School of Earth Sciences, SRTM University
Program: M. Sc. Geophysics- Course structure Under Choice Based Credit System (CBCS): Program Code: SES-S-GP-PG (14-2-5-01)
M. Sc. First Year (Semester I) Revised draft to be implemented from 2019-20

S.N	Course	Code	Course title	Credits
1	**Core**	**GP C 101**	Mathematics	**4**
2	**Core**	**GP C 102**	Numerical Methods & Computer Programming	**4**
3	**Core**	**GP C 103**	Physics of the Earth	**4**
4	**Discipline specific Elective (DSE) course for subject/School student (choose any one)**	**GP E 101 GP E 102**	**Basic Geology Earth System Sciences**	**3**
5	**Generic Elective Course (Open Elective) (GEC) to be selected by the School of Earth Sciences student from other Schools in University/MOOCS/SWAYAM/NPTEL/Skill oriented/Other Institutes**			**2**
	Generic Elective Course (Open Elective) (GEC) to be selected by the student from other Schools in University	**GP OE 101**	Earthquakes	

Practical I Semester M.Sc Geophysics

S.N	Course	Code	Course title	Credits
1	**Core**	**GP C 104**	Mathematics	**2**
2	**Core**	**GP C 105**	Numerical Methods & Computer Programming	**2**
3	**Core**	**GP C 106**	Physics of the Earth	**2**
4	**Discipline specific Elective (DSE) course for subject/School student (choose any one)**	**GP OE 104 GP OE 105**	**Basic Geology Earth System Sciences**	**1**
5	**Core**	**GP C 107**	**Seminar/Field Report**	**1**
Total				**25**

GP C 101//PHYC101 Mathematics/

Program: **M.Sc. Geophysics** SES-S-GP-PG (14-2-5-01)
Course: Mathematics/ (**Theory**)**;** Course code: **GP C 101** Core
Instructors: From School of Physical Sciences along with M.Sc Physics Program
Semester: **First Semester (summer session)**
Credits: **4 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **4 hours/week**

Required Basic knowledge of student:

- Must have studied Mathematics courses at his under graduate level

Course objective

- This course objective is to enable the students to gain an understanding of the applications of mathematics to solve the geophysical problems

Outcome:

- At the end of the course the student will get knowledge to apply mathematics in geophysical modeling and inversion and other related aspects. . . .

GP C 101 /PHYC101 Mathematics

Unit I: Vector Spaces and Matrices

Linear dependence and independence of vectors, Inner product, Schmidt's orthogonalization method. Matrices – Inverse, Orthogonal, Hermitian and unitary matrices, Transformation of vectors and matrices, System of linear equations, eigenvalues and eigenvectors of square matrix, diagonalisation of a matrix, rotation matrix.

Unit II: Special functions

i) Legendre equation, Rodrigues formula for Pn(x), generation functions and recurrence relation, Associated Legendre polynomial.
ii) Bessel equation, Bessel function of first kind, generating functions and recurrence relation, Associated Legendre polynomial.
iii) Hermite Equation, generating function and recurrence relation for Hermite polynomial.
iv) Leguerre equation, generating function and recurrence relation, Rodrigue formula, Associated Lagurre polynomials.

Unit III: Fourier Series and Integral Transform

Fourier series: General properties of Fourier series, Simple applications, properties of Fourier series, convergence, integration, differentiation.
Fourier Transform, Laplace Transforms, Properties of Fourier and Laplace transforms (Linearity, first shifting and second shifting property), Fourier sine and cosine transforms, Fourier and Laplace transform of derivatives,
elementary Laplace transform, Inverse Fourier and Laplace transforms, shifting theorm, step function, Solution of simple differential equation using Laplace Transform technique.

Unit IV: Complex function and Calculus of Complex function

Definition of complex function, exponential function and properties, circular function and properties, hyperbolic function and properties, Inverse hyperbolic function, logarithmic function, limit of a complex function, continuity, derivative (theorm), anlytic functions, harmonic functions, complex integration, Cauchy's theorm,
Cauchy's integral formula, Series of complex term-Taylor's series, Laurentz series. Zeros of an analytical function, Singularities of an analytical function (isolated, removable, poles and essential singularity), Residue Theorm-Calculus of residues.

