.

General application of satellite data for various Geological, Groundwater, Mineral prospecting and Environmental impact and Hydrocarbon studies.

Unit-IV

Airborne Geophysical Methods:

Introduction. Status of airborne geophysical methods.

Factors controlling airborne geophysical surveys.

Characteristics and effective assemblage of airborne geophysical Surveys

Advantages and disadvantage of airborne geophysical surveys.

Recommended Books:

1. Ward, S.H., 1967 Mining Geophysics, SEG Publ.
2. Floyd, F., Sabins, Jn., 1987, Remote Sensing Principles and Interpretation, W.H.Freeman, Company, New York.
3. Thomas, M.Lillesand, Ralphw and Kiefer, 1987, Remote Sensing And image interpretation., John Wiley & Sons, New York.
4. Paul, J.Currian, 1988, Principles of Remote Sensing, ELBS, London.
5. Joseph Lintz, Jr.David, S.Simorelt, S, 1976. Remote Sensing Environment , Addi Sen – Wesly Publ. Co., Inc., Canada.
6. Photo Geology-Miller, V.C., 1961, Mc Graw Hill, New York.
7. Landsberg, H.E., 1952, Advanced in Geophysics. Vol.I,

   Academic Press Inc., Publ. New York.
8. Landsberg, H.E., 1969, Advanced in Geophysics. Vol. 13,

   Academic Press Inc., Publ. New York.
9. Shivn Panedy, 1987, Principles and Applications of Photo Geology, Wiley Eastern Ltd., New Delhi.
10. Rao, D.P., 1955, Remote Sensing for Earth Resources, AEG

    Publ., Hyderabad.
11. Dr. G.Ramdass and Dr. D.Himabindu, 2001, Principles and Applications of Remote Sensing Techniques in Mineral, Groundwater and Oil & Gas Studies.

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Course No. GP 402 T M.Sc. GEOPHYSICS II YEAR IV SEMESTER

No. of weeks: 15.

Subject: WELL LOGGING

Unit-I

Reservoirs characteristics and objectives of well logging.

Reservoir Rocks : Clastic and carbonate rocks.

Reservoir Properties: Porosity, permeability, fluid saturation, need of drilling fluids & their properties. Borehole environment- invasion process and various profiles. Classification of well logging methods,

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.. Determination of formation water resistivity from SP logs.

Unit-II

Principles of Non focussed resistivity loggin.: Single Point Resistance (SPR)log, Conventional

(normal, lateral) resistivity logs and their response across a layer of anomalous resistivity

Principles of operations of Focused current logs : Laterolog 3, Laterolog-7 and Dual Laterolog.-Pseudo geometrical factor, environmental corrections. Interpretation of Laterologs.

Principles of Micro Resistivity (Wall) logging. micro- normal, micro-lateral and focused micro logs. Applications.

The Induction log principles, Geometric theory , Dual Induction Focussed Logs and its uses.

Unit-III

Radioactivity and Nuclear Logging Methods:

Principle of natural gamma logging - Causes of natural radioactivity in

rocks and use of gamma logs for litho logical & shaliness identification.

Spectral Gamma Ray log & uses

Principle of gamma-gamma(density) logging,-Litho Density tool (LDT)-Compensated Density tool (CDL) and their uses. Principles of Neutron –.Neutron logs and their uses. .

Acoustic (sonic) logging - Principle and uses. Thermal, Caliper logging and their applications

Unit-IV.

Field Instrumentation for Geophysical Logging and Field Procedures.

Well log interpretation - Quick look techniques, Hingle, Pickett & M-N cross plots, saturation estimation, lithology, porosity (primary and secondary) determination, Log interpretation case studies..Sub-surface correlation and mapping from log data . Production logging.

Application of Well logging for (a) Groundwater, (b) Ore Minerals, (c)Petroleum & Gas.

