

M.Sc. GEOLOGY
(CBS) (FIVE YEAR INTEGRATED PROGRAMME) (2017-2018)
REGULATIONS AND SYLLABUS
REGULATIONS

Eligibility

Candidates for admission to the First year of the Five year Integrated M.Sc., Geology degree programme shall be required to have passed in higher Secondary Course examinations (HSC) or equivalent thereto under academic stream in any science group.

Master Programme

A Master's programme consists of a set of Core courses and Common courses on languages, Computer application, Civics, Health & Environment and Soft skill.

Core courses are basic courses required for each programme. The number and distribution of credits for core courses will be decided by the respective faculties.

Common courses suggested by the respective departments may be distributed in the first four semesters.

A course is divided into five units to enable the students to achieve modular and progressive learning.

Semesters

An Academic year is divided into two semesters, Odd semester and Even semester. The normal semester periods are:

Odd semester: July to November (90 working days)

Even semester: December to April (90 working days)

Credit

The term credit is used to describe the quantum of syllabus for various programmes in terms of hours of study. It indicates differential weightage given according to the contents and duration of the courses in the curriculum design.

The minimum credit requirement for a Five year Integrated Master's Programme shall be 225.

The core courses shall carry 161 credits, Common courses shall carry 6 credits, Allied courses shall carry 22 credits, Language courses shall carry 24 credits and the optional courses shall carry 12 credits.

Courses

A course carrying one credit for lectures, will have instruction of one hour per week during the semester, if four hours of lecture is necessary in each week for that course then 4 credits will be the weightage. Thus normally, in each of the courses, credits will be assigned on the basis of the lecture tutorials/laboratory work and other form of learning in a 15 week schedule:

- i) One credit for each lecture hour per week.
- ii) One credit for every two or three hours of laboratory or practical work per week as per the requirement of department concerned.

Grading System

The term Grading System indicates a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

Duration

The duration for completion of a Five year Integrated Master's Programme in any subject is Ten semesters.

Structure and Programme

The Five year Integrated Master's Programme will consist of:

- i) Core courses and Common courses which are compulsory for all students.
- ii) Optional courses which students can choose amongst the courses offered by the Departments of Science faculty, Department itself and by the Departments of other faculties. (Arts, Education and Indian Language)

Attendance

Every teaching faculty handling a course shall be responsible for the maintenance of attendance register for candidates who have registered for the course.

Each student should earn 80% attendance in the courses of the particular semester failing which he or she will not be permitted to sit for the End-semester examination.

Examinations

The internal assessment for each theory course carries 25% marks and practical course 40% of marks which is based on two internal assessment tests with assessment tools such as seminar and assignment. The pattern of question paper will be decided by the respective faculty. The tests are compulsory.

For internal assessment evaluation, the break-up marks shall be as follows:

THEORY	MARKS	PRACTICAL	MARKS
Test-I	10	Test at the end of semester	30
Test-II	10		
Assignment	5	Record	10
Total	25	Total	40

There will be one End Semester Examination (75% marks) of 3 hours duration for each Theory course and an End semester examination (60%) to each Practical courses. The pattern of question paper will be decided by the respective faculty.

Evaluation

The performance of a student in each course is evaluated in terms of Percentage of Marks (PM) with a provision for conversion to Grade Point (GP). The sum total performance in each semester will be rated by GPA while the continuous performance in Core, Allied and Optional courses will be marked by (CGPA).

Marks and Grading

The student cannot repeat the internal assessment test I and internal assessment test II. However, if for any compulsive reason, the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

A student has to secure 50% minimum in the End Semester Examination.

The student who has not secured minimum of 50% of marks (Internal assessment mark plus End semester examination) in a course shall be deemed to have failed in that course.

A candidate who has secured a minimum of 50% marks in all the courses prescribed in the programme and earned a minimum of 225 credits will be considered to have passed the Masters Programme.

Grading

A ten point rating scale is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Programme.

Marks	Grade Point	Letter Grade	Class
90 +	10	S	Exemplary

85-89	9.0	D ⁺⁺	Distinction
80-84	8.5	D ⁺	”
75-79	8.0	D	”
70-74	7.5	A ⁺⁺	First Class
65-69	7.0	A ⁺	”
60-64	6.5	A	”
55-59	6.0	B	Second Class
50-54	5.5	C	”
49 or Less		F	Fail

Grade cards will be issued to the students, after the declaration of results. The grade card will contain the list of courses registered during the semester, the grades scored and the Grade Point Average for the semester.

GPA is the sum of the products of the number of credits of courses with the grade point scored in that programme, taken over all the courses for the semester divided by the sum of the number of credits for all courses taken in that semester. CGPA is similarly calculated considering the Core, Allied and Optional courses taken from first semester to tenth semester.

The results of the final semester will be withheld until the student obtains passing grade in all the courses of all earlier semesters.

DEGREE WILL BE AWARDED AS FOLLOWS:

Those who complete successfully all the TEN – Semester Examinations will be issued both M.Sc., degree in Geology.

For First class with Distinction the student must earn 225 credits Passes all the courses in the first attempt and obtain a CGPA of 8.00 or above in Part-III Core, Allied and Optional courses from first to ten Semesters.

For the First class the student must earn 225 credits, Pass all the courses and obtain a CGPA of 6.50 or above in Part-III Core, Allied and Optional courses from first to ten semesters.

RANKING OF CANDIDTES

The candidates who are Eligible to get the M.Sc degree in first class with distinction will be ranked on the basis of CGPA scored in Part-III Core, Allied and Optional courses of study from first semester to tenth semester.

The candidates passing with First class will be ranked next to those with distinction on the basis of CGPA scored in Part-III Core, Allied and Optional courses of study from first semester to tenth semester.

Candidates who obtain First class with distinction shall be deemed to have passed the examinations provided he / she passes all the courses prescribed for the programme at the First Appearance.

R13. TRANSITORY REGULATIONS

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three times consecutively after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent programmes, as per the new syllabi, on the recommendations of the Head of the Department concerned.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the programmes of study and the syllabi from time to time.

SCHEME OF SYLLABUS

SEMESTER – I

Course code	Theory & Practical	L	P	C
ITAC 11	Language- I Tamil / Hindi/French	3		3
IENC 12	Language- II English	3		3
ICEC 13	Civics, Environmental awareness & Health	3		3
IGYT 14	Physical & Dynamic Geology	5		5
CHEA	Ancillary I Chemistry-I (Compulsory)	5		5
	Total	19		19

SEMESTER – II

Course code	Theory & Practical	L	P	C
ITAC 21	Language- I Tamil / Hindi/French	3		3
IENC 22	Language- II English	3		3
ICAC 23	Computer Application	3		3
IGYT 24	General Geology	5		5
CHEA	Ancillary- I Chemistry –II	5		5
CHEAP	Practical – I Chemistry Practical		8	3
	Total	19	8	22

SEMESTER – III

Course code	Theory & Practical	L	P	C
ITAC 31	Language- I Tamil / Hindi/French	3		3
IENC 32	Language- II English	3		3
IGYT 33	Physics of the earth (Dept. of Physics)	5		5
IGYT 34	Paleontology and Micropalaeontology	5		5
PHA-I	Ancillary - II Physics-I	5		5
IGYP 35	Practical –II Paleontology and Micropaleontology		10	4
	Total	21	10	25

Field visit to various Paleontological significant areas

SEMESTER – IV

Course code	Theory & Practical	L	P	C
ITAC 41	Language- I Tamil / Hindi/French	3		3
IENC 42	Language- II English	3		3
IGYT 43	Mineralogy and crystallography	5		5
PHA-II	Ancillary- II Physics –II	5		5
IGYP 44	Practical - III Mineralogy & Crystallography		11	5
PHA	Practical - IV Physics		8	3
	Total	16	19	24

Field visit to various structural & Mineralogical features

SEMESTER – V

Course code	Theory & Practical	L	P	C
IGYT 51	Igneous Petrology	5		5
IGYT 52	Industrial Minerals and Mineral Economics	5		5
IGYT 53	Field Geology	5		5
IGYP 54	Practical – V Igneous Petrology and Industrial Minerals		11	5
	Total	15	11	20

SEMESTER – VI

Course code	Theory & Practical	L	P	C
IGYT 61	Global Tectonics	5		5
IGYT 62	Aerial photography, Cartography and GPS	5		5
IGYT 63	Metamorphic and Sedimentary Petrology	5		5
IGYT 64	Mineral Beneficiation	5		5
IGYP 65	Practical – VI Metamorphic, Sedimentary petrology, Aerial Photography and Mineral Beneficiation		11	5
	Total	20	11	25

TOTAL CREDITS UPTO VI TH SEMESTER = 135

Semester-VII

Course code	Theory & Practical	L	P	C
IGYT 71	Geomorphology and Structural Geology	4		4
IGYT 72	Advanced Crystallography, Mineralogy and Mineral Optics	4		4
IGYT 73	Indian Stratigraphy and Marine Geology	4		4
	Soft Skills	4		4
IGYP 74	Practical – VII Structural geology, Crystallography and Field reports		10	4
	Total	16	10	20

Geological Mapping training - two week's duration
Semester- VIII

Course code	Theory & Practical	L	P	C
IGYT 81	Geophysical Exploration	4		4
IGYT 82	Remote Sensing and GIS	4		4
IGYT 83	Hydrogeology and Engineering Geology	4		4
IGYP 84	Practical – VIII Mineralogy, Mineral Optics		10	4
IGYP 85	Practical –IX. Remote Sensing, Digital Image processing and GIS		10	4
IGYP86	Practical- X Geophysics, Hydrogeology, Engineering Geology and Survey		10	4
	Optional - I Statistics Applications	4		4
	Total	16	30	28

Industrial/ institutional training –Three/four week's duration.
Semester- IX

Course code	Theory & Practical	L	P	C
IGYT 91	Economic Geology and Mining Geology	4		4
IGYT 92	Geological and Geochemical Exploration	4		4
IGYT 93	Advanced Petrology	4		4
IGYO 94	Optional –II Environmental Geology and Disaster management (Internal)	4		4
IGYP 95	Practical – XI Economic Geology and Geochemistry		10	4
	Total	16	10	20

Short Field visits to nearby geologically interesting places during week end & holidays
Semester-X

Course code	Theory & Practical	L	P	C
IGYT 101	Coal and Petroleum Geology	4		4
IGYT 102	Atmospheric sciences and Meteorology	4		4
IGYP 103	Practical X Petrology and Petrochemistry		10	4
IGYP 104	Dissertations and Viva –Voce		6	2
IGYO 105.1 105.2	Optional III Isotope Geology and Nuclear Geology (internal) (OR) Instrumentation Techniques in geosciences (Internal)	4		4
IGYO 106.1 106.2	Optional – IV Medical Geology (OR) Application of Software in Geosciences	4		4
	Total	16	16	22

OVERALL TOTAL CREDIRTS = 225 (CORE 149: OPTIONAL =16: SOFT SKILL =4 ANCILLARY =26: LANGUGE= 24: COMPUTER APPLICATION = 3: CIVICS, ENVIRONMENTAL AWARENESS & HEALTH =3).