Reference Books:

1. A. W. Joshi, Matrices and Tensors in Physics,
2. Mathematical Physics, B. S. Rajput
3. Higher Engineering Mathematics, By B. S. Grewal.
4. Mathematical Physics, S. L. Kakani.
5. Mathematical Physics, S. Chandra

GP C 104 Related Practical

GP C 102 /PHY C 102 Numerical Methods & Computer Programming

Program: **M.Sc. Geophysics** SES-S-GP-PG (14-2-5-01)
Course: Numerical Methods & Computer Programming / (**Theory**)**;** Course code: **GP C 102 /PHY C 102** Core
Instructors: From School of Physical Sciences along with M.Sc Physics Program
Semester: **First Semester (summer session)**
Credits: **4 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **4 hours/week**

Required Basic knowledge of student:

- Must have studied Mathematics courses at his under graduate level and basic knowledge of computer programming

Course objective

- This course objective is to enable the students to gain an understanding of the Numerical Methods to solve the geophysical problems and to learn the programming skills

Outcome:

- At the end of the course the student will get knowledge of numerical techniques to solve geophysical problems, the student also acquire skills in developing computer programs in geophysical applications. The knowledge acquired in this course will be useful acquire knowledge of geophysics in coming semesters and also after graduation. . . . .

GP C 102 /PHY C 102 Numerical Methods & Computer Programming

Unit I: Curve fitting and interpolation

The Principle of Least squares, fitting a straight line, fitting a parabola, fitting an exponential curve, fitting curve of the form $y=ax^b$, fitting through a polynomial, Cubic spline fitting, Linear interpolation, difference schemes, Newton's forward and backward interpolation formula.

Roots of equation - Polynomial and transcendental equations, limits for the roots of polynomial equation. Bisectional method, false position method, Newton Raphson method, direct substitution method, synthetic division, complex roots.

Unit-II:Numerical integration

Newton cotes formula, trapezoidal rule, Simpson's one third rule, Simpson's three eight rule, Gauss quadratics method, Monte Carlo method: **Solution of differential equation**

Taylor series method, Euler method, Runge Kutta method, predictor-corrector method

Unit-III: Solution of simultaneous equation:

Gaussian elimination method, pivotal condensation method, Gauss-Jordan elimination method, Gauss-Seidal iteration method, Gauss-Jordan matrix inversion method, Gaussian-elimination matrix inversion method ; **Eigen values and eigenvectors of a matrix-** Computation of real eigen values and corresponding eigenvectors of a symmetric matrix, power method and inverse power method. **Partial differential equations-** Difference equation method over a rectangular domain for solving elliptic, parabolic and hyperbolic partial differential equation

Unit-IV:**C- Programming**

Elementary information about digital computer principles, compliers, interpreters, and operating systems, C programming, flow charts, integer and floating point arithmetic, expression, build in functions, executable and non-executable statements, assignment, control and input-output elements, user defined functions, operation with files: pointers, **Random numbers**:

Random numbers, Random walk, method of importance sampling.

Reference books:

1. H. M. Antia: Numerical methods for scientists and engineers.
2. Suresh Chandra Computer Applications in Physics with FORTRAN, BASIC and C, Narosa Publishers
3. Vetterming, Teukolsky, press and Flannery: Numerical recipes.
4. Sastry: Introductory method of numerical analysis.
5. Rajaraman: Numerical analysis.
6. Numerical Computational methods, P. B. Patil and U. P. Verma.
7. Numerical methods and computation – B. K. Bafna.
8. Advanced engineering mathematics – Erwin Kreszing 5^{th} or 7^{th} edition john Willey and sons inc.
9. C Programming : Balgurusamy
10. Suresh Chandra Applications of Numrical Techniques with C Narosa Publishers.

GP C 105/PHY C 102 Related Practical
GP C 103 Physics of the Earth

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course: Physics of the Earth (**Theory**)**;** Course code: GP C 103 Core
Instructor: **Prof. S.K.G. Krishnamacharyulu/Dr. T.Vijay Kumar**, **School of Earth Sciences**
Contact details: email:skgkchary@gmail.com; Mobile: 09403003553, vijay.srtmu@gmail.com
Semester: **First Semester (summer session)**
Credits: **4 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **4 hours/week**

Required Basic knowledge of student:

- Basic knowledge about physics and Earth

Objective:

- This course objective is to introduce the student about the basic physical process, properties in understanding the Erath and its process. This course forms as a foundation course for a student to gain overall understanding of the Geophysics subject and its approach.