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Recommended Books:

1 Serra ,1984, Fundamentals of well log interpretation-1.The acquisition of Logging data., Elsevier Science Publishers ,B.V

2 Serra ,1986, fundamentals of well log interpretation-2.The acquisition of Logging data., Elsevier Science Publishers ,B.V

3. Vaish,J.P.1997, Geophysical Well logging : Principles and practices, Asian Books PVT.Ltd.,New Delhi

4. John T.Dewan,1983 ,Essential of Modern open –hole log interpretation, Pennwell Books ,Pennwell Publ.Co.,Tusla, Oklahoma

5. Brock, James .G.,1986. Applied open – hole log analysis, Gulf Publ. Co.,Houston,Texas

6. Itenberg,S.S. 1971, Study of oil and gas series from Well logs, Mir. Pub. Moscow

7. Schlumberger, 1972 ,Essential of log interpretation Practice . Schlumberger ., France

8. Schlumberger, 1969 ,Log interpretation Principles and charts, Schlumberger. Ltd.,USA.

9. Ed.J.Lynch .,1964, Formation and evaluation, Harper and Row , Japan and US

10. Syllvin, J,Pirson,1963., Hand Book of Well log Analysis, Prentice ., Hall , Inc.

11. Bore hole Geophysics Applied to Ground water investigations by W.Scott Keys.US Geological Survey Open File Report, 87-539

12. Dresser Atlas, 1982 Well Logging and Interpretation techniques - Dresser Industries Inc

13. The Geological Interpretation Of Well Logs. By M.H.Rider-1986.

Elective I :

Course No. GP 403 T(a) M.Sc. GEOPHYSICS II YEAR IV SEMESTER

No. of weeks: 15.

Subject : : INTEGRATED GEOPHYSICS

Unit-I

Present status of surface, subsurface ,marine and airborne geophysical methods. Role of integrated approach in geophysical prospecting for solve certain geological problems. Exploration planning and procedural sequence. Economic factors in planning integrated approach, integrated geophysics in reduction of non -uniqueness of interpretation. Concept of integration of geophysical methods.

Unit –II

Factors controlling the choice of an effective assemblage of geophysical methods, stages of investigations, net work of observations, accuracy of data, effect of noises etc. Data evaluation: graphical presentation of results of measured physical fields, detection of weak geophysical anomalies. Synergetic interpretation of multisensor data. Use of integrated geophysics for geological mapping, (regional and detailed), and identification of various type of subsurface structures, stratigraphic trap determination.

Unit -III

Exploration of for oil and gas structures. Stages of geophysical investigation to solve different problems in locating oil and gas structures. Place of direct methods in oil exploration .case studies. Integrated geophysics in groundwater exploration, combination of seismic, resistivity and electromagnetic methods in soft/hard rock areas. Integrated approach in Gravity and magnetic methods

Unit-IV

Exploration for economic minerals. Exploration strategies in mineral exploration. Integration of different geophysical methods for

i) Ferrous (Iron, manganese, chromium)

ii) Non-Ferrous (copper ,lead, zinc etc.)

Precious (gold, diamonds) and radioactive mineral

iii) Non- metallic deposits (graphite, asbestos, barites)
Coal, along with case histories.

iv) Geophysical exploration in the solution of engineering geological problems.(Investigation of foundation and leakage, GEOTECHNICAL SURVEYS.

Recommended books:

1.Mining Geophysics, Vol.I Ed Ward SM.1967, SEG.publ.

2. Mining Geophysics. DS.Parasnis. 1973. Elesvier Publ.

3. Introduction to geophysical Prospecting for ore Deposits. Taakhov. AG.1965 CEG.publ.

4.Applied Geophysics. Telford.WH.1976. Cambridge Univ. press.

Elective-II

Course. No GP 403 T(b) M.Sc. GEOPHYSICS II YEA IV SEMESTER

No.of Weeks : 15

Subject : MINERAL EXPLORATION

Unit-I

Different types of mineral deposits and associated ore minerals, Stratigraphic, Lithologic and structural controls of mineralization and their significance in geophysical prospecting Problems in exploration geophysics, location, depth, dimension and extension of ore bodies.

Unit-II

Gravity, Magnetic, and Radiometric surveys in surface exploration for mineral deposits. Scales of surveys .Density of data collection, field procedures, data corrections and error. Some case histories and interpretation concept.

Unit -III.

Electrical and electromagnetic methods ,well-logging in mineral exploration. Special techniques and analysis of data . The importance of seismic, thermal and other methods in mineral prospecting. Suitable case histories with their data processing and interpretation .Special techniques and procedures used in subsurface geophysical exploration by geophysical methods.

Unit –IV

Integrated approach in geophysical exploration for mineral deposits. Optimization of exploration strategy. Computer applications in processing and interpretation of geophysical data. Application of GIS in mapping reserves and estimation.(Base metals, ferrous, precious and non metallic ore deposits, placer deposits, Uranium deposits etc.)

Books Recommend:

1. Introduction to mineral exploration, Author M.EVANS

2,Mining Geophysics, DS .Parasnis.

