MSc_Geophysics_2017-18AB_Isem.pdf

MSc_Geophysics_2017-18AB_IIsem.pdf

ADIKAVI NANNAYA UNIVERSITY
RAJAMAHENDRAVARAM
M. Sc. Geophysics I Semester Course Structure (W.E.F. 2017-18)

Paper Code	Title of the Paper	Internal marks	External marks	Total marks	No. of Credits
Semester - I		**100**	**550**	**650**	**26**
GP101	Numerical methods and Computer programming	25	75	100	4
GP102	Basics of Geology	25	75	100	4
GP103	Physics and dynamics of the Earth	25	75	100	4
GP104	Signal processing	25	75	100	4
GP105	Numerical methods and Computer programming lab	-	50	50	2
GP106	Basic Geology lab	-	50	50	2
GP107	Physics and Dynamics of the Earth lab	-	50	50	2
GP108	Signal processing lab	-	50	50	2
GP109	Seminar presentation/Viva-Voce	-	50	50	2

101: Numerical Methods and Computer programming

Unit I: Numerical solution of algebraic and transcendental equations - methods of bisection, false position and Newton - Raphson; Interpolation - finite differences, symbolic relations, Newton's formula, Gauss' central difference formulae, Bessel's formula, Lagrange's formula, Richardson's extrapolation; Numerical differentiation - maximum and minimum of a tabulated function, cubic spline method; Numerical Integration - Trapezoidal rule, Simpson' s formulae, Romberg's integration, Weddle's formula, numerical double integration; Numerical solution of ordinary differential equations, solution by Taylor's series, Picard's method of successive approximations, methods of Euler and Runga-Kutta; Finite element methods, basic concepts, boundary and initial value problems, variational formulation, variational methods of approximation, Ritz method, finite element analysis of 1d and 2d problems.

Unit II: Solution of linear system of equations – Matrix inversion method, Gauss' elimination method, Gauss-Jordan method, Jacobi's method, Gauss Seidel method, method of factorization, Centro-symmetric equations, ill-conditioned systems, generalized inversion techniques, properties, linear inversion, non-linear inversion – incorporating prior information, parametric inversion, assessing the uncertainty in inverted models.; Principles of least squares – fitting of polynomials, normal equations, linear and non-linear curve fitting, sum of exponentials, Chebysev polynomials.

UNIT III: C-Programming: character set, delimiters, keywords, identifiers, constants, variables, rules for defining variables, data types, comma and conditional operators, arithmetic operators, relational operators, logical operators, bitwise operators, priority of operators, input and output in C, formatted and unformatted functions, library functions;

IF statement, IF…. ELSE statement, nested IF, GOTO statement, break statement, CONTINUE statement, SWITCH-CASE statement, nested switch statement, FOR statement, WHILE statement, DO-WHILE statement, arrays, working with string and standard functions.

UNIT IV: Pointers, pointer declaration, arithmetic operations with pointers, pointers and arrays, array of pointers, pointers to pointers, pointers and strings, void pointers, function definition and declaration, prototypes, types of functions, call by value and reference, functions returning more values, functions with arrays and pointers, recursion, pointer to function, storage classes.

Preprocessor directives, structures and unions, bit wise operators, files, command line arguments, dynamic memory allocation, graphics in C.

Text Books/Reference books:

1. Introductory methods of Numerical analysis by S. S. Sastry, Prentice-Hall of India, New Delhi.
2. Higher Engineering Mathematics by B. S. Grewal, Khanna Publications.
3. Numerical Methods in Engineering and Sciences by B. S. Grewal, Khanna Publications.
4. Let us C by Yashavant P. Kanetkar, BPB publications.
5. Computer basics and C programming by V. Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.
6. Computer oriented numerical methods by V. Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.

I M. Sc. Geophysics -I Semester (Wef: 2017-18)
Model Question Paper
101: Numerical Methods and Computer Programming

Time : 3 hrs Marks : 75

SECTION – A

Answer **ALL** questions. Each question carries 15 marks.

1. (a). Find the root of the equation x^3-3x- 5=0 using (i) Bisection Method and (ii) Newton – Raphson methods and correct the result upto 3 decimal places.

OR

(b) Find f(2) for the data f(0)=1, f(1)=3 and f(3)=55 by using Newton's divided difference formula and Lagrange's formula.