Outcome:

- At the end of the course the student will get knowledge of physical concepts and Earth processes. With the knowledge acquired in this course the student gets foundations in understanding the subject in further semesters. . . . . .

GP C 103 Physics of the Earth (4 credits)

Unit I

History of development and scope of geophysics, hypotheses for the origin of solar system, Kepler's law of planetary motion, planet and satellites of the Solar system and their characteristics, Internal constitution of the earth, Characteristics of Crust, Mantle and Core, lithosphere, and asthenosphere,.

Unit II

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

UNIT III

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

UNIT IV

Introduction to seismology, Introduction to earthquake phenomena, concept of focus, focal depth, epicenter, great Indian earthquakes, intensity and magnitude scales and energy of earthquakes, foreshocks and aftershocks, elastic rebound theory, seismicity of India, Himalayas and global seismicity, seismic microzonation, seismic zoning of India,

1. Planet Earth by Press and Siever
2. Fundamentals of Geophysics by Lowrie
3. The Solid Earth by Fowler
4. Introduction to seismology by Peter Shearer
5. Introduction to Geophysics by Howell :
6. Physics and Geology, by Jacobs and Russel
7. Physics of the earth, by Stacey
8. The interior of the earth, by M.H.P. Bott
9. Topics in Geophysics, by P.J. Smith

GP C 106 Related Practical

GP E 101 Basic Geology

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course: **Basic Geology** (**Theory**)**;** Course code: **GP E 101** Elective
Instructor: **Faculty from Geology discipline**
Contact details:
Semester: **First Semester (summer session)**
Credits: **3 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **3 hours/week**

Required Basic knowledge of student:

- Basic knowledge of geography or geology,

Objective:

- This course objective is to introduce the student about the basics of geology which is essential as the geophysics is applications of physics to solve geological processes. At the end of the course the student gains the knowledge of essentials of geology to study geophysics.

Outcome:

- Very essence of geophysics is to apply the physical principles to understand the geological processes. After the course the student gets basic knowledge of geology in tune with the geophysical applications. The knowledge acquired in this course will be useful to acquire knowledge of geophysics and its complete understanding in coming semesters and also after graduation. . . . .

GP E 101 Basic Geology
3 credits

Unit 1:
Introduction to geology, Geology as a fundamental science; branches of geology and relationships with other branches of science, weathering agents, Introduction to geomorphology Folds, faults, unconformities, joints and their classification, Geological time scale , *Earth System:* Lithosphere, Hydrosphere, Cryosphere and Atmosphere and their interactions

Unit 2
Mineralogy : Mineral - its definition and mode of occurrence, physical properties of minerals like form, colour, lustre, streak, cleavage, fracture, hardness and specific gravity, Physical characters and chemical composition of different rock forming minerals.

Unit 3
Petrology : Rock – its definition; classification and distinguishing characteristics of Igneous, Sedimentary and Metamorphic rocks; forms of Igneous rocks, elementary ideas regarding formation; Texture and structure of Igneous, Sedimentary and Metamorphic rocks; Brief petrographic description and occurrences different rocks :

Suggested Books:

1. The Earth: Press and Seiver
2. Blue Planet: Skinner and Porter
3. Physical Geology: Arthur Holmes
4. A Text Book of Geology: P.K. Mukherjee
5. Engineering Geology: Purbin Singh
6. Earth Materials: Klein and Philpotts
7. Principles of Petrology by Tyrrell
8. . Elements of Mineralogy by Read & Rutley's

GP E 104 Related Practical

GP E 102 Earth System Sciences

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course: **Basic Geology** (**Theory**)**;** Course code: **GP E 102** Elective
Instructor: **Faculty from Geology discipline**
Contact details:
Semester: **First Semester (summer session)**
Credits: **3 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **3 hours/week**

Required Basic knowledge of student:

- Basic knowledge of geography or geology, This course is recommended for those who already studied geology in their graduation and are confident about their concepts about geology

Objective:

- This course objective is to introduce the student about the understanding of the Erath System, various components and its interrelation. This helps the student to gain knowledge about the overall interaction and processes of various systems of the Earth...