SEMESTER – I

ICEC 13 CIVICS, ENVIRONMENTAL AWARENESS & HEALTH SCIENCES

(A) CIVICS

UNIT – I: Democracy – citizenship – duties of Good Citizen – Society, State and Citizen – Limits of State Activity. Indian Constitution: Preamble – Basic Features – Citizenship – Fundamental Rights – Fundamental Duties.

Unit II: Union Government: President – Prime Minister – Parliament – Supreme Court – Electoral System – State Government: Governor – Chief Minister – Center-State Relations.

Local Government: Urban Administrative System – Panchayat Raj System.

Books Recommended

- B.L. Fadia, 1999, Indian Government and Politics, Agra, Sahitya Bhawan Publication.
- S.R.Maheswari, 1996, Local Government in India, Agra, Lakshmi Narain Agarwal.
- R.C. Agarwal, 2000, Indian Political System, New Delhi, S.Chand & Company.
- James H. McCrocklin, 1961, Building Citizenship, USA Allyn and Bacon, INC.,.

(B) ENVIRONMENTAL SCIENCES

Unit – I: Fundamental Concepts and Principles – Structure and Function – Classification – Modern concept of Ecosystem – Energy flow – Ecological Indicators.

Unit – II: Definition – Natural Resources – Classification – Conservation – Development of Public water supply – Need for protected water supply – Per capita consumption – Sanitation – Sewerage system – Disposal of sewage – kinds of pollution – Their effects of human beings.

References

- Odum, E.P, 1971, Fundamental Ecology, 3rd edition, Saunders.
- Colvinvaux. P. 1986, Ecology. John Wiley & Sons.
- Agarwal & Rana. S.V.S. Environment & Natural Resources, Society of Biosciences.
- Duggal, K.N. A 1985, Text Book on Public Health Engineering – S.Chand & Co. Ram Nagar. New Delhi.

(C) HEALTH SCIENCES

UNIT – I: Physical Health – Introduction to health – Food, meaning of balanced diet. Sources, Common nutritional deficiencies and prevention. Personal Health – Cleanliness of body. Care of Skin, Nails, Eye, Hair, Oral Health and Clothing. Body posture and good habits such as exercises – Importance of avoiding smoking, alcoholism, drugs etc. Population explosion and family planning – Importance, Common Methods of family planning for Men & Women. Mothers and Children – Immunization of Children

(importance, Schedule) care of mothers during pregnancy and after delivery.
Communicable Diseases – Symptoms and prevention.

UNIT – II:

1. Mental Health – Factors for maintenance of good mental health. (i) Adolescent problems. (ii) First Aid.
2. Environment – Ventilation, Lighting, Simple methods of Worm infestation (round worm, hook worm).

Books for study and reference

- Murray Grant, 1987, Hand Book of Community Health, Philadelphia: Lea & Febiger publications.
- Lawrence B.Chenoweth, et al., 1934, Community Hygiene New York: F.S.Croft's & Co.,
- Charles Fredric Boldman, et al., 1936, Public Health and Hygiene, Philadelphia: W.B Saunders Company.
- Harold S.Diehl, 1945, Text Book of Healthful Living, New York: Mc Graw – Hill Book Company.

IGYT-14 PHYSICAL & DYNAMIC GEOLOGY

Objective: To know about the basic principles of Geology, Composition of the earth, Age of the earth, Earth's various exodynamic processes like weathering and action of geological agents and endodynamic processes like earthquake, volcanoes and tectonic process.

UNIT-I:Solar system – outer and inner planets. Earth as a member of the solar system and its relation to other planets – Size and Density of the Earth. Origin of the Earth – Nebular, Planetesimal, Tidal and Dust cloud hypotheses; their merits and demerits.

UNIT-II: Relief features-classification of relief feature into I, II and III orders. Mountains and mountain chains-Classification of mountains-origin of tectonic mountains; contraction theory, continental drift theory. Age of the Earth. Interior of the earth – structure and constituents.

UNIT-III: Continental drift – concept and evidences – Theories for the drift (Taylor & Wegner) sea floor spreading – definition and evidences. The concept of plate tectonics: a brief account on lithospheric plates, plate boundaries and mechanism of plate motion.

UNIT-IV:Volcanoes – types of volcanic eruption – central vent and fissure types; dormant and extinct volcanoes. Types of volcanic cones; classification of volcanoes based on the nature of volcanic activity; Products of volcanoes – distribution and causes of volcanism.

UNIT-V: Earthquakes–Definition– Seismic waves, definition of Focus, Epicenter and isoseismic lines. Seismograph and seismogram – Time, distance graphs – effects and causes

of earth quakes – Richter’s scale of earthquake–Mercalli’s intensity scale–Distribution of earthquake.

Books for study and reference

- Arthur Holmes, 1992, Principles of Physical Geology, Edited by Duff.P.Mcl.D.4th Ed. Chapman and Hall, London.
- Don Leet & Sheldon Judson, 1960, Physical Geology, Prentice Hall & Co.
- Gorshkov,G & A.Yakushova,A, A, A,1967, Physical Geology, Mir publishers, Moscow
- Miller, 1949, An Introduction to Physical Geology, East West Press Ltd.
- Spencer, E.V, 1962, Basic concepts of physical Geology, Oxford & IBH,New Delhi
- Wyllie, P.J, 1971, The Dynamic Earth, John Wiley and Sons.
- Mahapatra G.B, 2002, A Text Book of Geology, CBS publishers & Distributors.
- S.M. Mathur, 2000, Elements of Geology, CBS publishers & Distributors
- P.S. Saklani, 2006, Tectonic Geology, Satish serial publishing.
- G. Singh, 2009, Earth Science Today, Discovery publishing Pvt, Ltd.

SEMESTER – II

ICAC- 23 COMPUTER APPLICATIONS

UNIT-I: Introduction- Types of computers- Characteristics of computers - classification of digital computer systems: Introduction- Microcomputers- Minicomputers- Mainframes- Supercomputers- Network computers - anatomy of a digital computer: Functions and components of a computer- Central processing unit (CPU) – Memory - computer architecture: Introduction- The first electronic computers- The peripheral Devices- Memory cache – Number system: Introduction- Decimal number system- Binary number system- Octal number system- ASCII code memory units: Introduction- RAM- ROM- PROM- EPROM-EEPROM- Flash memory - auxiliary storage device: Introduction- Magnetic tape- Winchester disk- Hard disk- Floppy Disk- Zip disk- Jaz disk- Super disk- Optical disk- CD-ROM- Magneto-optical (MO) drives - input devices: Keyboard- Mouse- Scanners - output devices: Introduction- Monitor- Classification of monitors-Based on color- Printer- Plotter.

UNIT-II: Introduction- Operating systems- Utilities- - Word processors- Spreadsheets- Presentation Graphics- Database management systems(DBMS)- Image processors-operating systems: Introduction- Functions of an operating system- Classification of operating systems -programming languages: Introduction- Machine languages- Assembly languages- High level languages- Types of high-level languages- Compilers and interpreters- The compilation Process-data processing: Introduction- Data versus information- File processing- Database

processing-computer networks: Introduction- Overview of a network- Communication processors- Communications media- Telecommunication software- Types of networks- Network topologies- Network protocols- Network Architecture.

UNIT-III: Managing files in office- text tools- word- editing text- documenting format – styles and templates- tables and columns – mail merge, labels and envelopes Databases: Databases in access – defining and developing tables – creating queries – forms and reports – building a database application

UNIT-IV: Excel – Formatting worksheets and restricting data – calculating with formulae and functions – charts and pivot tables. Presentations: Power point- creating and editing slides- adding graphics, multimedia and special effects in slides. Showing the power point presentations.

UNIT-V: Introduction- Internet axis- Internet basic- Internet addressing- WWW- Web browsing- Searching the web- ELECTRONIC MAIL: Introduction- Use E-mail?- E-mail-names & addresses- Mailing basics- E mail-advantages & disadvantages- Mailing lists- Newsgroups- ELECTRONIC COMMERCE: Introduction- Business-to- business E-commerce- The virtual shop- MULTIMEDIA TOOLS: Introduction- Paint and draw applications- Graphic effects and techniques- Sound and music- Video- Multimedia authoring tools. APPLICATIONS OF COMPUTERS in: Business and Industry, Home-Education and Training - Entertainment, Science, Medicine and Engineering

Books for study and reference

- Alexis Leon and Mathews Leon, 1999, “FUNDAMENTALS OF INFORMATION TECHNOLOGY” Leon Tech World Publications..
- Kettell, Hart, Davils, Simmons, Hill “Microsoft office 2003 – The complete Reference”, Tata McGraw Hill.
- Steinmetz and Nahrstedt “Multimedia: Computing, Communications & Applications”, Innovative Technology series, Pearson Education, 2000.
- Margaret Levine Young, 1999, “INTERNET MILLENNIUM EDITION” Tata McGraw Hill,
- Alexis Leon & Mathews Leon, “THE INTERNET IN A NUT SHELL” Leon Press, Chennai & Vikas Publishing House, New Delhi, 2000.
- Tay Vaughan, ”MULTIMEDIA MAKING IT WORKS”, Osborne Tata McGraw Hill, 1996.
- Krishnan, “COMPUTER FUNDAMENTALS AND WINDOWS WITH INTERNET” technology, SCITECH PUBLICATIONS (INDIA) PVT LTD, 2000

IGYT-24 GENERAL GEOLOGY

Objective: To gain knowledge in different aspects of geomorphology viz. theoretical geomorphology (geomorphic concepts, theories of landscape development, plate tectonics,

morphometry etc.), geological geomorphology (rocks, earth's movement, structural geomorphology), weathering, transportation and deposition by different agents. To learn about the application of geomorphic features and types of soils and landforms.