2. (a) Solve the following system of equations by the Gauss-Seidel method

$$4X_1 + X_2 - X_3 = 3$$
$$2X_1 + 7X_2 + X_3 = 19$$
$$X_1 - 3X2 + 12X_3 = 31$$

(b) From the following table, find the area bounded by the curve and X axis from X=7.47 to X= 7.52 using trapezoidal, Simpson 1/3, Simpson 3/8 rule.

X	7.47	7.48	7.49	7.50	7.51	7.52
f(X)	1.93	1.95	1.98	2.01	2.03	2.06

(c) Evaluate I = $\int_0^1 \frac{1}{1+x} dx$ by using Simpson's rule with h=0.25 and h=0.5

3. (a) What is keyword? Write any five keywords in C language and explain them.
(b) Distinguish between local and global variables in C language.

(c) Write a C program to compute roots of quadratic equation using switch – case statement.

OR

(d) Write the precedence rules for arithmetic operators and give example.

(e) What are loops? Explain various loop statements in C language with suitable example.

4. (a) Explain the following concepts associated with functions in C language: (i) Function declaration (ii) Function definition (iii) Function call.
(b) Explain various parameter passing mechanisms in C language

OR

(c) What is Pointer? How is it initialized? What are the functions of a pointer variable? What are its uses?
(d) Explain the concept of pointers to structures with suitable example.

Section – B

Answer any **THREE** questions. Each question carries 5 marks.

5. Explain Principle of least square Technique.
6. Write about increment and decrement operators in C language with their syntax.
7. Write about various character sets in C.
8. How to declare and initialize string variables in C.
9. Briefly write Picard's method of successive approximations.
10. Dynamic memory allocation.

102: Basics of Geology

UNIT I: Introduction and Scope of Geology: Branches of Geology, relation with other sciences and Geophysics. Weathering and Erosion – physical, chemical and biological weathering, Geological work of wind - erosion – its products, sediment transport by wind, types of dunes. Geological work of glaciers, featured formed by glacial transportation and related features. Geological work of rivers – initial, youth, mature and old stages of river, important features formed by river action – canyons, meanders, Ox - bow lakes, flood plains, natural levees, denudation, Peni plains, monad rocks, Drainage patterns, types of deltas and process of their formation.

UNIT II: Geomorphology: Fundamental concepts of Geomorphology, principles of Geomorphology, Geomorphological features formed by geological work of mountains and mountain building activity, plate tectonics and earth quakes, seas, waves and currents of sea and their transportation. Features formed by marine erosion, deposition; Evolution of major geomorphic process in India; Study of topographic and thematic maps.

UNIT III: Physiographic divisions of ocean floor: Continental margins, abyssal plains, seamounts and guyots, aprons, submarine canyons, deep sea channels, turbidity currents and submarine sedimentation, mid oceanic ridge system and its structure, aseismic ridge systems, island arcs, trenches, hotspots and their mechanism, Coral reefs and processes of formation of coral reefs; Temperature, salinity and density of sea water, composition of sea water.

UNIT IV: Introduction to Stratigraphy: Principles of Stratigraphy and its classification, Principles of Correlation, fossils and their importance in Stratigraphy, physiographic divisions of india, Stratigraphic units of india, Geological Time Scale; Indian stratigraphy (Introduction, classification and economic importance of Archeans, Dharwars, Cuddapah, Vindhyan, Gondwana groups, Deccan traps, Siwaliks and Quaternary formations etc.)

Text Books/Reference books:

1. Introduction to Physical Geology by A. K. Datta,
2. A text book of Geology by P. K. Mukherjee, World Press.
3. Principles of Physical Geology by A. Holmes and D. L. Holmes.
4. Principles of Geomorphology by W. S. Thornbury, Wiley Eastern, New Delhi.
5. Indian geology and stratigraphy by M. S. Krishnan,
6. Geology of India by M. Ramakrishnan and R. Vaidyanadhan,
7. Historical Geology by Ravindra Kumar,

I M. Sc. Geophysics/I Semester Wef: 2017-18
Model Question Paper
102: Basics of Geology

Time : 3 hrs Marks: 75

Section A

Answer **ALL** questions. Each question carries 15 marks.