Outcome:

- At the end of the course the student gains the knowledge of Earth and understanding the interrelation between various spheres the knowledge acquired in this course will be useful to acquire knowledge of geophysics and its complete understanding in coming semesters and also after graduation. . . . .

GP E 102 Earth System Sciences
Detailed syllabus)

Unit 1
Earth as a planet Holistic understanding of dynamic planet 'Earth' through Astronomy, Geology, Meteorology and Oceanography. Introduction to various branches of Earth Sciences. General characteristics and origin of the Universe, Solar System and its planets.
Earth and Planetary system, size, shape, internal structure and composition of the earth; atmosphere and greenhouse effect;;

Unit 2:
Plate Tectonics Concept of plate tectonics, sea-floor spreading and continental drift Geodynamic elements of Earth- Mid Oceanic Ridges, trenches, transform faults and island arcs Origin of oceans, continents, mountains and rift valleys Earthquake and earthquake belts Volcanoes- types, products and their distribution.

Unit 3:
Lithosphere, Hydrosphere and Atmosphere, Internal structure of the Earth, isostasy; elements of seismology; physical properties of the interior of the earth; continents and continental processes Introduction to Earth and formation theories. Seismicity and earth's interior.Compositional and Rheological divisions of Earth; crust, mantle and core; discontinuities. Earth's magnetic field, paleomagnetism, continental drift, plate tectonics.

Suggested books

1. The Earth: Press and Seiver
2. Blue Planet: Skinner and Porter
3. Physical Geology: Arthur Holmes
4. A Text Book of Geology: P.K. Mukherjee
5. Earth Materials: Klein and Philpotts
6. Holmes' principles of physical geology. Taylor & Francis. By Duff, P. M. D., & Duff, D. (Eds.).
7. Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press. by . Emiliani, C
8. Oceanography: A view of the earth by Gross, M. G.

School of Earth Sciences, SRTM University
Program: M. Sc. Geophysics- Course structure Under Choice Based Credit System (CBCS): Program Code: SES-S-GP-PG (14-2-5-01)
M. Sc. First Year (Semester II) Revised draft to be implemented from 2019-20

S.N	Course	Code	Course title	Credits
1	**Core**	**GP C 201**	Gravity Method	**4**
2	**Core**	**GP C 202**	Signal processing	**4**
3	**Core**	**GP C 203**	Electrical Methods	**4**
4	**Discipline specific Elective (DSE) course for subject/School student (choose any one)**	**GP E 201** **GP E 202**	**Applied Geology** **Geo dynamics**	**3**
5	**Generic Elective Course (Open Elective) (GEC) to be selected by the School of Earth Sciences student from other Schools in University/MOOCS/SWAYAM/ NPTEL/Skill oriented/Other Institutes**			**2**
	Generic Elective Course (Open Elective) (GEC) to be selected by the student from other Schools in University	**GP OE 201**	**Basics of Geophysics**	

Practical II Semester M.Sc Geophysics

S.N	Course	Code	Course title	Credits
1	**Core**	**GP C 204**	Gravity Method	**2**
2	**Core**	**GP C 205**	Signal processing	**2**
3	**Core**	**GP C 206**	Electrical Methods	**2**
4	**Discipline specific Elective (DSE) course for subject/School student (choose any one)**	**GP E 204** **GP E 205**	**Applied Geology** **Geo dynamics**	**1**
5	**Core**	**GP C207**	**Seminar/Field Report**	**1**
Total				**25**

GP C 201 Gravity Method

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course: **Gravity Method (Theory);** Course code: GP C **201** Core
Instructor: **Prof. S.K.G. Krishnamacharyulu/Any other guest faculty**, **School of Earth Sciences**
Contact details: **email:skgkchary@gmail.com; Mobile: 09403003553**
Semester: **Second Semester (winter session)**
Credits: **4 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **4 hours/week**

Required Basic knowledge of student:

- Basic Physical concepts of gravitational field of the Earth

Objective:

- This course is intended to discuss about the gravitational field of the Earth and its applications in Geophysics. . Density variations of Erath materials, gravity method concepts, instrumentation, data acquisition, data processing, data analysis and data interpretation of gravity data and its applications. .