UNIT-I: Definition of geomorphic agent, gradation, degradation and aggradation. Weathering – definition of processes, climatic influences and products. Mass wasting - slow flowage types and rapid flowage types.

UNIT-II: Geological work and landforms produced by wind. Groundwater-Water table, Springs -Hot springs and Geysers. Geological work and land forms produced by groundwater in limestone terrains, Karst topography.

UNIT-III: Running water; Geological work and landforms produced. Base level of erosion –rapids, cascades and water falls. Drainage patterns - river capture, river meandering, stream rejuvenation, river terraces, entrenched meanders, braided streams. Lakes - origin and classification of lakes with Indian examples.

UNIT-IV: Definitions, origin of glacial ice-types of glaciers and their movement. Geological action and landforms produced by Glaciers. A brief outline on causes of glaciations.

UNIT-V: Marine erosion, deposition and resulting landforms- Sand bars, spit, berm, shingles, sea caves, sea cliff, sea arch and pillars. Definition of submarine canyons and its origin. Coral reefs-types and origin.

Books for study and reference

- Bloom, A.L, 1999, Hand book of Geomorphology, Prentice Hall of India
- Fairbridge, R.W, 1968, Encyclopdia of Geomorphology, Reinhold Book Corporation
- King, L.C 1967, Morphology of the Earth, 2nd Ed. Oliver & Boyd, London
- Leopold L.S. et.al., 1969, Fluvial processes in Geomorphology, Eurasia Publishing House, New Delhi
- Loback, A.K, 1974, Origin of Landforms, Oxford University Press
- Phillip G.Worchester, 1964, Geomorphology, D.Van Nostrand . Co., New York
- Sharma H.S, 1991, Indian Geomorphology, concept Publ. Co., New Delhi.
- Thornbury, W.S, 1969, Principles of Geomorphology, Wiley Eastern, New Delhi
- Thornbury.W.S, 2004, Principles of Geomorphology, CBS publishers
- Dayal. P, A, 1996, Text book of geomorphology, Shukla Book Department, Patna
- Ashutosh Gautam, 2008, Earth quake – A natural Disaster, APH Publishing Corporation

SEMESTER – III

IAGT-33 PHYSICS OF THE EARTH

Objective : To under stand the physical structure and behavior of the earth as well as geomagnetic and Palaeomagnetic properties of rocks in the Earth's crust.

UNIT- I:The earth and the solar system. Important physical parameters and properties of the planet earth, stress and strain, wave and motion, seismic waves. Travel time tables and velocity-depth curves, variations of density within the earth.

UNIT –II: Rotation of the earth, gravitational attraction, gravitational theory, measurements of gravity, gravity meters. Principles and method of measuring gravity, gravity anomalies, local and regional variations.

UNIT-III: Temperature in the primitive earth and the earth's surface and interior. Thermal conductivity. Generation of heat in the Earth. Heat flow measurements, methods and results.

UNIT-IV: Elastic constants and elastic process in the earth. Earth's free notation. Latitude variation. Tides of the Solid earth. Numerical values of Love's numbers. Rigidity of the Earth. Bulk modulus in the earth. Poisson's ratio in the Earth, Young's modulus and Lamé's constant.

UNIT-V: Geomagnetism and palaeomagnetism, earth's magnetic field. Origin-theory of earth's magnetic field. Magneto hydrodynamics of the Earth. Magnetic reversals. Polar wandering. Tectonic movements and its relation to palaeomagnetism. Measurement of magnetic properties of rocks. .

Books Recommended

- Alan Cox, 1973, Geomagnetic reversals and Plate tectonics, Freeman and company.
- Cook , A.H.1973, Physics of the Earth and planets, Macmillan,
- Eve, A.S. & Keys, D.A., (1954) Applied Geophysics, Cambridge University.
- Fowler, C.M.R. (1990)., The Solid Earth: An introduction to Global geo physics, Cambridge University press.
- Gutenberg, 1959. Physics of the Earth's Interior, International Geophysics series, Vol.1Academic press.
- Jacobs, J.A. Russel, R.D. and Wilson, J.T.1974, Physics and Geology, International student edition. Wyllie, P.J., 1971, The Dynamic Earth, John Wiley and Sons

IGYT-34 PALAEOONTOLOGY and MICROPALAEOONTOLOGY

Objective: To know about the general outline of the vertebrate, invertebrate and plant fossils, their mode of preservation, classification and characters of various important phyla, morphology, distribution and geological range. Significances on environmental reconstruction, petroleum and coal industries.

UNIT-I: Definition of Palaeontology; General classification of Animal kingdom; Habitats and Habits of animals. Nature and mode of preservation of fossils: Unaltered hard parts, altered hard parts, petrification, permineralisation, carbonization, recrystallization,

silification. Geological Time Scale. Index fossil. Uses of fossils, discussion on importance of fossil in stratigraphic record.

UNIT-II: General morphology, classification, geological history and environmental significance of the following with examples: Phylum- Mollusca - Classes - Pelecypoda, Gastropoda and Cephalopoda; Phylum - Brachiopoda.

UNIT-III: General morphology, classification, geological history and environmental significance of the following with examples: Phylum- Echinodermata; Phylum-Coelenterata-Class-Anthozoa (Corals). Phylum - Hemichordata- Class- Graptoloidea.

UNIT-IV: General morphology, classification, geological history and environmental significance of the following with examples: Phylum-Arthropoda- Class- Trilobita; Classification of Plant kingdom; General morphology, classification, geological history and environmental significance of the following: Glossopteris, Gangamopteris, Ptilophyllum, Lepidodendron, Calamites, Sigillaria and Phyllothea.

UNIT-V: Introduction, Micropaleontological classification, sampling methods and sample processing techniques. Bathymetric distribution of microfossils. Morphological characters and palaeoecology of Foraminifera, Radiolarians, Diatoms and flagellates. Palynofossils: General morphology. Spores and pollens and their geological significance. Application of Micropaleontology in geological and petroleum exploration.

Books for study and reference

- W.W. Berry, 2003, An Introduction to Paleontology, Sonali publications
- Robert R. Shrock and William H., Twenhofel, 1953, Principles of Invertebrate Paleontology Mc Graw-Hill Book Co
- H.Woods, 1961, Invertebrate Paleontology, Cambridge University press
- R.C.Moore, C.G., Lalicker and A.G. Fisher, 1952. Invertebrate Fossils, Mc Graw Hill Book Co
- Alfred S.Romer, 1963, Vertebrate Paleontology, University of Chicago press
- B.U.Haq and A.Boerma, 1978, Introduction to Marine Micropaleontology, Elsevier Publishing Company
- M.D., Brasier, 1980, Microfossils, George Allen & Unwin, London
- G.Bigot, 1985, Elements of micropaleontology, Graham & Trotman, London
- H.H.Swinerton, 1961, Outlines of Paleontology, Edward Arnold Publisher Reference Books
- Derek V.Ager, 1963, Principles of Paleocology, Mc Graw Hill Book Co
- Benton, M.J. 1990, Vertebrate Paleontology, John Wiley
- Unwin Hyman, , 1971, Vertebrate Paleozoology, John Wiley
- J.P.Kennet and M.S.Srinivasan; 1951, Forminifera, W.H.Freeman & Co
- Jones, 1989,Introduction to Microfossils

- P.C. Jain and M.S. Anantharaman, 1989, An introduction to paleontology, Vishal Publication, Delhi
- David.M. Raup, Steven. M. Stanley, 2004, Principles of Palaeobotany, 2nd Ed, CBS publications.
- K.N. Prasad, 1999, An Introduction to palaeobotany, APH Publications Corporation
- Kennet, J.P and Srinivasan; M.S, (1951). Foraminifera, W.H.Freeman & Co.,
- Bigot, G, (1985), Elements of micropaleontology, Grahm & Trotman, London.

PRACTICAL – II

IGYP 35- PALAEOLOGY & MICROPALAEOLOGY

Objectives: Mathematical interpretation of various structures and determination thickness of Identification of important macro fossils and micro fossils under binocular microscope, separation techniques and their environmental significance.

PALAEOLOGY:

Identification and description of the following fossils:

1. **Brachiopoda:** Lingula, Orthis, Productus, Pentamerus, Rhynoconella, Terebratula, Atrypa, Spirifer and Athyris. Ceras
2. **Mollusca: Pelecypoda** - Arca, Glycimeris (Pectenculus) Inoceramus, Ostrea, Alectryonia, Pecten, Spondylus, Trigonia, Pholadomya, Cardita, Hippurites, Cardium, Meretrix, Gryphaea, Exogyra.
3. **Gastropoda:-** Nautica, Turbo, Turritella, Hamites, Baculites
4. **Cephalopoda:** Natilus, Goniatites, Ceratities, Ammonite, Phylloceras, Acanthoceras, Scaphites, Turrilites, Belemnites
5. **Arthropoda:Trilobita;** Para doxides, Olinus, Ollenellus, Calymene, Phacops
6. **Echinodermata :Crinoids;** Encrinus, Marsupites
7. **Blastoidea:** Pentremites
8. **Echinoidea:** Cidaris, Hemicidaris, Holaster, Hemiaster, Micraster.
9. **Hemichordate:graptoloidea;** Tetragraptus, didymograptus, Phyllograptus, Diplograptus, Monograptus, Rastites
10. **Plant fossils:** Calamites, Sphenophyllum, lepidodendron, Sigillaria, Glossopteris, Gangamopteris, Ptilophyllum

MICROPALAEOLOGY:

Identification and morphological characteristic of Benthic and Planktonic foraminifera and to determine their paeleo-environmental significance

SEMESTER – IV

IAGT-43 MINERALOGY and CRYSTALLOGRAPHY

Objectives: To know about the nature, forms, habit, symmetry elements, measurement of interfacial angles and twins in crystals. The classification of crystals into system and classes. To learn about the physical and optical properties of rock forming minerals. It deals about

the structure, physical and chemical properties of ortho, ring, sheet, chain and framework silicates

UNIT-I: Definition and scope – general characteristics of minerals – Classification of minerals- physical properties of minerals and their determination. Definition and examples of the following: Isomorphism, Dimorphism, Polymorphism, Isodimorphism, Paramorphism, Pseudomorphism-Molecular and empirical formulae of minerals.