1. What is meant by weathering and erosion? Explain in detail the geological work of wind with neat sketches.

OR

2. Describe different stages of river and illustrate features formed by the geological work of rivers.

3. Describe various geomorphological features formed by marine erosion and deposition.

OR

4. Write a detailed note on the formation of mountains and mountain building activity.

5. Describe various physiographic divisions of ocean floor.

OR

6. What is meant by a hotspot? Explain its mechanism.

7. What is geological time scale? Write brief note on Archeans to quaternary rocks

OR

8. Explain the Stratigraphy of Cuddapah basin with reference to its economic importance

Section B

Answer any **THREE** questions. Each question carries 5 marks.

9. (a) Biological Weathering.
   (b) Deposits formed by glaciers.
   (c) Topographic maps.
   (d) Temperature and salinity of sea water.
   (e) Principle of correlation.
   (f) Index fossil.

103: Physics and Dynamics of the Earth

Unit I: The Universe and the solar system: Milky Way and the solar system, modern theories about the origin of the solar system, the earth, meteorites and other planetary bodies; Age of the Earth and the Universe.

Interior of the Earth: Broad structure of the earth, Major subdivisions of the Earth – Crust (continental and oceanic), Mantle (upper and lower) and Core (outer and inner) their structures and composition, variation of density, temperature, pressure, acceleration due to gravity and elastic constants within the Earth.

Thermal history of the Earth – Terrestrial heat flow measurements in land and oceanic areas, methods, thermal properties of rocks, transfer of heat within the Earth, the Earth's internal sources of heat, continental heat flow - variation of continental and oceanic heat flows with age, with depth and lithospheric age.

Unit II: Gravity field and figure of the earth - Earth's gravitational attraction, force of gravity on the surface of the Earth, gravitational theory, the figure of the Earth, Clairaut's theorem, the geometric and gravitational flattening, International gravity formula, rotation of the earth, gravitational potential, spheroid and geoid; Isostasy and models of isostasy, isostatic compensation and vertical crustal movements.

Theory of continental drift, evidences for continental drift, sea-floor spreading hypothesis - Vine-Matthews-Morley hypothesis, rates of sea floor spreading, drift of the Indian continent; Plate tectonics - The lithosphere, lithospheric plates, distribution of major and minor lithospheric plates, types of plate margins – constructive, destructive and conservative plate margins, triple junctions their evolution and stability, forces acting on lithospheric plates, relative magnitudes of forces driving plate motions.

Lithospheric plate motion on the surface of a sphere, Euler poles of rotation, absolute plate motions; mantle viscosity, concepts of mantle convection models, coupling between plates and mantle convection; plate tectonics and evolution of Himalayas.

UNIT III: Geochronology – Dating of rocks, advent of radioactive methods, closed and open systems, Uranium-Lead method: the Concordia-Discordia diagram, Interpretation of discordant ages, isochron diagrams, Potassium-Argon method, Rubidium-Strontium method, Argon-Argon method, Radioactive Carbon and Tritium methods, mass spectrometer, Fission-track dating, age of the Earth; History of Precambrian chronology, subdivisions of Precambrian time.

UNIT IV: Geomagnetism – General features of Earth's magnetic field, field of uniformly magnetized sphere; The magnetic fields of external and internal origins and their separation, the origin of the Earth's internal magnetic field, the dynamo theory and dynamo models; secular variations and westward drift of the Earth's magnetic field; Paleomagnetism, Field reversals, polar wandering.

Transient magnetic variations, Quiet day solar daily variation Sq, magnetic storms, auroras and airglow, theories of magnetic storms and aroras, the physical properties of upper atmosphere, the magnetosphere; Natural Remanent Magnetisation (NRM) - Measurement of NRM by Astatic and Spinner magnetometer, demagnetization effect; IGRF.

Text Books/Reference books:

1. The Solid Earth, An introduction to global geophysics, C.M. R. Fowler, Cambridge University Press, Second edition.
2. Fundamentals of Geophysics by William Lowrie, Cambridge University Press.
3. Physics and Geology by J.A. Jacobs, R. D. Russel and J. Tuzo Wilson, McGraw-Hill International series.
4. Plate tectonics and crustal evolution by Kent C. Condie, Butterworth-Heinemann
5. Interior of the Earth by M. H. P. Bott. Edward Arnold
6. Geodynamics of the Indian Peninsula and the Indian plate margins by R. K. Varma, Oxford & IBH publishing co. pvt. Ltd.