Outcome:

- At the end of the course the student get knowledge about gravitational field and its applications. The student will be in a position to use gravitational methods in the geoexploration, resource evaluation, figure of the Earth and geological mapping. . .

GP C 201 Gravity Method

Unit -1

Earth's Gravity Field, principle and Characteristics, Properties of Newtonian potential, Laplace's and Poisons'' equations, Green's theorem, Gauss law - Rock densities and factors affecting density, density measurement techniques of the samples, concept of gravity anomaly, gravity prospecting instruments, zero length spring, Worden & Lacoste gravimeters, Absolute gravimeters.

Unit II

Gravity units, concept of geod and spheroid, gravity base, collection of gravity data, drift correction, reduction of gravity, Bouguer gravity anomalies, airborne and ship borne gravimetry, Isostacy.

Plan of gravity surveys, presentation of gravity data, Concept of noise, regional and residual anomalies, methods of calculation, upward and downward continuation, derivative calculations, Fourier transformations and Harmonic analysis. Ambiguity in gravity

Unit III

Interpretation of gravity data- qualitative interpretation, identification of two and three dimensional bodies, structural features, quantitative interpretation, conventional methods of interpretation techniques- thumb rules and methods of characteristic curves, gravity anomalies of geophysical models- point mass, line mass, discs, cylinders, sheets, faults, slabs, irregular shaped bodies.

Unit IV

Computer based techniques- Forward modeling and inversion – principles of inversion- computer aided interpretation of gravity anomalies of different regular, irregular shaped bodies, sedimentary basins. Application of gravity in mineral and oil exploration, geological mapping, groundwater and geotechnical engineering – some case studies. Mass estimation in gravity.

Books:

1. Gravity and Magnetic methods by Rao B.S.R and Murthy I.V.R
2. Gravity and Magnetic interpretation in Exploration Geophysics by I.V.R. Murthy
3. Applied geophysics by W.W. Telford
4. Introduction to Geophysical prospecting by M.B. Dobrin
5. An Introduction to Geophysical Exploration by Philip Kearey , Michael Brooks and Ian Hill
6. Fundamentals of Geophysics by Willium Lowrie

Related Practical GP C 204 Gravity Method

GP C 202 Signal processing

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course: Signal processing, (**Theory**)**;** Course code: GP C **202**Core
Instructor: Dr. T. Vijay Kumar, School **of Earth Sciences**
Contact details: **email: vijay.srtmu@gmail.com; Mobile: 08087912034**
Semester: **Second Semester (winter session)**
Credits: **4 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **4 hours/week**

Required Basic knowledge of student:

- Basic Physical concepts of gravitational field, Acoustic wave propagation, magnetic field , electrical and electromagnetic field of the Earth

Objective:

The objective of this course is that students learn how to reconstruct continuous signals from sampled ones, filtering techniques, discrete Fourier transforms in the analysis and processing of digital signals...

Outcome:

- At the end of the course the student will get knowledge for geophysical data processing of both continuous and discrete data. After completing the course the student will get knowledge in the data processing of gravity, magnetic and seismic signals, which the student will be dealing in further semesters. The students become adept at using discrete Fourier transforms in the analysis and processing of digital signals.

GP C 202 **Signal processing (4 credits)**

Unit I

Introduction, definition of signal and noise, types of signals, Analog and Digital signals, Sampling theorem Digitization of geophysical data. Nyquist frequency and Aliasing. Errors of digitization.

Unit II

Fourier series, Gibbs phenomenon, fourier transforms, time and frequency domain, fourier transforms and some important functions – rectangular, periodic, exponential, singularity, Spectral analysis, FFT.

Unit III

Time series analysis, correlation, convolution, impulse response and transfer function, Z-transform Hilbert transform, wavelets. Waveform processing, power spectrum, Wiener-Khintchin theorem.

Unit IV

Windowing,Filtering techniques – design - digital and frequency filters; Amplitude and phase responses of filters, low pass, hipass and band pass filters, butter worth filters, recursive and non recursive filters, Wiener filters, Deconvolution and predictive deconvolution. Generalised linear inverse method.

Books:

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. Clarebout, 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.