3.Introduction to Mineral Exploration by Charles J,Moon,MKG Whatel

Elective III:

Course No. GP 403 T (c) M.Sc. GEOPHYSICS II YEAR IV SEMESTER

No. of weeks: 15.

Subject : GEOPHYSICAL INSTRUMENTATIONS

Unit-I

Introduction to Geophysical Instrumentation

Electrical Instrumentation.

E.M. Instrumentation (Slingram system), Tilt angle system. M.T.

And Telluric equipment I.P. Instrumentation.

Unit-II

Seismic Instrumentation:

Signal enhancement Seismographs.-2D and 3 D Digital field seismic equipment

(Land & Marine) Filters, Multiplexers, gain ranging IFP Systems.

A/D converters, recording formats.

Unit-III

Well-Logging Instrumentation:

S.P. resistivity loggers, E.M., Nuclear, Acoustic and temperature logging equipment.

Magnetic Instrumentation :

Optical pump magnetometer. SQUID Magnetometer, Cesium Magnetometer.

Unit-IV

Gravity: Radiometric and Geothermal equipment-principles, design and calibration.

Global positioning systems (GPS)

Overview of GPS: Concepts, Principle, Users segment, Space segment, Control segment.

Processing techniques for position determination.

Accuracies and Application of GPS.

Recommended Books:

1. Edward, A.Wolff and Enrico P.Mereanti, 1974. Geoscience Instrumentation.
A Wiley - Interscience Publication, John Wiley & Sons, Inc, New York.London.
2. P.F.Shokin, 1963Gravimetry (Apparatus and methods for measuring gravity)-
Israel Programme Scientific translation limited (Jerusalem).
3. B.S.Evenden and D..Stone, 1981, Seismic Prospecting Instruments. Vol.II
Gebruder Burntraeger. Berlin Stuttgart Geopublication Associates.
4. N.A.Anstey, 1971, Seismic Prospecting Instruments – Vol.I & Vol.12, Gebruder Burntrager,
Berlin . Stuttghart Geopublication associates.
5. George V.Keller & Frischknecht F.C 1982, Electrical methods in Geophysical Prospecting
Pergamon Press.
6. B.S.Rama Rao & I.V.R. Murthy, 1986. Gravity and Magnetic Methods of Prospecting.
Gulab Vazmani for Arnold- Heinemann Publishers (India) Pvt.,Ltd., New DelhiPPPp.
7.Vaish, J.P., 1977, Geophysical Well Logging . Asian Books Private Ltd., New Delhi.
8. Bhattacharya, P.K. and Patra, H.P. 1968. Direct current geoelectric soundings,
Amsterdam, Elsevier Publishing Company.

Under Choice based Credit system effect from 2011 onwards

Course No. GB/GP404T Subject: Geophysics

Paper 1: Groundwater, Environmental and Engineering Geophysics (15 Weeks)

OR

2. Hydrocarbon Exploration(15 Weeks)

SNO.	Subject Code	Subject	Instructions Hrs./Week	Duration of Exam	Marks Internal Main	Total Marks
4	GB/GP304T Within the faculty/department	Theory	4	3	20 80	100

Note: A Post Graduate student has a choice of selecting one choice based papers in the IV semester offered by other cohesive Department s within the faculty/ within the department.

Paper 1 : Groundwater, Environmental and Engineering Geophysics

Unit I

Importance of Groundwater, Hydrologic cycle, subsurface water and its distribution, classification of rocks as aquifers. Groundwater Provinces of India. Role of geophysical methods in solving hydro geological problems. . Artificial recharge- Need for artificial recharge – Recharge Methods – Geophysical Methods for site selection for recharge operations .

Unit II

Different types of environmental pollutants, Landfills, Waste disposal- Industrial waste, mining activity, nuclear waste, etc. Causes of Groundwater pollution: Industrial, geological ,sea water intrusion and major engineering projects. Effects of Environmental pollution on the human body and human civilization. Water – logging courses – geophysical studies for water logged areas with a view to reclamations.

Unit III

Engineering properties of soils and rocks: Characteristics of important engineering problems – landslides, tunnels, cavities, roads etc., foundation and archaeological problems. Land slides – types of mass movements, identifications of land slide zones .Characteristics of Near surface geophysical Investigations, types of methods used, scales of survey and peculiarities of Near surface geophysics.