I M. Sc. Geophysics/I Semester Wef: 2017-18
Model Question Paper
103: Physics and Dynamics of the Earth

Time : 3 hrs Marks: 75

SECTION – A

Answer **ALL** questions. Each question carries 15 marks.

1. Write about the modern theories about the origin of the solar system and the earth

OR

2. Explain the broad structure and composition of the Earth

3. Explain the principle of the Isostasy with various models of isostasy.

OR

4. Explain in detail the Vine-Matthews-Moorley's hypothesis of the sea floor spreading.

5. Describe Uranium-Lead and Potassium-Argon methods for dating of rocks.

OR

6. Write about the history of the Precambrian chronology and subdivision of Precambrian time.

7. Explain in detail the general features of the Earth's magnetic field.

OR

8. Describe the procedure of measuring NRM by Astatic and Spinner magnetometers.

SECTION - B

Answer any THREE questions. Each question carries 5 marks

9. Transfer of heat within the earth.
10. Clairaut's theorem.
11. Plate margins.
12. Euler poles of rotation.
13. Fission-track dating.
14. Magnetic storms.

104: Signal Processing

UNIT I: Definitions of signal and noise, various classes of signals – continuous, piece wise continuous, absolute integrable, singularity, unit impulse, unit step etc., Fourier series, Dirichlet conditions, Fourier analysis of continuous, discontinuous, even and function, Gibb's phenomenon, complex form of Fourier series; Fourier integral theorem, Fourier sine and cosine integrals.

UNIT II: Fourier Transforms: The Fourier Transform (FT) and its properties – linear, scaling, shifting properties, modulation, frequency and shifting theorems, derivation and integration theorems; Fourier transforms of gate, exponential, impulse, step, singularity and periodic functions; Amplitude, phase and power spectra; Spectrum of observational data, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), FFT algorithm.

UNIT III: Z-Transforms: The Z-Transform (ZT) and its properties, ZT of casual and non-casual sequences, use of ZT in Geophysics; Inverse ZT, analysis of discrete-time systems, application of ZT to the analysis of Discrete-Time systems; Introduction to Hankel, Hilbert, Wavelet and Walsh transforms and their applications in geophysics.

Time-series analysis: Discrete time signals, auto and cross correlations and their applications; convolution, methods and properties of convolution; Deconvolution and its applications in signal analysis, impulse response and transfer functions, delay properties of wavelets,

UNIT IV: Band limited signals, sampling theorem, Nyquist frequency, aliasing, sampling of band and time limited signals, reproduction of continuous function from sampled data; windowing, types of windows, spectral leakage; Wiener Khinchin theorem, spectrum computation *via* autocorrelation and periodogram.

Digital filtering, design, amplitude and phase response, low-pass, high-pass and band-pass filters, optimum filters, Butterworth filter, recursive and non-recursive filters, optimal and optimum Weiner filters; deconvolution, deterministic and statistical deconvolution, predictive deconvolution, time-variant deconvolution, frequency filtering.

Text Books/Reference books:

1. Seismic data Analysis by Oz Yilmaz, Society of Exploration Geophysicists, Tulsa, USA.
2. Spectral analysis in Geophysics by B. Markus Bath, Elsevier Science.
3. Digital signal processing and time series analysis by Enders A. Robinson and M. T. Silvia, Holden-Day, The University of California.
4. Digital signal processing by S. Salivahanan, Tata McGraw Hill Education (India), Pvt. Ltd.

I M. Sc. Geophysics/I Semester (Wef: 2017-18)
Model Question Paper
104: Signal Processing

Time : 3 hrs Marks: 75

SECTION – A

Answer **ALL** questions. Each question carries 15 marks.

1. Define the signal. Classify the signals into various classes giving one example to each of the class.

OR

2. Write down the conditions required required to express a periodic function into a fourier series. Derive the complex form of the Fourier series.

3. What is a Fourier Transform? Explain linear, scaling and shifting properties of Fourier Transforms.

OR

4. Find out the Fourier Transforms of gate, exponential, impulse and step function.

5. Define the Z-Transform. What are the Z-transforms of casual and non-casual sequences.

OR

6. Write about Deconvolution and its application in signal analysis.

7. Write about sampling of band and time limited signals. Explain how a continuous function can be reproduced from a sampled data.