UNIT-II: Physical and optical properties, chemical composition and mode of occurrence of the minerals of the Silica group, Feldspars, Feldspathoids, Mica, Zeolite, Scapolite, Wollastonite and Rhodonite.

UNIT-III: Physical and optical properties, chemical composition and mode of occurrence of the following minerals-Pyroxenes, Amphiboles, Garnets, Olivine, Epidote, Beryl, Apatite, Cordierite, Staurolite, Tourmaline, Topaz, Zircon, Sphene, Chlorite, Serpentine, Andalusite, Kyanite, Sillimanite, Talc, Kaolin, Fluorite, Calcite, Dolomite, Magnesite and Rutile.

UNIT-IV: Definition and scope of Crystallography, Crystalline and amorphous form and nature of crystals -Pseudomorphism. Weiss and Millerian system of crystal notation. Measurement of interfacial angles.

UNIT-V: Symmetries and classes of systems. Isometric, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic

Holohedral forms, Hemihedrism, Tetratohedrism. Hemimorphic forms. Enantiomorphism. Crystal growth, Irregularities in crystals. Twins: Simple and contact twins, Interpenetration twins, polysynthetic twin. Twin laws.

Books for study and reference

- W.A.Deer, R.A.Howie and J.Zussman, 1966, An introduction to the rock forming minerals, Longmans
- Alexander N.Winchell, 1968, Elements of Optical mineralogy, Parts I and II, Wiley Eastern (P) Ltd
- Ernest, E.Walhstrom, 1960, Optical crystallography, John Wiley & Sons
- E.S.Dana, 1935, A Text Book of, Mineralogy, John Wiley & Sons
- L.G.Berry Mason, 1961, .Mineralogy, W.H.Freeman & Co.
- Kerr, B.F., 1995, Optical Mineralogy 5th Ed. Mc Graw Hill, New York
- S.Mitra, 1994, Fundamentals of optical spectroscopic and X-ray mineralogy, available at S.R.Technico Book House, Ashok Raj Path, Patna
- Dana, E.S, 1985, A Text book of Mineralogy (Revised Edt.), Wiley Eastern Ltd.
- Read, H.H, 1962, Rutley's Elements of Mineralogy, Murby and Co.
- Smith, H.G, 1957, Minerals and microscopes, Allied publishers PVT. Ltd.
- Winchel, A.M., 1958, Optical Mineralogy, Part 1&2, John Wiley.
- Philips R.Wm and Griffen D.T, 1986, Optical mineralogy, CBS publishers.

- Donald Bloss, F, 1961, Optical crystallography- Holt Rinehart and Winston, New York.
- Berr.L.G, 2004, Mineralogy: concepts, Description & Determination, CBS publications.

PRACTICAL – III

IGYP 45-MINERALOGY & CRYSTALLOGRAPHY

OBJECTIVE: Aim to do exercises on mineralogy and Crystallography.

MINERALOGY:

Megascopic identification and description of the following minerals in hand specimen:

Quartz and its macro crystalline varieties; Milky, Amethyst, Rose quartz, Smoky quartz. *Cryptocrystalline varieties:* Chalcedony, Blood stone, Agate, Flint, Chert, Jasper, Tiger eye. *Opal:* wood and milky Varieties.

Feldspar Group: Sanidine, Microcline, Amazon stone, Orthoclase, Moonstone, Perthite. **Plagioclase feldspars** – Albite, Oligoclase, Labradorite.

Feldspathoid Group: Leucite, Nepheline, Sodalite

Pyroxene Group: Enstatite, Bronite, Hypersthene, Diopside, Augite, Spodumene.

Pyroxenoid Group: Rhodonite and Wollastonite

Amphibole group: Anthophyllite, Tremolite, Actinolite, Hornblende, Glaucophane and Riebeckite.

Garnet Group: Almandine, Pyrope, Andradite

Aluminum Silicate Group: Andalusite, Sillimanite, Kyanite.

Clay Mineral: Kaolin; **Mica Group:** Biotite Muscovite

Other minerals: Beryl, Cordierite, Zoisite, Epidote, Olivine, Zircon, Titanite, Apophyllite, Talc, Staurolite, Topaz and Tourmaline

Microscopic identification and description of the following minerals in thin section:

Quartz Varieties

Feldspar: Orthoclase, Microcline, Albite, Oligoclase, Andesine, Labradorite, Bytownite, Anorthite

CRYSTALLOGRAPHY:

Morphological study of the crystal models representing the following minerals:

1. **Isometric system;** Normal Class: Galena, Garnet, Gold, Fluorite, Copper, Magnetite
Pyritohedral Class: Pyrite;
2. **Tetrahedral Class:** Tetrahedrite, Sphalerite, Boracite. Plagihedral Class: Cuprite;
Tetragonal System: Normal Class: Zircon, Rutile, Vesuvianite, Cassiterite, Apophyllite; Tripyramidal Class: Scheelite, Scapolites; Pyramidal-Hemimorphic Class: Wulfenite; Sphenoidal Class: Chalcocopyrite ; Trapezohedral Class: Nickel Sulphate
3. **Hexagonal System:** Normal Class: Zincite; Hemimorphic Class: Zincite; Tripyramidal Class: Apatite; Hexagonal Trapezohedral Class: Quartz, Rhombohedral Class: Calcite, Haematite, Corundum; Rhombohedral-Hemimorphic Class: Tourmaline; Trirhomboidal Class: Dioptase, Phenacite; TrigonalTrapezohedral Class: Quartz
4. **Orthorhombic system**-Normal class: Barite, Sulphur, Olivine, Topaz, Staurolite, Hypersthene; Hemimorphic Class: Calamine, Sphenoidal Class: Epsomite

5. **Monoclinic System**; Normal Class: Gypsum, Augite, Hornblende, Epidote, Orthoclase
6. **Triclinic system**; Normal class: Axinite, Albite, Anorthite, Rhodonite.

Twin Crystal of the minerals: Spinel, Fluorite, Pyrite, Rutile, Calcite, Staurolite, Aragonite, Calamine, Gypsum, Orthoclase, Augite, Hornblende, and Albite

SEMESTER -V **IGYT-51 IGNEOUS PETROLOGY**

Objective: Understanding the origin and nature of igneous rocks. To understand the forms, structures and textures of the intrusive nature of the igneous rocks, Crystallization, classification and petrogenesis of igneous rocks.

UNIT I: Nature and scope of Petrology – The Earth shells and the chemical composition of the Earth. General classification of the rocks into and a comparative study of the characteristics of Igneous, Sedimentary and Metamorphic rocks. Magma – composition and constitution of magma; Primary magma. Forms of Igneous rocks, extrusive forms – lava flows and pyroclastic deposits, intrusive forms – concordant and discordant forms.

UNIT II: Structure and texture of igneous rocks. Structures – vesicular, amygdaloidal, block lava, ropy lava, pillow structure, flow structure, sheet joints, mural joints and columnar joints, rift and grain. Textures – definition, elements of texture, kinds of textures – equigranular, inequigranular, directive, intergrowth, reaction, xenolithic and others.

UNIT III: Principles and parameters in the classification of igneous rocks – megascopic classification, Shands saturation principles. Outlines of classification of C.I.P.W, Zirkel – Rosanbusch, Johannsen and Tabular Classification of Tyrrell.

UNIT IV: Petrographic characteristics of Granite, Granodiorite, Syenite, Diorite, Gabbro, and their Hypabyssal and Volcanic equivalents. Petrographic characters and brief account of origin of Pegmatites and Aplites, Lamprophyres, Alkaline rocks, Ultrabasic rocks and Anorthosites.

UNIT V: Silicate systems and igneous petrogenesis; Crystallization of Unicomponent magma, Binary magma with simple eutectic (Diopside – Anorthite system), with solid solution (Albite-Anorthite system) and with incongruent melting (MgO – SiO₂ system). Bowen's reaction principle and its bearing on igneous petrogenesis. Diversity of igneous rocks in space and time – evidences and theories of differentiation. Assimilation. Elementary treatment of variation diagrams and petrographic provinces.