Unit IV

Application of Geophysical methods in solving Groundwater problems. Case studies in soft and hard rock areas. Delineation of salt & fresh water boundary.

Application of geophysical methods in foundation and road investigations (depth, aerial extent, fractures, rip ability etc.), case studies

Application of Geophysical methods in solving environmental problems, case studies.

Recommended Books:

1). Murali,S. and N.S.Pathangay ,1998, Principles and applications of ground water geophysics, AEG. Publications, Hyderabad.

2).Kelly,KE. and Mares , S., 1993,Applied Geophysics in Hydro Geological and Engineering Practice, Elseiver , Amsterdam.

3).P.V.Sarma, 1986 ,Geophysicak methods in Geology.

4). Lillesand ,T.M. and R.W.Keitter , 1994., Remote Sensing and Image Interpretation ,John Wiley & Sons.,

5).Karant ,K. 1987 ,Ground water assessment , development and management Tata .Mc Graw Hill.,New Delhi.

6). Mares .S, 1984. Introduction to Applied Geophysics, D.Reidel ,Publishing Co.,Dordrccht.

OR

1. Hydrocarbon Exploration(15 Weeks)

SNO.	Subject Code	Subject	Instructions Hrs./Week	Duration of Exam	Marks Internal	Marks Main	Total Marks
4	GB/GP304T Within the faculty/department	Theory	4	3	20	80	100

Note: A Post Graduate student has a choice of selecting one choice based papers in the IV semester offered by other cohesive Department s within the faculty/ within the department.

Paper 2. Hydrocarbon Exploration

Unit-I

Different types of Trace gathers, Concepts of CDP.2D and 3D seismic Amplitude recovery, Spherical divergence correction and Normal movement (NMO) in a horizontally stratified earth: The velocity spectrum, Factors effecting velocity estimates ,Horizon velocity analysis. Surface consistent residual statics corrections. Residual statics corrections in practice: maximum allowable shift,Deconvolution,predictive and spiking Deconvolution correlation window, other considerations.

Unit – II

Refraction statics: Field statics corrections, the plus-minus method, the least square method stacking procedure. Brute stack, and S/N improvements. Migration Principles and practice: Kirchhoff migration, finite difference migration, Frequency wave migration. Frequency space migration, Migration and spatial aliasing. Migration and ambient noise, Migration and profile length.Pre Stack Time migration (dip move out).

Migration Velocity analysis:

Unit-III

3-D data processing: marine data processing, Land data processing

3-D migration: Two –pass verses one pass 3-D migration, 3-D time verses depth migtation,3-D datuming, traces interpolation techniques.

Interpretation of 3-D seismic data: Time slice, interactive interpretation session.

Special Topics: Introduction, Multiple Suppression: Velocity discrimination in the F-K domain, velocity discrimination in t-x domain.

Seismic resolution: Vertical resolution, Lteral resolution Seismic modeling, synthetic sonic logs, Instantaneous attributes, Vertical Seismic Profiling,2-D wave length filtering.

Unit-IV

Wave Propagation and de propagation : Introduction, stacking, Diffraction summation migration and wave front superposition Migration, Wave De-propagation simplified. The WKB method, Relationship of Snell's law to the WKB Migration.

Application of seismic methods in Hydrocarbon, Mining Exploration.

BOOKS RECOMMENDED:

1. Ozdogan Yilmaz,1987.Seismic Data Processing, SEG,USA.

2. E.A,Robinson,T.S,Durrani,L.P.Peardon,1986,Geophysical Signal Processing, Prentice Hall International ,UK,Ltd.

3. RE Sherif and H Savit Exploration Geophysics.

Course No. GP 451 P M.Sc. GEOPHYSICS II YEAR IV SEMESTER

PRACTICALS

Subject: REMOTE SENSING AND GEOPHYSICAL APPLICATIONS

1. Generation of image from digital data.
2. Identification of Spectral signatures of different ground features from the image.
3. Identification of features like tone, texture, pattern on satellite Images for Interpretation.
4. Applications of Remote Sensing techniques to
    a) Geological Mapping.
    b) Groundwater studies.
    c) Oil and Gas studies.
5. Qualitative and quantitative interpretation of Airborne Gravity and Magnetic data.