OR

8. Explain briefly deterministic, statistical and predictive deconvolutions.

SECTION – B

Answer any **THREE** questions from the following. Each question carries 5 marks.

9. Gibb's Phenomenon.
10. Amplitude, Phase and Power spectra.
11. Auto and Cross correlations.
12. Sampling theorem and Nyquist frequency.
13. Frequency filtering.
14. Hankel transform and its application in Geophysics

ADIKAVI NANNAYA UNIVERSITY

M. Sc. Geophysics Course Structure (W.E.F. 2017-18)

Paper Code	Title of the Paper	Internal marks	External marks	Total marks	No. of Credits
Semester - II		**100**	**550**	**650**	**26**
GP201	Essentials of Geology	25	75	100	4
GP202	Principles of remote sensing techniques	25	75	100	4
GP203	Seismology	25	75	100	4
GP204	Gravity and magnetic methods of exploration	25	75	100	4
GP205	Geology lab	-	50	50	2
GP206	Remote sensing lab	-	50	50	2
GP207	Seismology lab	-	50	50	2
GP208	Gravity and magnetic exploration lab	-	50	50	2
GP209	Seminar presentation/Viva-Voce	-	50	50	2
	TOTAL	**100**	**550**	**650**	**26**

201: Essentials of Geology

UNIT I: Crystallography: Introduction, Elements of crystallography – Characters of crystals, symmetry elements, Brief classification of 6 systems; Basics of physical properties of minerals, Isomorphism, polymorphism; Classification of minerals, brief description of physical properties of quartz, feldspar, mica, pyroxene, amphibole and garmet group and clay minerals.

UNIT II: Petrology: Definition, classification of rocks of rocks - Igneous, sedimentary and metamorphic rocks, distinguishing features between three types of rocks; Composition and constitution magma, forms of Igneous rocks, structure of igneous rocks, brief classification of igneous rocks, origin of sedimentary rocks, classification of sedimentary rocks based on their structures and textures, metamorphism, types, grades and zones of metamorphism, brief classification of metamorphic rocks.

UNIT III: Economic Geology: Origin and classification of economic minerals, geological thermometers, magmatic concentration, hydrothermal process, sedimentation, metamorphism, metallic and non – metallic minerals, placer deposits; Introduction to Hydrocarbons (including Petroleum, natural gas, coal, gas hydrates, coal bed methane, shale gas, poly metallic and manganese nodules).

UNIT IV: Structural Geology: Principles of stress and strain, structural features of rocks – primary and secondary structures, strike and dip. Folds – introduction, classification and origin. Faults – Introduction, classification, causes of faults and recognition of faults in the field. Joints – introduction, Classification and origin unconformities – definition, types and origin of unconformities, Different types of field and laboratory scales used in the preparation of geological maps, different symbols used in the preparation of geological maps.

Text Books/Reference books:

1. Rutley's elements of mineralogy by C.D. Gribble,
2. An introduction to rock forming minerals by W. A. Deer, R. A. Howai and J. Zusmann, Longman group Ltd., London.
3. Igneous and Metamorphic Petrology by A. Philpots, 1992.
4. A text book of Geology by P. K. Mukherjee, World Press.
5. Principles of petrology by G.W. Tyrrel, B. I. Publications Pvt. Ltd.
6. Structural Geology by M. P. Billings, Printice Hall of India Pvt. Ltd., New Delhi.
7. Structural geology and tectonic principles by P. C. Badgley.

202: Principles of Remote sensing techniques

UNIT I: Electromagnetic radiation**,** electromagnetic spectrum, Planck's law, Wien's displacement law, Interaction with the atmosphere, earth's surface and matter, selective and non-selective scattering, impact of scattering on remotely sensed data, atmospheric windows and absorption bands.

Spectral reflectance curves of water, snow, clouds, vegetation, soils, rocks/minerals; imaging and non-imaging sensors, radiometers, spectrometers, spectro radiometers, line scan systems, array scanning systems, multispectral scanner systems, whiskbroom and pushbroom imaging systems, circular/conical/side scanning systems; sensor characteristics, spatial resolution, spectral resolution, radiometric resolution and temporal resolution.

UNIT II: Platforms for data acquisition – Air borne and space borne platforms; Satellite orbits - geo-synchronous and sun-synchronous orbits; Indian Remote Sensing Satellites.