Related Practical GP C 205 Signal Processing

GP C 203 Electrical Methods

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course: **Electrical Methods (Theory);** Course code: GP C **203** Core
Instructor: **Prof. S.K.G. Krishnamacharyulu/Any other guest faculty**, **School of Earth Sciences**
Contact details: **email:skgkchary@gmail.com; Mobile: 09403003553**
Semester: **Second Semester (winter session)**
Credits: **4 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **4 hours/week**

Required Basic knowledge of student:

- Basic Physical concepts of Electricity,

Objective:

- This course is intended to impart knowledge about the various electrical properties of Erath materials, methods developed based on the electrical properties, instrumentation, data acquisition, data processing, data analysis and data interpretation of electrical data and its applications. .

Outcome:

- At the end of the course the student gets knowledge about Electrical methods and its applications. The student will be in a position to use Electrical methods in the geoexploration, resource evaluation, figure of the Earth and geological mapping. . .

GP C 203 Electrical Methods

Unit -I

Electrical fields in geophysics, Principles and classification of Electrical methods of prospecting, current and potentials, electrical properties of the rocks, current flow in ground, Electric conduction in rocks, factors affecting electrical conduction in rocks, isotropy, anisotropy, principles of equivalence, Dar Zarrouk parameters- Longitudinal conductance and transverse resistance.

Unit II

Self potential (SP) – origin, measurement, field technique, SP anomalies over different models, interpretation of SP anomalies. Applications of SP method.

Resistivity methods – concept of resistance and resistivity. Concept of true and apparent resistivity. Apparent resistivity for multi layer Earth and super position.

Unit III

Different Electrode arrays – Wenner, Schlumberger, Dipole-diploe – Geometric factor. Vertical Electrical Sounding (VES), Horizontal Profiling techniques. Field procedures.

Types of VES curves- Interpretation-Curve matching, partial curve matching techniques- direct and indirect methods of interpretation – resistivity transform functions.

Resistivity profiling over fault, vertical contacts, buried 2-d and 3-D bodies, estimation of overburden thickness. Application of resistivity methods in various applications like groundwater, mineral, geotechnical and geological mapping.

Unit IV

Induced polarization (IP) method: Basic concepts, source of IP. Over voltage and Induced polarization. Membrane polarization and electrode polarization. IP measurements- Time domain measurements – Chargeability and delay time. Frequency domain measurements – percentage frequency effect (PFE), metal conduction factor. Relation between time and frequency domain IP measurements. Field procedures – collection and presentation of data – pseudo section plotting – complex resistivity. Magnetic Induced Polarization (MIP) method. Applications of IP in exploration and geological applications.

Books:

- Applied geophysics by W.W. Telford
- Introduction to Geophysical prospecting by M.B. Dobrin
- An Introduction to Geophysical Exploration by Philip Kearey , Michael Brooks and Ian Hill
- Applied Geophysics, Telford, et. al., revised edition
- Electrical methods of Geophysical Prospecting, Keller and Frischknecht
- Mining Geophysics, Parasnis
- Outline of Geophysical Prospecting, M.B. Ramchandra Rao.
- Field Geophysics , John Milsom

Related Practical GP C 206 Electrical Methods

GP E 201 Applied Geology

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course **Applied Geology** (**Theory**)**;** Course code: **GP E 201** Elective
Instructor: **Faculty from Geology discipline**
Contact details:
Semester: **Second Semester (winter session)**
Credits: **3 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **3 hours/week**

Required Basic knowledge of student:

- Basic knowledge of geology, of undergraduate course are must have studied Basic geology/ Earth System Studies course at first semester in this school

Objective:

- This course objective is to introduce the student about the geology which is essential as the geophysics is applications of physics to solve geological processes. At the end of the course the student gains the knowledge of essentials of geology and relevant geological inputs to study geophysics.

Outcome:

- After the course the student gets basic knowledge of geology in tune with the geophysical applications. The knowledge acquired in this course will be useful to gain skills in geophysics and its complete understanding in coming semesters and also after graduation. . . . .

GP E 201 Applied Geology

Unit I:

Petrology: Different kinds of rocks – igneous, sedimentary and metamorphic rocks - their physical properties and its variations, factors affecting the physical properties of different rocks

Folds: Nomenclature of folds, Types of folds, origin of folds, identification of folds in the field

Unit II:

Structural geology - Faults, folds and joints: Nomenclature, types, mechanisms, identification in the fields. of Faults, Types of Faults, Fault Mechanism, Identification of Faults in the field. Geological structures and associated physical processes.