Books Recommended

- Anthony Hall, 1987, Igneous petrology, ELBS Publishers,
- Barth, T.F.W.1962, Theoretical petrology, John & Wiley and sons. Principles of petrology, G.W.Tyrell, ., 1989, Methuen and Co (Students ed.)
- Best.M.G. 1986, Igneous petrology, CBS.
- Bose,M.K.1997, Igneous petrology, World press
- Bowen, N.L. 1956, The evolution of Igneous rocks – Dover publications.
- Daniel, S.Barkar , 1983, Igneous rocks, Prentice Hall, Englewood Cliffs, New Jersey 07632.
- Donald W.Hyndman, 1968, Petrology of Igneous and Metamorphic rocks, McGraw Hill Book Co.,
- Edwin Roedder, 1986, Fluid inclusions.
- Hatch F.H. Wells A.K.& Wells M.K.1949 Petrology of Igneous rocks Thomas Murby
- Hess, H.H. and Poldervaart, A. 1967, Basalts, Vols I and II, Ed., Interscience pub.
- Huang W.T.1962 – Petrography McGraw Hill.
- Johannsen, A 1962 – Descriptive Petrology of Igneous rocks, Vol.I to IV, Allied Pacific.
- Mehnert, K.R. 1968, Migmatites and the origin of granitic rocks, , Elsevier Pub. Co.,
- Moorhouse, W.W. 1969, The study of rocks in thin sections, Harper and sons,
- Nockolds, S.R. Knox, R.W.O B. Chinner, G.A.1979, Petrology for students, , Cambridge University press.
- Paul C.Hess, 1989, Origin of Igneous rocks, Harvard University press, Cambridge, London, England,
- Philipotts,A.(1992) Igneous and Metamorphic petrology, Prentice Hall.
- Ranguin, E., 1966, Geology of Granites, Interscience Publishers.
- Shand, S.H.J. (1990) Eruptive Rocks, John Wiley & Sons.
- Turner, F.J. & Verhoogen, J. 1960, Igneous and Metamorphic petrology, McGraw Hill Book Co
- Tyrrell.G.W. (1970) – The Principles of Petrology, Methuen & Co.
- Wahlstrom , E.E., 1961, Theoretical Igneous petrology, John Wiley & Sons
- Wernst G.Ehlers, and Harvey Blatt, 1987 Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers & Distributors, New Delhi.
- Williams, H. Turner, F.J. and Ghilbert, C.M., 1954, Petrography W.H.Freeman and Co.

IGYT-52 INDUSTRIAL MINERALS AND MINERAL ECONOMICS

Objective: To learn about geology of the non metallic minerals and their industrial applications, distribution & mode of occurrences. To gain knowledge about the mines legislation of India, National mineral policy, and their role in National economy.

UNIT I: Introduction to Geology of Industrial minerals and rocks. Identification of minerals: Physical properties of minerals. Mineral wealth of Tamil Nadu. Mineral based Industries in India. Mode of occurrence and origin of the raw materials of the following Industries: Refractory and abrasives.

UNIT II: Study of the following economic minerals of India such as ceramic materials, construction materials-cement raw materials, mineral pigments, asbestos, mica and fullers earth- their mode of occurrence, distribution in India, and origin. Mineral fertilizers: Geology, source, uses, Production and distribution of potash, nitrates, phosphates, gypsum, lime, sulphur, and minor fertilizer minerals.

UNIT III: Industrial properties of rocks: Building stones, decorative stones: Granite Industry: Granites, black Granites (Dolerites) their mode of occurrence, origin and distribution. Cement Industry: Limestone, gypsum: origin and distribution in Tamil Nadu. Gem Industries: Gem varieties. Clay mineralogy: Physico-chemical and structural properties of clay minerals.

UNIT IV: Mineral economics and its concepts. Classification and mineral resources. Peculiarities inherent in mineral Industry. National mineral Policy and conservation of mineral resources. Mines and Mineral legislation in India, Mining laws in various lands, Law of Seabed for marine mineral resources, Mineral taxation.

UNIT V: Strategic, critical and essential minerals, present and future mineral supplies of World. India's mineral production, Consumption, export and import details and their role in National economy. Tenor, grade and specification of important minerals with relevant to domestic examples.

Books Recommended

- Aiyengar, N.K.N.1964, Minerals of Madras, Dept. of Industries and Commerce, Madras,
- Alan M.Bateman , 1961, Economic mineral deposits, Asia Publishing House, Mining Geology, H.E. Mc Kinstry, Asia publishing house, 1960.

- Coggin Brown, J. & Dey, A.K.1955, India's Mineral Wealth, Oxford University Press,
- Deb, S., 1980, Industrial minerals and Rocks of India, Allied Publishers Pvt. Ltd.
- Evans, A.M. (1993) Ore Geology and industrial minerals, Blackwell.
- Gkhale, K.V.G.K. and Rao, T.G.1972, Ore deposits of India, Thompson press Ltd., Delhi – 6, Indias Krishnaswamy, S.1972, Mineral Resources, , Oxford and IBH Publishing Co.,
- Lindgren, W. 1933, Mineral deposits, Mc Graw Hill Book Co.,
- Minerals for Atomic Energy, Robert, D.Nininger,D.van Nostrand Co., 1955.
- Ralph, B.Grim, 1953, Clay Mineralogy, , Mc Graw Hill Book, Co.,
- Sinha, R.K and Sharma , B.N.L., 1973, Mineral Economics, , Oxford and IBH Publishing Co

IGYT-53 FIELD GEOLOGY

Objective: The paper aims to understand the field essentials like understating a map, the basic equipments, traversing and field markings

UNIT- I:Previous Literature and Maps, Destruction of Rocks, Physiography, Topographic Expressions and Relief, Inliers and Outliers, Soils and Vegetation, Requirements for the Field, Some Field Suggestions and Precautions.

UNIT-II:Basic equipment, Additional requirements, Supplementary supplies, Special requirements, Optional, For mapping on aerial Photographs. Geological Hammers, Pocket and Hand Lenses, Hydrochloric Acid, Streak Plate, Pocket Knife, Measuring Tapes and Scales, Haversack or Rucksack, Mohs scale of Hardness, Cold Chisel, Protractors, Pocket Calculator, Cameras, Care and Upkeep of Instruments.

UNIT-III: The Compass and Its Uses, Dip of the Compass Needle, Magnetic Declination, Clinometer, Bearing and Reading Directions, Measuring Attitudes, Handling of the Compass, Finding Direction without a Compass.

UNIT- IV:Base Maps, Scale of Maps, Direction of Relief, Latitudes and Longitudes, Map Grids Measurement of the Map Areas, Mounding and Folding of Field Maps, Marking on Maps.

UNIT-V:The Notebook, Notes, Checklist for Notes, Writing Materials, Field Sketches and Drawings, Field Photographs. Trimming of Hand Specimens, Fossil Specimens, Mineral Specimens, Samples and Samplings, Numbering and Labelling of Specimens, Packing and Storage.

BOOKS FOR REFERENCE

- Davis, G.R. 1984, Structural Geology of Rocks and Region, John Wiley

- H.W. Fairborn, 1949, Structural petrology of deformed rocks, John Wiley and sons
- John Suppe 1985, Principles of Structural Geology, prentice Hall publications
- Price N.J., and Cosgrove, J.W. 1990. Analysis of Geological structures, Cambridge Univ. Press
- Ramsay, J.G. and Huber, M.I., 1987, Modern structural Geology Vol, I and II Academic press
- Robert R. Compton, 1962, Manual of field geology, John Wiley and sons.

PRACTICAL-V

IGYP 54 -IGNEOUS PETROLOGY AND INDUSTRIAL MINERALS

Objectives: To develop skill and abilities in the identification of igneous rocks with their texture, mineralogy, genesis both in hand specimen and thin sections. To interpret petrochemical data to understand the petrochemistry and petrogenesis of igneous rocks. To learn about the kinds, textures and structures. To know about different metallic ores, genesis, and their distribution. To know the techniques of ore microscopic studies and identification of industrial minerals and its application. To know the non metallic minerals and their industrial applications, distribution, occurrence.

Megascopic identification and description of the following rocks in hand specimen:

Mica Granite, Hornblende Granite, Pyroxene Granite, Tourmaline Granite, Schorl Rock, Graphic Granite, Pegmatite, Aplite, Mica Syenite, Hornblende Syenite, Pyroxene Syenite, Nepheline Syenite, Diorite, Gabbro, Norite, Dunite, Pyroxenite, Peridotite, Anorthosite, Dolerite, Dolerite Porphyry, Rhyolite, Trachyte, Andesite, Felsites, Basalt, Obsidian Pitchstone, Pumice, Volcanic Tuff, Volcanic breccias, Vitrophyre. Important sedimentary rocks.

Microscopic identification and description of the following rocks in thin section:

Acid igneous rocks: varieties of granites and Rhyolites, Pegmatite- Aplite, and Rhyodacite, Granodiorite and Dacite.

Industrial Minerals: Identification of important minerals used for various industrial purposes, their origin and occurrence.

SEMESTER VI

IGYT 61 GLOBAL TECTONICS

Objectives: To understand the concepts of tectonics, different plates, mechanism of plate movements and various theories of plate tectonics. To know about the sea floor spreading and polar wandering.

UNIT-I: Orogeny and epiorogeny. Theories of mountain building and its relation to tectonism. Isostasy movements and theories. Plate tectonics and Cenozoic mountain building. Theories of palaeomagnetism-Ice ages and their periodicity

UNIT-II: Plate boundaries: definition, types, role of rotation of plates. Mechanism of movement of plates. Mantle convections . Physiography, gravity, seismic and magnetic anomaly patterns in plate boundaries.

UNIT-III: Convergent and divergent plate. Transform Faults and transcurrent faults. Triple junction, Benioff zones. Mineralization, rock assemblages in plate boundaries, ophiolite suite.

UNIT-IV: Configuration of Indian plate-mobile belts in Peninsular India. Evolution of the Himalayas and Himalayan tectonics. Continental drift. Rift valleys and their characteristics and origin.

UNIT-V: Continents and ocean basins-their permanence and evolution.Rethinking of earth history. Mid-oceanic ridges. Evidences of plate tectonics and Polar wandering.

Books Recommended

- B.F.Windley, 1978. The Evolving continents, , John Wiley & sons, Allen Cox, 1973, Plate Tectonics, Freeman and company, Plate tectonics, Lee Pichon & others.
- Badgley, P.C.1960, Structural and Tectonics in principles, , Harper international students Reprint, Belossov, V.V. 1962, Basic problems in geotectonics,.Mc Graw Hill,.
- Jeanm Goguel, W.H 1962, Tectonics. Freeman & Co.,
- Moores,E and Twiss,R.J. (1995) Tectonics, FreemanKeary.P. and Vine,F.J. (1990) Global Tectonics. Blackwell.
- Park, R.C.1988, lackies Geological Structures and moving plates, Chapman and Hall, New York
- Summerfield,M.A.(2000) Geomorphology and Global tectonics.
- Valdiya,K.S. 1998, Dynamic Himalaya, University press, Hyderabad.
- Wyllie, P.J.1971, The Dynamic Earth, John Wiley and Sons, Jacobs, J.A. Russel, R.D. and Wilson., J.T.Physics and Geology 1959, International Series in the Earth Sciences, Mc Graw Hill Book Co.,

IGYT 62 AERIAL PHOTOGRAPHY, CARTOGRAPHY AND GPS

Objectives: To know about the application of Remote sensing and photogeology in the interpretation of physiography, lithology and structures. To gain knowledge in application of Geology in Engineering practices such as construction of dams, tunnels, and bridges and in Hydrogeology, lineament, drainage pattern, surface water bodies etc.