Microwave remote sensing: Wavelength bands, geometry of the radar image, passive microwave radiometers, penetration of the radar signal, polarization; advantages and disadvantages of passive microwave remote sensing; active microwave remote sensing: SLAR, SAR; look direction and look angle, Interpreting Brightness values, satellite image radars, LiDAR, scope of micro wave remote sensing in earth science applications.

UNIT III: Thermal remote sensing: thermal radiometry, microwave radiometers, thermal scanners, thermal properties of objects, geometry of thermal images, thermal image and its interpretation, heat capacity mapping mission, TM thermal data, scope of thermal remote sensing in earth science applications.

Hyperspectral remote sensing: spectroscopy, image cube, AVIRIS, spectral matching, spectral mixing analysis, data libraries, MODIS, processing of hyper-spectral data, applications of hyperspectral remote sensing, scope of hyperspectral remote sensing in various earth science applications.

UNIT IV: Image resolution, field data and image interpretation, target variables, system variables, operation conditions, measurement of resolution, mixed pixels, kinds of field data, nominal data, field radiometry, locational information, geographic sampling, image interpretation tasks, strategies, keys and equipment.

Elements of image interpretation, collateral information, interpretive overlays, preparation for manual interpretation, image scale calculations, image registration, image enhancement, image filtering, image smoothening, image classification – Supervised, Unsupervised and Fuzzy classifications, classification accuracy assessment.

Text Books/Reference books:

1. Remote sensing of the environment: An earth resource perspective by John R. Jensen, Second edition, Pearson Education, Inc.
2. Digital remote sensing by Prithvish Nag and M. Kudrat, Concept publishing company, New Delhi.
3. Hyperspectral data, analysis techniques and applications, Ed. R. R. Navalgund and S. S. Ray, Indian Society of remote sensing.
4. Remote sensing and image interpretation by T. M. Lillesand, Kiefer, R. W., and Chipman J.W., Wiley.
5. Remote sensing geology by Ravi. P. Guptta, Springer International Edition, Springer (India) Pvt. Ltd. New Delhi.

203: Seismology

UNIT I: Introduction: Elastic theory – elastic, inelastic and plastic behavior of material, the stress matrix, the strain matrix, longitudinal strain, dilatation and shear strain, Elastic constants and internal relationships between them, elastic parameters in terms of lame constant; Seismic waves – Body waves - Longitudinal waves, Transverse waves - Surface waves - Rayleigh waves, Love waves; Seismic wave equation and the solution to the seismic wave equation; The energy in seismic disturbance, the attenuation of seismic waves, the dispersion of seismic waves.

UNIT II: The earthquake seismology: Introduction, definition of an earthquake, focus, epicenter, location of the epicenter of an earthquake, classification of earthquakes – based on the depth of the focus and on the causative mechanism; Travel-time curves and velocity depth curves; Earth quake size – Intensity, magnitude and the relation between them, earthquake frequency, energy released in an earthquake; Secondary effects of an earthquake.

Continental margins: Types of continental margins – Passive, Active and transform continental margins, classification and distribution of continental margins on the globe, the global seismicity, belts of active seismicity; hotspots and mantle plumes, plume generation mechanism, evidence of mantle plumes from seismology and geoid.

UNIT III: Instrumentation: Introduction, principle of seismometer – vertical motion seismometer, horizontal motion seismometer, the equation of seismometer – effect of instrumental damping, long period seismometer, short period seismometer, broad band seismometer; The seismogram – Analogue recording, digital recording, phases on a seismogram.

UNIT IV: Analysis of earthquakes: Source parameters of an earthquake and their determination; Analysis of earthquake focal mechanisms – single couple and double couple radiation pattern, fault plane solutions, machanics of faulting, focal mechanism at active plate margins, focal mechanism at continental collision zones; Earthquake prediction – prediction of the location, time and size of an earthquake, reservoir induced seismicity, seismic zonation.