Course No. GP 452 P M.Sc. GEOPHYSICS II YEAR IV SEMESTER

PRACTICALS

Subject: WELL - LOGGING

1. Demarcation of bed boundaries from the given

   a) Electrical resistivity – Potential and Gradient logs.
   b) S.P.Logs.
2. Determination of resistivity of formation water from S.PLog
3. Determination of true resistivity using nomograms.
4. Interpretation of micrologs.
5. Determination of(a) radio active beds and their percentages of radio activities

   (b)Shaliness from natural gamma ray log.
6. Demarcation of bed boundaries and identification of lithological

   units from the complex geophysical logs of.

   (a) Hard Rock Terrain., b) Soft Rock Terrain
7. Demarcation of bed boundaries and identification of aquifer horizons

   for groundwater utilization from well log data.
8. Demarcation of bed boundaries and identification of mineralized

   zones from well log data
9.. Demarcation of bed boundaries and identification of oil and gas

   horizons from well log data.
10. Computation of following Reservoir properties from well log data..

   (a) Formation Factor, (b) Porosity from Resistivity,Density, Neutron,&Accoustic Logs

   (c) Water Saturation (d) Hydro-Carbon Saturation

Electives

Coursee No. GP 453 P (a) M.Sc. GEOPHYSICS II YEAR IV SEMESTER

PRACTICALS

Subject: Integrated Geophysics.

1.Presentation of data on physical properties of rocks and minerals and their analysis.

2. Analysis of the published case histories based on the concept of Integrated Geophysics, including the following factors,

i) Is the selection of various geophysical techniques correct ?

ii) How much additional information is provided by the combination of techniques?

iii) Is the procedural sequence reasonable and if not way was it done in this way and how would you modify it?

iv) Is the selection of station spacing and accuracy of the data optimum identification in quality?

V) Is the information obtained positive or negative, definite or indefinite in quality?

vi) Are the number and the selection of methods necessary and superfluous to make a decision?

3. Exercise in combined interpretation of integrated geophysical data using the integrated geophysical indicator, complex parameter and mutual correlation methods.

Elective

Course No.GP4543P (b) M.Sc. GEOPHYSICS II YEAR IV SEMESTER

PRACTICALS

Subject: Mineral Exploration

1. Study of the characteristics features of various minerals anomalies of different geophysical methods Gravity/magnetic, electrical and E.M.methods
2. Interpretation and processing of associated anomalies
3. Collection of radioactive and other mineral samples
4. Laboratory measurements of minerals associated properties like density /electrical/ radioactive and magnetic .
5. Acquaintance with modern mineral exploration processing software.

Elective:

Course No. GP 453 P c) M.Sc. GEOPHYSICS II YEAR IV SEMESTER

PRACTICALS

Subject: Geophysical Instrumentation

1 Calibration of resistivity meter and its practical application in the field.

2. Design and study of characteristics of seismic detectors

3. Measurements and calibration with fluxgate/Proton precession Magnetometer

4. Measurements and calibration with Gravity instruments.

5. Design and construction of Seismic Filters

6. Measurements with GPS instruments.

Course: GP 456 F M.Sc. Geophysics II Year IV-Semesters

No. of Hours: 4 No. of Weeks: 15 Total No. 60 hrs

Per week

Subject: Geophysical Field Work-3

During the Fourth Semester, the students will undergo Field Training for familiarization at specialized centers i.e., Field Work for about 2 weeks.

The field report on this will be submitted at the end of 4th semester .This will be assessed by viva-voce consisting of (External, HOD, Chairman BOS and the concerned teacher) and marks area awarded for their performance. The students are required to submit 2 copies of Field Work report to the HOD Department of geophysics

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OSMANIA UNIVERSITY
CENTRE OF EXPLORATION GEOPHYSICS,
DEPARTMENT OF GEOPHYSICS, HYDERABAD-7.
COURSE with effect from 2011 onwards
Scheme of Instruction and Examination of PhD Course (Pre-PhD) in Geophysics

Theory: PhD Course Total No.Weeks:15

Total No.Hrs 60

Sl. No.	Subject Theory Theory	Instruction Hrs/Week	Exam Duration	Max Marks
1.	Paper-I Common for all candidates	4	3	100
2.	Specialization/Electives*			
A	Groundwater Geophysics	4	3	100
B	Mineral exploration	4	3	100
C	Petroleum & coal Geophysics	4	3	100
D	Solid Earth Geophysics	4	3	100
	Total	8		200

*Note: Candidate has to choose one specialization.

CENTRE FOR EXPLORATION GEOPHYSICS
DEPARTMENT OF GEOPHYSICS
OSMANIA UNIVERSITY, HYDERABAD – 500 007.