Unit – I : Introduction to Cartography: Definitions, terms, concepts, types, history, applications, conventional cartography v/s digital cartography. Map : Types of map, map

scale, classes of maps. Map projection : fundamentals and types; Base Maps & Thematic Maps; Map Legend, Symbols & Border Information; label placement.

Unit – II : Aerial Photography: History - Types Based On Camera Axis, Altitude, Film. Lens and angle of Coverage. Scale of Photographs: Definition – Derivation - Determination of Scale in Vertical Photo over Flat and Variable Terrain, Average Photo Scale, Scale in Tilted Photographs – Scale Distortions due to Lens, Flying height, relief, tilt, pitch, yaw, roll.

Unit – III: Camera System: Parts of Simple Camera - Aerial Cameras – Camera Calibration Lens System - Distortions and Abberations - Spectral Sensitivity of Aerial Cameras - Films - Photographic Resolution - Radiometric Characters of Aerial Photographs. Stereomodels: Monoscopic Observation - Stereoscopy - Psuedoscopy - Base Height Ratio - Stereomodel Observation – Height Measurement using Monoscopic and Stereoscopic Methods

Unit IV: Photo Mosaics: Photo Indexing - Photo Mosaicing - Uncontrolled, Semi Controlled and Controlled - Orthophotography, Analog digital techniques, Flight Planning, Concepts of Map Projection Stereoscopic Plotting Instruments and Map Making: Stereo Plotters, Map Compilation Stereo Plotters - Automated Stereo Plotting instruments- Principles and Utility.

Unit V: Introduction to GPS: Definition, concept, GPS working principle, history and timeline, overview. Technical Description and GPS Observables: System Segmentation – Space segment; control segment, user segment- types of receivers ; GPS satellite signals, GPS data, position and time from GPS, code phase tracking, GPS positioning types –absolute positioning, differential positioning; Factors that affect GPS - number of satellites, multipath, ionosphere, troposphere, satellite geometry, satellite health, signal strength, distance from the reference receiver, DGPS and kinematic method, kinematic method. Real time DGPS.

Reference Books

1. Robinson, A.H. [1983], Elements of Cartography, John Wiley and Sons, New York.
2. Misra, R.P. and Ramesh, A. Fundamentals of Cartography, Prasaranga, Manasagangotri, Mysore,
3. Sarkar, A,K. Practical Geography - A Systmetic Approach, Orient Longman, Calcutta.
4. Singh, R.L. and Dutt, D.K. [1979]. Elements of Practical Geography, Kalyani Pub., New Delhi.
5. Khan, Z.A, [1998]. Text Book of Practical Geography Concept, New Delhi.
6. Monkhouse, F.J. and Wilkinson, K.H.R (1994). Maps and Diagrams. Methuum, London.

7. Streets, J.A. [1994]. Map Projections University of London Press.
8. Pandey, S.N. [1957]. Principles of Application of Photogeology, Wiley Eastern New Delhi.
9. Curran, P. (1985). Principles of Remote sensing, Longman, London.
10. Lillisand, T M and P W Kiefer, 119861 Remote Sensing and Image Interpretation, John Wiley & Sons, New York
11. Sabins, F.F. Ju., [2978]. Remote Sensing Principles and Interpretation, Freeman, Sanfrancisco.
12. Rey, R.G., [1969]. Ariel Photographs in Geological Interpretation USGS. Proc. Pap 373.
13. Drury, S.A., (1987). Image Interpretation in Geology: Allen & Unwin.
14. GPS satellite surveying : Alfred Leick, 2007, John Wiley & Sons, New York.

IGYT 63 METAMORPHIC AND SEDIMENTARY PETROLOGY

Objective: Understanding the origin and nature of sedimentary and metamorphic rocks.

Aims to study about sediments, sedimentation processes at various environments.

UNIT-I: Definition, agents and kinds of metamorphism – facies, grades and zones of metamorphism – metamorphic textures and structures – migmatites – A short account on Anatexis and Palingenesis – Cataclastic metamorphism and its products – Thermal metamorphism and its products – Thermal metamorphism of limestone.

UNIT-II: Dynamo thermal metamorphism and its products – Plutonic metamorphism and its products – Metasomatism and metasomatic process – Pneumatolytic metamorphism – Injection metamorphism and Auto metamorphism. Petrographic description of the following rock types– quartzite, slate, schist, gneiss, marble, hornfels and charnockite.

UNIT-III: Sedimentary process – disintegration and decomposition of rocks, transportation, deposition and diagenesis. A broad outline of classification of sedimentary rocks into residual, mechanical, chemical and organic groups. Clastic and non clastic textures of sedimentary rocks. Mechanical, chemical and organic structures of sedimentary rocks.

UNIT-IV: Residual deposits – clay, laterite, terrarossa and soils, their mode of formation. Characteristics of important types of Clastic deposits – Rudaceous, Arenaceous and Argilaceous groups, their classification, mineral composition and texture. Descriptive study of Conglomerate, Breccias, Sandstone and Shale.

UNIT-V: Chemical deposits of siliceous, calcareous, ferruginous organic and salt deposits. Organic deposits of calcareous, siliceous, phosphatic, ferruginous and carbonaceous origin. A brief study of flint, chert, siderite, gypsum, rock salt, caliche and guano.

Books for study and reference

- Alan Spry, 1976 Metamorphic textures-, Pergamon press
- Barker, A.J. 1989., Introduction to metamorphic textures and microstructures, Chapman and Hill, Ernest gy, Igneous, Sedimentary and MetamorphicG.Ehlers, and Harvey Blatt Petrolo rocks, CBS Publishers & Distributors, New Delhi.
- Bhaskar Rao, 1986, Metamorphic petrology, International Book House, Second Ed. 12, U.B. Bangalow Road, Delhi-110 007.
- Butcher,K. and Frey,M. (1994) Petrogenesis of metamorphic rocks, Springer Verlag.
- F.J.Pettijohn; Sedimentary Rocks, , Harper and Row Publication
- G.W.Tyrell; The principles of petrology — C.G.S. publishers and Distributors, Delhi.
- H.G.F. Winkler Petrogenesis of Metamorphic Rocks — Narosa Publishing House, New Delhi.
- H.William, F.J. Turner and C.M. Gillbert, Petrography — Freeman and Company.
- Harker; Petrology for students, Cambridge University Press
- Kretz,R.1994 Metamorphic crystallization, John Wiley.
- L.V. Pirsson and A.Knopf; Rocks and Rock minerals — John Wiley & Sons, New York.
- Mehnert, K.R., 1968, Migmatites and the origin of granitic rocks, Elsevier Pub. Co.
- Moorhouse, W.W. 1969.,The study of rocks in thin sections, Harper and sons,
- Myron G Best; Igneous and Metamorphic Petrology, , C.B.S Publication
- Origin of Sedimentary rocks, H.Blatt, Prentice Hall Publication
- Greensmith; Petrology of the sedimentary rocks , C.B.S Publishers and Distributors, Delhi.
- Roger Mason, 1984, Petrology of the Metamorphic rocks, CBS Pub. & Distributors.
- S.R.Nockolds, R.W.O.B. Knox and G.A.Chinner; Petrology for students — Cambridge University Press.
- Turner, F.J. & Verhoogen, J.1960. Igneous and Metamorphic petrology, Mc Graw Hill Book Co.,
- Turner,F.J. 1980, Metamorphic petrology, Mc Graw Hill,
- Tyrell, G.W.1989, Principles of petrology, , Methuren and Co., (Students ed.)
- Vernon , R.H.1976, Metamorphic process.. George Allen and Unwin ltd
- W.T.Huang, Petrology — McGraw Hill Book Company.
- Williams, H. Turner, F.J. and Ghilbert, C.M.1954, Petrography W.H.Freeman and Co.,
- Winkler, H.G.S.1979, Petrogenesis of Metamorphic rocks, , Springer Verlag Vth ed.
- Yardley, BN.W. 1989, An introduction to Metamorphic petrology. Longman, New york.

IAGT 64 MINERAL BENEFICIATION (Department of Chemical Engineering)

Objectives: To know the various methods of beneficiation of ore minerals. To become familiar about the methods of grinding, crushing, and separation of minerals.

UNIT-I:General principles-Ores, ore types and properties-Scope of ore dressing. A description study of the following Unit operations: Size reduction: Fundamentals-Methods-Preliminary breaking-Jaw crushers-Different types-Jaw and Gyratory crushers-Comparison of disintegrators-Rolls, steam stamps, gravity stamps and stamping.

UNIT-II:Fine grinding, wet grinding, Mechanism of tumbling mills,Rod mills, Ball mills and tube mills, Grinding pan. Dry grinding: Buhr and attrition mills, Impact mills, Jet pulveriser, Roller mills. Tube mills, Compartment mill operation. Closed and open Circuit grinding, Modern equipment. Laws of crushing and work index.

UNIT-III:Size separation, screening, sizing by screens-Principles of screening-sizing-sieve scale-limits of screening-screening surfaces-types of screens-grizzlies, trammels, revolving shaking and vibrating screens and sampling.

Air sizing and dust collection: Principles of suspension in air-Gravitational separators-Internal separators-filters-washers-Electrical precipitation-Dust collecting system.

UNIT-IV:Classifiers: Principles of settling, free settling, hindered settling-Hydraulic classifiers-Hydroseparators-Mechanical classifiers, types, construction and operation-Gravity concentration-jigging and shaking tables-Wilfley tables-Sink float separation-Film fixing-pneumatic concentration.