Text Books/Reference books:

1. Fundamentals of Geophysics by William Lowrie, Cambridge University Press.
2. Introduction to Seismology by Markus Bath,

204 - Gravity and Magnetic methods of exploration

UNIT I: Principle of gravity and magnetic prospecting: Properties of Newtonian potential, Laplace's and Poissons's equations, Green's theorem, Gauss' law, continuation integral, concept of gravity anomaly; Rock densities, factors controlling rock densities; Principles of gravity prospecting instruments - static and astatic gravimeters, Zero-length spring; Concept of magnetic anomalies, Origin of magnetic anomalies, induced and remanent magnetizations; Dependence of magnetic anomalies on latitude and orientation; Magnetic susceptibility, factors controlling susceptibility, magnetic classification of minerals and rocks, laboratory and in-situ methods of determining susceptibility; Principles of magnetic prospecting instruments - Fluxgate, Nuclear, Proton precession and Optical pumping magnetometers.

UNIT-II: Gravity and magnetic surveying for mineral and Hydrocarbon exploration and geological mapping, establishment of base stations, gravity drift correction; Reduction of gravity and magnetic data; Free-air, Bouguer and Complete Bouguer gravity anomalies and magnetic anomalies; Bouguer density and its in-situ determination – Nettleton's density profiling and Seigert's methods; Airborne magnetometry, orientation mechanisms, survey techniques, data acquisition and reduction; Gradient measurements; Satellite magnetometry.

Regional, residual and noise anomalies in gravity and magnetics; Regional residual separation - graphical, average, grid and curve fitting techniques, reliability of different types of residuals; Vertical derivative calculations; Equivalent stratum, upward and downward continuations - classical methods using continuation integral, harmonic analysis and Fourier transformation.

UNIT III: Interpretation of gravity and magnetic anomalies: Qualitative interpretation - Nature of anomalies, identification of structural features and litho contacts from contour maps; Ambiguity in gravity and magnetic interpretation, strategies for resolving the ambiguity.

Quantitative interpretation: Concepts of forward modeling and inversion; Forward modeling of gravity anomalies - Gravity anomaly equations and characteristics of anomaly profiles of point and line masses, circular discs, vertical cylinders, sheets, faults and rectangular slabs; Generalized equations for the magnetic anomalies of single pole, sphere, line dipoles, dykes, sheets and faults, anomaly equations and characteristics of anomaly profiles; Interpretation by thumb rules and characteristic curves; Poisson's relation, similarity of magnetic anomalies of two-dimensional bodies in different components; Magnetic equivalence of dykes, faults and anticlines.

UNIT IV: Forward modeling of gravity and magnetic anomalies of two-dimensional and three-dimensional bodies - graticules, computer models; Inversion of gravity anomalies of 2-D polygonal bodies; Automatic gravity modeling of sedimentary basins by Bott's method and density interfaces, concepts of density contrast and density difference, inversion of gravity anomalies of density interfaces; Mass estimations from gravity anomalies; Magnetic inversion - 2d polygonal bodies, dykes and magnetic interfaces; Interpretation in frequency domain, depth calculations.

Application of gravity and magnetic methods for regional geological mapping, oil and mineral exploration with special reference to salt domes, structural traps, sulphide ores, ferrous and non-ferrous ores, diamonds, placer deposits, coal, groundwater, engineering problems.

Text Books/Reference books:

1. Milton B.Dobrin and Carl H.Savit, Introduction to Geophysical Prospecting, 1988, McGraw-Hill International Edition, Geology Series, New Delhi
2. Telford W. M. et. al., Applied Geophysics, 1988, Oxford & IBH Publishing Co. Pvt . Ltd., New Delhi.
3. Philip Kearey and Michael Brooks, An introduction to geophysical exploration, 2000, Blackwell Science.
4. I. V. Radhakrishna Murthy, Gravity and magnetic Interpretation in Exploration Geophysics, Geological Society of India Memoir No.41.
5. Gravity and magnetic methods of prospecting by B. S. R. Rao and I. V. R. Murthy.

Adikavi Nannaya University
I M.Sc Geophysics/II Semester (Wef : 2016-17)
Model Question Paper
201: Essentials of Geology

Time : 3 hrs **Marks: 75**

SECTION – A

Answer **ALL** questions. Each question carries 15 marks.