Syllabus for Ph.D. Course in Geophysics, O.U.

PAPER – 1 (Common for all candidates)

Note: Eight questions will be set out of(each unit 2 questions) which candidates have to answer one question from each unit.

Total: 60 lectures Marks:100 Total No. Weeks:15

Unit –I

1. Research Methodology:
   Identification of Research Projects, Data acquisition and literature collection, survey planning and execution of Research projects, and thesis writing.
2. Review of theoretical methods in Applied/prospecting Geophysics
3. Geophysical signal processing sampling theorem, aliasing Nyquiist frequency,Fourier series, periodic waveform, Fourier and Hilbert transeform, Z-transform, power spectrum. Principles of digital filters.

Unit-II

4 .Physical properties of rocks and minerals and their analysis.
Mechanical (density, elastic, including wave velocities
- - Electrical (conductivity/resistivity, dielectric constant)
- - Magnetic (Permeability, susceptibility Remanence)
- - Hydraulic (Porosity, Permeability, retention and yield)

5. Principles of Wellogging methods - Radioactive & Geothermal methods

Unit-III

6. Principles of data acquisition in Geophysics, Principles of measuring gravity, magnetic, electrical fields and radio-activity of earth materials. Acoustic wave velocities, common field equipment and their use. Observational corrections and errors. Seismic data acquisition techniques in brief.

7. Principles and fundamentals of Electromagnetic methods, Magneto telluric methods, and I.P. methods.

8 Principles of Remote Sensing,. Types of satellites, data reception, characteristics of the IRS. Aplication of remote sensing in geological and structural mapping.

9. Present status and different factors controlling airborne geophysical surveys.

Unit-IV

10.Computer application in processing and interpretation of Geophysical data. Case study

in seismic ,electrical , gravity and magnetic methods.

11. Basic concept of forward and inverse problems of geophysics

12. Applications of bore hole geophysics in ground water, mineral & oil exploration

Books recommended:

1) Roubine E 1970 – Mathematics applied to Physics Springer Vorlag (Berlin).
2) Sokolinkoff IS and Redhaffer RM (1966) – Mathematics of Physics and Modern Engineering.
3) Anderson, J and others (1970) – Thesis and assignment writing – Wiley.
4) Field Geophysics, Volume 12, John Milson,2003.
5) Cordasco F, and Gatner ESM (1970) – Research and Report writing Barnes and Noble N.Y.
6) Red sky V and Novak G (1971). Physics of rocks Mir Publishers (Moscow).
7) Telford WM and others (1976) – Applied Geophysics – Cambridge Univ. Press.
8) Merriam D.F. (1969) – Computer Application in the Earth Sciences – Plenum.
9) Dobrin, M.B. (1976) – Introduction to Geophysical prospecting – Mc Graw Hill.
10) Herman M. Weisman (1968) Basic Technical Writing.
11) M.J. Murray and H.H. Roe (1986) Engineered writing Pennwell Books.
12) P.G. Cooray (1992) Guide to Scientific and Technical writing 426, Mahakala Road, Hindagala, Srilanka.
13)Floyd, F., Sabins Jn., 1987, Remote Sensing principles and interpretation. W.H. Freeman Company, Newyork
14)D.S. Parasnis,1997-Principles of applied Geophysics, Springer
15) Philip Kearey, Michael Brooks, Ian Hill, 2002- An Introduction to Geophysical Exploration
16)Edwin Robinson, Cahit Coruh, 1988- Basic Exploration Geophysics.
17)Donald Harrison Griffiths, Roy Favell King, 1981- Applied Geophysics for Geologists and Engineers,

18) D.S. Parasnis 1973 – Mining Geophysics.
19) John M. Reynolds, 2001 - An Introduction to Applied and Environmental Geophysics.
20) William Lowrie,1997 –Fundamentals of Geophysics.
21) **Alan E**. Mussett, M. Aftab Khan, 2000 - Looking into the Earth: **An Introduction to Geological Geophysics.**
22) **Luis** Lliboutry,2000- **Quantitative geophysics and geology- Springer**
23) **P Kearey** and FJ Vine, 2009 - **Global Tectonics**
24) C. M. R. Fowler - **The Solid Earth: An Introduction to Global Geophysics**

Elective/Specialization 2(A)

GROUNDWATER GEOPHYSICS

Note: Eight questions will be set out of(each unit 2 questions) which candidates have to answer one question from each unit.