UNIT-V:Concentration floatation: Definition-Principle and application for the formation, conditioning. Frothing agents and their action-collecting agents and their action-Pulp control reagents-Dispersing agents-Defloculators and protective colloids-Floatation machines-Operation flow sheets-performances-Floatation practice. Electrical concentration: Magnetic separation and concentration-Drum separators-Pully separators-Ball separators-Wet magnetic separation-Magnetic flocculation and deflocculation-Principles of Electrostatic separation-Electrostatic separators.

Books Recommended

- Gaudin, A.M.1984, Principles of Mineral dressing, , Mc Graw Hill Book Co.,
- Gilchrist , 1967, Extractive Metallurgy, Wiley Eastern, New Delhi,
- Gilchrist, 1981, Extraction Metallurgy, 2nd Ed. Pergamon press, London,

- Jain S.K. , 1986, Ore processing, Oxford and IBH publishing Co., pvt. Ltd., New Delhi,
- Parbin Singh, 1997, Engineering and General Geology, S.K.Kataria and sons., Delhi,
- Richards, R.H. and Lecke, C.E. 1964, Text Book of ore-dressing, McGraw Hill Book Co.,
- Taggart, A. F.1955, Hand book of Mineral dressing, John Wiley and Sons,
- Truscott, S.J.1954, Text book of ore-dressing, , Macmillan Co.,

IAGP 65 PRACTICAL VI METAMORPHIC, SEDIMENTARY PETROLOGY, AERIAL PHOTOGRAPHY AND MINERAL BENEFICIATION

Objective: Identification of rock types in thin section, their textures and optical properties of rocks of metamorphic and sedimentary origin. This also aims to understand the basics of aerial photography and orient towards the landuse interpretation and lithological studies.

Metamorphic Petrology: Megascopic study of metamorphic rocks.

Sedimentary Petrology: Identification of Clastic and Nonclastic Rocks under hand specimen.

Aerial photography :

Ex.I

1. Stereo Vision Test use cards Weiss plate.
2. Determination of personnel exaggeration factor.
3. Determination of Flight direction
4. Scale
5. Eye base-photo base calculation.
6. Photo recognition elements.

Ex. II. Aerial Photograph in Geology

1. Lithological mapping
2. Lineaments mapping
3. Fold / Structural trend line mapping

Ex. III. Aerial Photograph in Geomorphology

1. Mapping of denudational geomorphic features.
2. Mapping of fluvial geomorphic features
3. Mapping of volcanic geomorphic features.

Ex. IV. Aerial Photograph in Agriculture / Land use

1. Classification of land use / land cover
2. Land use / Land cover mapping.

Mineral Beneficiation:

Crushing and grinding

Tests-Sieve analysis

Air apparatus-Elutriation-Hydraulic classifiers-Wilfley tables-

Flotation methods of separation-settling tests, sink and float-Filters and driers.

SEMESTER –VII

IGYT 71 GEOMORPHOLOGY AND STRUCTURAL GEOLOGY

Objective: To gain knowledge in different aspects of geomorphology viz. theoretical geomorphology (geomorphic concepts, theories of landscape development, plate tectonics, morphometry etc.), geological geomorphology (rocks, earth's movement, structural geomorphology), weathering, transportation and deposition by different agents. This also focuses structural relationship of rocktypes and understanding the structural movement in rocks.

UNIT-I: Basic principles and Concept of Geomorphology, erosion cycles. Historical and process Geomorphology. Processes – weathering, pedogenesis, mass movement, erosion, transportation and deposition, Influence of climate on processes. Geomorphic processes and landforms – fluvial, glacial, eolian, coastal and karst. Earth's gravity and magnetic fields and its thermal structure: Concept of Geoid and, spheroid; Isostasy. Theories of palaeomagnetism. Ice ages and their periodicity.

UNIT-II: Indian plate tectonics: configuration of Indian plate, mobile belts in peninsular India. Evolution of Himalaya and Himalayan tectonics. Applications of geomorphology in mineral prospecting, civil engineering, hydrology, structure, lithology and environmental studies. Geomorphology of India.

UNIT-III: Mechanical properties of rocks- - elastic, plastic and rupture. Theory of stress and strain. Behaviour of minerals and rocks under stress. Mohr circle. Various states of stress and their representation by Mohr circles.

UNIT-IV: Geometry and analyses of brittle-ductile and ductile shear zones. Sheath folds. Geometry and mechanics of development of folds, boudins, foliations and lineations. Interference patterns of superposed fold. Geometry and mechanics of Fault; Fault-related folding. Gravity induced structures. Recognition of fold and fault in the field, determination of top and bottom of beds, introduction to map reading

UNIT-V: Structural analysis: Principles and elements of structural analysis of simple and complex structures – Microscopic to macroscopic scale. Petrofabric analysis: Field technique-laboratory technique and interpretation. Stereographic projection – equal area projection and structural analysis. Tectonites, their classification and geological significance.

Books Recommended

- Billings, M.P, (1974), Structural Geology, Prentice Hall of India.
- Davies, F. (1999). Dynamic Earth, Cambridge University Press.
- Dayal, P. (1990). A Text Book of Geomorphology, Shukla Book Depot, Patna.
- Duff.P.Mcl.D. (1992), Holmes, Principles of Physical Geology, Edited by 4th Ed. Chapman and Hall, London.
- Fairbridge, R.W. (1968), Encyclopedia of Geomorphology, Reinhold Book Corporation.
- Hobbs, Means and William, (1976), an outline of Structural Geology, Wiley International Edition.

- Jeanm Goguel, (1962). Tectonites, W.H. Freeman & Co.,
- King, L.C. (1967), Morphology of the Earth, 2nd Ed. Oliver & Boyd, London.
- Leopold, L.S. et.al. (1964), Fluvial processes in Geomorphology, Eurasia Publishing House, New Delhi.
- Park, R.C. Blackies, (1988). Geological Structures and moving plates, Chapman and Hall, New York.
- Phillips Edward, F.C. (1994). The use of Stereographic projection in Structural Geology, Arnold Publishers.
- Ramsay, J.G., Huber, M.I., (1987), Vol.2, The Techniques of modern Structural Geology, Folds and Fractures.
- Robert R. Compton, (1962), John Wiley & Sons, Manual of field geology, INC, Newyork, London.
- Sharma, H.S. (1990), Indian Geomorphology, concept Publ. Co., New Delhi.
- Thornbury, W.S. (1969), Principles of Geomorphology, Wiley Eastern, New Delhi.
- Windley. B.F., John Wiley & sons, (1978). The Evolving continents, Allen Cox, 1973. Plate Tectonics, Freeman and company.

IGYT 72 ADVANCED CRYSTALLOGRAPHY, MINERALOGY & MINERAL OPTICS

Objectives: To know about the nature, forms, habit, symmetry elements, measurement of interfacial angles and twins in crystals. The classification of crystals into system and classes along with X- diffraction pattern and their interpretation. To learn about the physical and optical properties of rock forming minerals. It deals about the structure, physical and chemical properties of ortho, ring, sheet, chain and framework silicates.

UNIT-I: Crystalline and amorphous states of matter, symmetry elements, translation, rotation, reflection, inversion, screw and glide-point groups. Crystal Projections: Spherical, Stereographic and Gnomonic-Zones. Zone symbols and Weiss Zone law equation, Law of anharmonic ratio-Napier's rule-Equations to Normal-Calculation of interfacial angles, axial ratios, Miller indices.

UNIT-II: Crystal classes-Derivation of 32 crystal classes based on Schoenflies notation,

Hermann Mauguin system. Bravies lattices and their derivation. An outline on space groups.

X-ray diffraction method: basic principle, powder method: Bragg's law and its application. Calculation of cell dimensions. Method of identification of minerals from X-ray diffractogram.

UNIT-III: Brief account of silicate structure and distinguishing features and geochemical significances of the following group of minerals. Frame work silicates: Feldspar, Feldspathoid, Zeolite and Scapolite. Chain silicates: Pyroxene and Amphibole. Sheet silicates: Mica, Chlorite and clay minerals.

UNIT-IV: Description of chemical, optical and physical properties, distinguishing features, paragenesis of the following important group of minerals: Ortho and ring silicates: Olivine, Garnet, Alumino silicates and Epidote. Study of following individual minerals: Zircon, Staurolite, Beryl, Cordierite and Tourmaline. Non-silicate-Spinel group, Carbonates and Phosphates.

UNIT-V: Optical classification of minerals: Optical properties: Refractive indices, Pleochroism, Birefringence. Optic sign, Uniaxial and biaxial interference figures. Optic axes, Optic axial angle measurements-

Optic orientation-Optical anomalies. Atomic structure, Chemical bonds. Structural classification of silicate minerals. Transformation of minerals - polymorphism, polytypism, and polysomatism. Solid solution and exsolution. Isomorphism, Atomic substitution, Pseudo-morphism-Flourescence in minerals. Metamict state. Bonding of common oxides, sulphides and silicate minerals.

Books Recommended

- Azaroff, L.V. & W.H.Berger, (1959). The powder method, Mc Graw Hill Book Co., American mineralogist special volumes on Mineralogy.
- Babu, S.K. and D.K.Sinha, (1987), Practical Manual of Crystal Optics, CBS Publishers & Distributors.
- Berger, W.H. (1956). Elements of Crystallography, John Wiley and sons.
- Berry Mason, L.G. (1961). Mineralogy, John Wiley & Sons
- Dana, E.S. (1935). A Text Book of Mineralogy, John Wiley & Sons
- Deer, W.A, Howie, R.A and Zussman, J, Longmans, (1966), An Introduction to Rock Forming minerals,
- Deer, W.A., Howie, R.A., Zussman, J., (1962), Longmans,. Rock forming minerals (Vols1-5).
- Ernest, E. Walhstrom, (1960). Optical Crystallography, John Wiley & Sons
- Kerr, B. F. (1959),Optical Mineralogy, 5th Ed. Mc Graw Hill, New York, Evans, 1966.An introduction to Crystal chemistry, R.C., Cambridge University Press,
- Mitra, S. (!986) Fundamentals of Optical, Spectroscopic and X-ray Mineralogy, S.R.Technico Book House, Ashok Raj Path, Patna.
- Ralph, B.Grim, (1953), Clay mineralogy, Mc Graw Hill Book Co.,

IGYT 73 INDIAN STRATIGRAPHY AND MARINE GEOLOGY

Objectives:To learn about the geological time scale, principles of stratigraphy and the description of strata and their relationship to tectonics, climate, fossils along with their distribution in different parts of India from Precambrian to recent and geological boundary problems and applications of stratigraphy.To gain knowledge of marine environments, morphology, processes, classification, and marine resources. To integrate modern and classical concepts of geology in an understanding of the history of the oceans and

microfossils. Also aims in dealing the current sea level changes, its impact and coastal management.