15×4 = 60

1. What is mineral? Describe the physical properties of minerals based on natural light and aggregation.

Or

2. Explain in brief about the structure, chemistry and physical properties of pyroxene group of minerals.

3. Write the composition and constitution of magma

Or

4. What is metamorphism? Write a note on types, grades and zones of metamorphism.

5. What is geological thermometer? Explain various geological thermometers.

Or

6. Explain the migration and entrapment of petroleum deposits of Krishna – Godavari basin.

7. Write a detailed note on the physiographic divisions of seas and oceans.

Or

8. Explain in detail about the mid – oceanic ridge system and various physical processes taking place at MOR systems.

Section B

Each question carries 5 marks

Answer any three of the following **5×3=15**

9. Symmetry elements of a crystal
10. Isomorphism
11. Granularity of Sediments
12. Distinguishing features between 3 types of rocks
13. Sedimentation
14. Turbidity
15. Island Arc

I M. Sc. Geophysics/I Semester (Wef: 2017-18)
Model Question Paper
202: Principles of remote sensing techniques.

Time: 3 hrs Marks: 75

SECTION – A

Answer **ALL** questions. Each question carries 15 marks.

1. Write short notes on
   (a) Electomagnetic radiation and spectrum
   (b) Plank's law
   (c) Wien's displacement law

OR

2. Describe spectral reflectance curves of water, snow, soils, and rocks/minerals

3. Write about satellite orbits. Give details of remote sensing satellite.

OR

4. Describe the principles of microwave remote sensing. Explain the scope of microwave remote sensing in earth sciences.
5. Describe the geometry of thermal images. Write above thermal scanner and thermal properties of objects.

OR

6. Write in detail the scope of hyperspectral remote sensing in earth sciences.

7. Explain in detail the elements of image interpretation. What collateral information is required during the interpretation of satellite imageries?

OR

8. Describe in detail supervised and unsupervised image classification technique highlighting the difference between them.

SECTION-B

Answer any **Three** of the following. Each question carries 5 marks.

9. Advantages and disadvantages of passive microwave remote sensing technique.
10. Heat capacity mapping mission.
11. AVIRIS.
12. Image resolution
13. Classification accuracy assessment.
14. Atmospheric windows and absorption bands.

I M. Sc. Geophysics/I Semester (Wef: 2017-18)
Model Question Paper
203: Seismology

Time: 3 hrs Marks : 75

SECTION – A

Answer **ALL** questions. Each question carries 15 marks.

1. a. Describe elastic, inelastic and plastic behavior of materials and stress and strain matrices.
   b. Write a note on types of seismic waves.

OR

2. Describe how attenuation and dispersion of seismic waves takes place and also explain the energy in seismic disturbance.

3. Define an earthquake. Classify earthquakes.

OR

4. Describe various types of continental margins.

5. Describe principles of vertical and horizontal motion seismometers.

OR

6. Define a seismogram. Explain how analogue and digital recording will be carried out and phases on a seismogram.

7. What are different source parameters of an earthquake and explain how they can be determined.

OR

8. Mechanics of faulting and focal mechanism at active plate margins.

SECTION-B

Answer any **Three** of the following. Each question carries 5 marks.

9. Reservoir induced seismicity.
10. Hotspots and mantle plumes.
11. Secondary effects of an earthquake.
12. Broad band seismometer.
13. Inter relationship between elastic constants.
14. Global seismicity.

I M. Sc. Geophysics/I Semester (Wef: 2017-18)
Model Question Paper
204: Gravity and magnetic methods of exploration

Time: 3 hrs Marks: 75

SECTION – A

Answer **ALL** questions. Each question carries 15 marks.

1. Explain the working principles of static, astatic gravimeters and zero-length spring.

OR

2. Define magnetic susceptibility. Write a note on the factors controlling magnetic susceptibilities of rocks and minerals.

3. What is meant by Bouguer density? Describe Nettleton's density profiling method for its in-situ determination.

OR

4. Define equivalent stratum. Describe upward and downward continuation calculations using continuation integrals.

5. Explain ambiguity in gravity and magnetic interpretation. Give the strategies for resolving ambiguity in gravity and magnetic interpretation.

OR

6. Write down the generalized equations for magnetic anomalies of dykes, sheets and faults describing all the parameters in the equations.

7. Describe automatic gravity modeling of sedimentary basins by Boot's method.

OR

8. Describe how forward modeling of 3D bodies can be carried out using computer models.

SECTION-B

Answer any **Three** of the following. Each question carries 5 marks.

9. Green's theorem
10. Orientation mechanisms in airborne magnetometery
11. Vertical derivative calculations
12. Magnetic equivalence of dykes, faults and anticlines
13. Interpretation of gravity anomalies in frequency domain
14. Role of Gravity method of exploration in salt dome identification.