Total: 60 lectures Marks:100 Total No. Weeks:15

Unit-I

1. Importance of ground water, Hydrological cycle, subsurface water and its distribution, classification of rocks as aquifer. Groundwater provinces of India. Types of groundwater problems encountered in exploration - Mutual relation between hydro geological, structural and groundwater exploration.
2. Basic data for hydro geological maps,geomorphalogical and topographical map, hydrogeoplogical prospects in different rock terrain for ground water exploration. Use of Remote sensing &GIS methods for ground water exploration.

Unit-II

3. The variants of D.C. Electrical methods applied in groundwater exploration – Brief theory, field procedure and interpretation – Applications.
4. The variants of Electromagnetic methods (VLF, EM, HLEM, EMFS, IP.) applicable in groundwater studies – (Theory, field procedure and interpretation – Applications.
5. Seismic methods in groundwater exploration – Refraction and reflection Techniques – field procedure analysis of data – case histories.
6. Gravity and magnetic methods in hydrogeology. Brief theory – field procedure – interpretation & Applications.

Unit-III

7. Geophysical well-logging in hydrogeology, Electrical methods like SP, SPR, Short and long Normal techniques – Procedure of well – logging interpretation – applications.

8. Geophysical well logging of water wells using Radioactive methods like natural gamma, gamma-gamma, and nuclear logging.
9. Other geophysical techniques for groundwater flow studies – charged body method – Resistivity method.

Unit-IV

10. Application of geophysical methods solving in groundwater problems. Case study in soft & hard rock areas. Delineation of salt & fresh water boundary
11. Study of some important case histories in geophysical exploration for ground water in hard rock areas, alluvial, sedimentary terrains and coastal areas. Applications in groundwater management and solving environmental problems.

Recommended Books:

1). Murali,S. and N.S.Pathangay ,1998, Principles and applications of ground water geophysics, AEG. Publications, Hyderabad.

2).Kelly,KE. and Mares , S., 1993,Applied Geophysics in Hydro Geological and Engineering Practice, Elseiver , Amsterdam.

3).P.V.Sarma, 1986 ,Geophysicak methods in Geology.

4). Lillesand ,T.M. and R.W.Keitter , 1994., Remote Sensing and Image Interpretation ,John Wiley & Sons.,

5).Karant ,K. 1987 ,Ground water assessment , development and management Tata .Mc Graw Hill.,New Delhi.

6). Mares .S, 1984. Introduction to Applied Geophysics, D.Reidel ,Publishing Co.,Dordrccht.

7) David Keith **Todd, 2005.** Ground Water **Hydrology**

Elective/Specialization 2(B)

Mineral Exploration

Note: Eight questions will be set out of(each unit 2 questions) which candidates have to answer one question from each unit.

Total: 60 lectures Marks: 100 Total No. Weeks:15

Unit-I

1. Planning of geophysical surveys. Scales of survey. Density of data collection. Surface and subsurface geophysical surveys and their applications in exploration.
2. Problems in exploration geophysics , location of deposit classification of minerals. Different types of mineral deposits and associated are minerals. Stratigraphic, Lithologic and structural controls of mineralization and their significance in Geophysical prospecting.

3. Application of GIS and Remote sensing in mapping and reserve estimation

Unit-II

4. Physical properties of minerals and there analysis, In situ and in the laboratory
5. Electrical resistivity, induced and spontaneous polarization methods. Electro-magnetic methods in exploration. Some case histories.

Unit-III

7. Interpretation and inversion of geophysical data with special reference to electrical, EM, gravity and magnetic &Seismic methods. Some case histories.
8. Geophysical well logging from the surface and underground workings. Variants of electrical radiometric and mechanical logging techniques – Interpretation and correlation of well logging data.

Unit-IV

9. Combination of Seismic, Resistivity, Electromagnetic methods in Soft and Hard rock areas.
10. Synergistic applications of multi-sensor geophysical data. Integrated approach in geophysical prospecting for minerals.

Books Recommend:

1.Introduction to mineral exploration., Author M..EVANS
2. Mining Geophysics, DS .Parasnis
3. Introduction to Mineral Exploration by Charles J.Moon MKG Whateley.
4. Mineral Exploration:Recent Strategies by S.Rajendran et.al. 2007
5. An Introduction to Geophysical Exploration by Philip Kearey, Michael Brooks, Ian Hill, 2002

Elective/specialization 2(C)

Petroleum coal Geophysics

Note: Eight questions will be set out of(each unit 2 questions) which candidates have to answer one question from each unit.