Unit III:

Geotectonics: Convection currents, Plate, types of plates, plate boundaries, causes of plate movement, Rifting of continent, Subduction zone, island arcs, mid oceanic ridges, Hot Spot, Formation of Deccan Shield, Collision and its types,

Suggested Books:

1. Fundamentals of Structural Geology: Pollard & Fletcher
2. Foundations of Structural Geology: R. G. Park
3. Structural Geology: Marland Pratt Billings
4. The Techniques of Modern Structural Geology: John G. Ramsay
5. Introduction to the Structure of the Earth: Edgar Winston Spencer
6. Flow Processes in Faults and Shear Zones: G. Ian Alsop
7. Plate Tectonics: Continental Drift and Mountain Building: Wolfgang Frisch, Martin MesChede, Ronald C. Blakey
8. Plate Tectonics: Kent. C. Condie
9. Plate Tectonics: A. Cox and R.B. Hart
10. Mantle convection: Plate Tectonics and Global Dynamics: W.R. Peltier
11. When Did Plate Tectonics Begin on Planet Earth: Kent. C. Condie and Victoria Pease

Related Practical GP E 204 Applied Geology

GP E 202 Geo dynamics

Program: **M.Sc. Geophysics: Code** SES-S-GP-PG (14-2-5-01)
Course **Geodynamics** (**Theory**)**;** Course code: **GP E 202** Elective
Instructor: **Faculty from Geology discipline**
Contact details:
Semester: **Second Semester (winter session)**
Credits: **3 credits;** Course duration: **One semester (15 weeks of 6 day week)**
Teaching hours: **3 hours/week**

Required Basic knowledge of student:

- Basic knowledge of geology, of undergraduate course are must have studied Basic geology/ Earth System Studies course at first semester in this school

Objective:

- This course objective is to introduce the student about the dynamic processes associated with the Erath. The objective is to teach both exogenic and endogenic processes in relation to the understanding of geophysics...

Outcome:

- After the course the student gets basic knowledge of dynamic processes of the Earth in tune with the geophysical applications. The knowledge acquired in this course will be useful to gain skills in geophysics and its complete understanding in coming semesters and also after graduation. . . . .

GP E 202 Geo dynamics

Unit 1

Geology and geodynamics, Lithosphere, hydrosphere and atmosphere, endogenic and exogenic forces, Internal constitution of the earth, Crust, mantle and core, characteristics of lithosphere and asthenosphere, causes of geodynamical process, geodynamic models

Unit 2:

Rock forming minerals, Classification of rock formations, rock cycle and geodynamic processes, Geological action of agents like water and wind, weathering, soil formation, atmosphere and climatic changes, Geomagnetism, paleomagentism

Unit 3

continental drift, ocean floor spreading, plate tectonics and its geological implications, new global tectonics and plate margin process, geomagnetic time scale, Benioff zones, oceanic ridges, evolution of the triple junction, trenches and island arcs, hot (20) spots, geodynamics of Indian subcontinents and formation of Himalayas, 900 E ridge, concept of isostasy, Airy, Heiskanan and Pratt-Hayford hypotheses

Suggested books

1. Fundamentals of Structural Geology: Pollard & Fletcher
2. Introduction to the Structure of the Earth: Edgar Winston Spencer
3. Flow Processes in Faults and Shear Zones: G. Ian Alsop
4. Plate Tectonics: Continental Drift and Mountain Building: Wolfgang Frisch, Martin MesChede, Ronald C. Blakey
5. Plate Tectonics: Kent. C. Condie
6. Mantle convection: Plate Tectonics and Global Dynamics: W.R. Peltier
7. When Did Plate Tectonics Begin on Planet Earth: Kent. C. Condie and Victoria Pease
8. Geomagnetism by Jacob
9. The Earth: Press and Seiver
10. Blue Planet: Skinner and Porter
11. Physical Geology: Arthur Holmes
12. A Text Book of Geology: P.K. Mukherjee
13. Oceanography: A view of the earth by Gross, M. G.