Total: 60 lectures Marks: 100 Total No. Weeks:15

Unit-I

1. The geological problems related to the occurrence of petroleum and coal and their solution by geophysical methods. Direct detection of oil and gas deposits and coal seams as compared with structural or associational methods.
2. Conventional gravity, magnetic and electrical methods in the search for hydrocarbons and coal. Field procedures and data interpretation.
3. Seismic methods and well logging in the search for hydrocarbons and coal. Special techniques of field surveys, analysis of data presentation.

Unit-II

4. Airborne and marine geophysical techniques in hydrocarbon exploration. Equipment, procedures and interpretation of data.
5. The use of computer aided techniques in noise suppression, processing and presentation of data with special reference to prospecting for hydrocarbons.
6. Autoregressive moving average methods, minimum entropy de convolution and use of spectrum in signal analysis. Wavelet estimation methods.

Unit-III

7. Seismic sequence of stratigraphy
8. High resolution seismic for identification of coal deposits.
9. Vertical seismic methods – 2 – D and 3-D considerations – Computer processing of VSP data.

Unit-IV

10. Seismic Migration methods.
11. Application of Seismic methods and Remote sensing studies in Hydrocarbon exploration.
12. Multi parameter geophysical logging for coal exploration, identification of coal seams and correlation with ash content. Study of different geophysical logging software available commercial.

BOOKS RECOMMENDED:

1. Ozdogan Yilmaz, 1987, Seismic Data Processing, SEG, USA.

2. E.A.,Robinson, T.S.Durrani, L.P.Peardon, 1986, Geophysical Signal Processing, Prentice Hall International, UK.Ltd.
3. RE Sherif and H Savit Exploration Geophysics
4.Coal and Petroleum exploration,Caspeyork peninsula by T.J.Denaro, C.J.Shield,1993.

Elective/Specialization 2(D)

SOLID EARTH GEOPHYSICS

Note: Eight questions will be set out of (each unit 2 questions) which candidates have to answer one question from each unit.

Total: 60 lectures Marks: 100 Total No. Weeks:15

Unit-I

1. The physical fields of the earth and their relation to physics – Constitution of rocks and study of the physical properties of rocks.
2. The earth's interior – The internal constitution of earth, Structure of the earth based on Geophysical parameters. Vertical and lateral inhomegenitics in the earth's crust and mantle.
3. Gravity field of the earth. Internal and external components of gravity field. The geoid, the figure of the earth and elements of geodesy. Theory of isostasy and earth tides.

Unit-II

4. Seismicity of the earth. Origin, occurrence and distribution of earthquakes. Determination of earthquake parameters, Prediction of earthquakes.
5. The earth's natural electrical and electromagnetic fields. Propagation of Electromagnetic energy through the earth and at the earth air interface. Application in determining the earth's structure.

Unit-III

6. Thermal fields of the earth. Geothermal flux measurement and distribution over continents and oceans. Relation between heat flow gravity and seismicity.
7. Earth's magnetic field. Spatial and time variation of the field. Theory of origin of earth's magnetic field.
8. History of earth's magnetic field and palaeomagnetism. Study of Geomagnetic field reversals and techniques. Continental draft and polar wanderings. Marine magnetic anomalies and their interpretation.

Unit-IV

9. Global tectonics. Its historical perspective and essential features. Plate tectonics – Evolution the continental margins and ocean basins. Geodynamics of the Indian sub-continent.

10. Geochronology, Dating of rocks based on radiogenic dating principle. Fission track and magnetic dating.

Recommended Books:

1. P.V. Sarma, 1976, Geophysical Methods in Geology, Elsevier.
2. Howell, 1959, Introduction to Geophysics, Mc Graw Hill Book Co. New York.
3. R.E. Sheriff, 1989, Geophysical Methods. Prentice Hall Engle Wood Cliffs. New Jerssy.
4. I.K. Kaul, S. Senugupta and A.K. Bhattacharya, 1990, General and Applied Geophysics, (An introduction), Associate of, Geophysics.
5. F.D. Stacey, 1977, Physics of the Earth, John Wiley and Sons, New York.
6. Rezhevisky and Novik, 1971, Physical properties of Rocks, Mir Publications.
7. Richter, C.F. 1969, Elementary Seismology, Eurasia Publishing house, Pvt. Ltd. New Delhi.