UNIT-I: Principles of stratigraphy, Geological time-scale. Nomenclature and the modern stratigraphic code. Lithostratigraphic, chronostratigraphic and biostratigraphic subdivisions. Concept of sequence stratigraphy. Methods of stratigraphic correlation including Shaw's Graphic correlation. Stratigraphic correlation of fossiliferous and unfossiliferous strata. Dharwar-Stratigraphy and their economic importance-Cuddapah Basin structure and tectonics, Stratigraphy and economic importance; Vindhyan system, its fossils, age and economic importance.

UNIT-II: Cambrian to carboniferous system, their distributions, geological succession and fossils. Saline series-Gondwana group-classification, geological succession, distribution, structure, sedimentation, fossils, palaeogeography and economic importance. Triassic and Jurassic system of extra peninsular region and Kutch, their stratigraphy, classification and faunal characteristics. Cretaceous system, Trichinopoly and Pondicherry, its

stratigraphy, distribution and faunal characteristics, Palaeogeography of Cretaceous Period.

UNIT-III: Deccan traps and their distribution, structural features-inter-trappean and infra-trappean beds, Lameta beds, age and economic importance. Tertiary group; Cretaceous-Tertiary transition in India. Siwaliks - their distribution, constitution, sedimentation, climate and fossil assemblages and correlation. Quarternary geology; Pleistocene-Holocene system-division and distribution-Glacial and interglacial periods - igneous epochs in India.

UNIT-IV:Origin of ocean water- Physical and chemical properties of sea water- Morphology of oceans: Continental margins, continental shelf, Continental slope, rise, submarine canyon, ocean floor, Abyssal hills, sea mounts and trenches. Ocean circulation: Causes and characters, surface currents, deep water circulation. Ocean waves and tides. Shore and Shoreline processes - sediment types, character, movement and distribution. Satellite applications in marine process. Sea level processes and Sea level changes. Sea Surface temperature.

UNIT-V: Life in the ocean; major environmental domains, modes of marine life. Marine resources: heavy minerals, petroleum hydrocarbons, gas hydrates, Mn-nodules, Phosphorite, Limestone Evaporites (Salt and gypsum). Marine pollution, Coastal zone

management and conservation Oceanic sediments:
Factors controlling the deposition and
distribution of oceanic sediments;
geochronology of oceanic sediments. Tectonic
evolution of the ocean basins, Evolution of
east and west coast of India.

Books Recommended

- Arkall, W.S. (1956), Jurassic Geology of the World, Oliver and Boyd Ltd., Edinburg.
- Bowen, D.C. (1978), Quaternary Geology, Pergamon press.
- Detrich, G. (1963), General Oceanography, Interscience, London.
- Gignox, M.(1960), Stratigraphic Geology, Paris.
- Grabau, A.W., (1957), Principles of Stratigraphy, John Wiley and Sons, Newyork.
- James, (1982), Deltas, Process of deposition and models for exploration, M.Colman,2nd Ed. International Human Resources Development Corporation, Boston.
- Keith Stowe, (1979), Ocean science, John Wiley and Sons, Newyork.
- Kennett, J.P. (1982), Marine Geology, Prentice Hall, Inc. New Jersey.
- King, (1967), An Introduction to oceanography, Mc Graw Hill Book Co., New York.
- Krishnan, M.S. (1982), Geology of India and Burma, 6th Edition, CBS Publishers and distributors.
- Kuenen, Ph.H. (1950), John. John Wiley & Sons, Marine Geology.
- Palivaal, B.S. (1998), The Indian Precambrian, Scientific Publishers, Jodhpur.
- Ravindra Kumar, (1985), Fundamentals of Historical Geology and Stratigraphy of India, Wiley Eastern Ltd, New Delhi.
- Read, H.H, and Watson, (1972),Earth's History,1, 2, Vols.,London
- Shepard, F.P. (1960), Submarine Geology, John Hopkins press.
- Wadia, D.Tata (1975), Geology of India, McGraw Hill Pub. Co., 4th Ed.
- Weller, J.M. (1960), Stratigraphic principles and practice, Harper & Bros, Publishers, New York.

IGYP 74 – PRACTICAL -V STRUCTURAL GEOLOGY CRYSTALLOGRAPHY,

OBJECTIVE: Aim to do exercises on Structural Geology Crystallography.

STRUCTURAL GEOLOGY:

Calculation of True dip and apparent dip.

Determination of Throw/Heave/ Stratigraphic separation.

Estimation of Thickness of beds,

Elementary structural analysis with use of stereographic methods

Interpretation of geological and contour maps.

CRYSTALLOGRAPHY:

Stereographic projections of crystals of Isometric, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic system. Calculation of axial ratios, miller indices of faces application of Weiss zone law, Tangent relationships, Napier's rule, law of anharmonic ratio and equation to normal.

SEMESTER –VII

IGYT 81 GEOPHYSICAL EXPLORATIONS

Objective: To know the different sampling methods for collecting water, rock, ores. Sample preparation for different analysis of minerals, ores and rocks. To familiarize the different search for ore minerals, economic minerals, geological mapping. To gain knowledge in the different geophysical prospecting methods.

UNIT-I: Scope and historical development of Geophysics- geophysical exploration methods- limitations- problem of ambiguity in geophysical interpretation-Out line of field theories. Electrical methods: Self potential method, Instruments, Field procedure- Resistivity method- Instruments, Field procedure, Interpretation, Electrical Resistivity Tomography- Electromagnetic methods- Magneto-Telluric method-Induced Polarization Methods- Applications of electrical methods

UNIT-II: Basic theory-Geoid-Gravitational field of Earth-Measurement of gravity- types of gravimeter- Field Procedure-Reduction of gravity data-Interpretation of gravity anomalies- Applications

Earth's Magnetism- Secular and transient variations and their concepts-Palaeomagnetism- Instruments-Field procedure- Corrections and reduction of data-Magnetic anomaly maps- Removal of regional effects-Interpretation-Applications-Principles of airborne magnetic survey

UNIT-III: Elements of earthquake seismology; seismic waves, seismic sources, faulting source, double couple hypothesis, electrodynamics, focal mechanism and fault plane solutions; seismic gaps; Generalized Snell's Law; Ray theory; reflection, refraction, diffraction; Seismic methods, seismic energy sources; detectors; recording and telemetry devices

UNIT-IV: Principles of reflection and refraction methods-Instruments and equipments- Operational methods-weathering and elevation corrections- Interpretation of a refraction

seismic data by graphical and analytical techniques- seismic reflection data processing, velocity analysis, F-K filtering, stacking-Applications

UNIT-V: Principles of Radioactivity-Instruments-Field procedure- Interpretation-Applications. Well logging principles and concepts. Open hole, cased hole and production logging; Electrical logs; lateral, latero, induction, S.P porosity logs sonic, density, neutron natural gamma logging while drilling.

Books Recommended

- B.D. Gupta, 2001. Mathematical physics., Sangam Books Limited.
- Brooks, A.R. (1972), Geobotany and Biogeochemistry in mineral exploration, Harper and Row.
- D.A. Cox, (1995), The elements of Earth , Oxford University Press, New York
- Dobrin, M.B. (1960), Introduction to Geophysical prospecting, , Mc Graw Hill Book Co., New Delhi.
- Govett, G.J.S. (Ed) (1983). Handbook of Exploration Geochemistry, Elsevier.
- Hawkes, H.E. and Webb, (1965), Geochemistry in Mineral Exploration, Harper and Row Publishers.
- Mason and Moore, (1985), Principles of Geochemistry, Wiley Eastern Ltd. New Delhi.
- Mathew N.O, Sadiku, 2007.Elements of Electromagnetics,., Fourth edition, Oxford University Press.
- Mc Kinstry, H.E. (1960). Mining Geology, Asia publishing house, Course in Mining Geology.
- Parasnis, D.S. (1975). Principles of Applied Geophysics, Chapman and Hall. Pacal, 2nd Ed. 1977,
- Ramachandran Rao, M.B. (1975), Outlines of Geophysical prospecting (A Manual for Geologists) Prasa Ranga, University of Mysore,
- Rose, A.W.Hawks, H.E. and Webb, J.A. (1979), Geochemistry in Mineral Exploration, Academic press.
- S.S. Sastry, 2005.Introductory Methods of Numerical Analysis, , PHI Learning Pvt Ltd. Delhi.
- Sharma, P.V. (1986), Geophysical methods in Geology, Elsevier.
- Stanislane, M. (1984), Introduction to Applied Geophysics, Reidel Publishers.
- Telford.W.M, Sheriff, R.E., Gelot, L.P, (2001), Applied Geophysics (Second Edition) Cambridge University press.London.

IGYT 82 REMOTE SENSING&GIS

Objective: To know the basic knowledge of the EMR spectrum, resolutions, data acquisition system and image processing of satellite images. It also deals in detail about the application of soil and aerial photography. To know about the application of Remote sensing in the interpretation of physiography, lithology and structures. To know the concepts of GIS & its application in Geology. Especially in hydrogeochemistry, engineering geology and

environmental geology. To become familiar with different GIS softwares. This deals in detail about the concepts of GIS, the spatial data analysis and data management

UNIT-I: Remote sensing concept, definition and types, an overview of Indian space mission. Electromagnetic spectrum, energy sources and radiation principles. Energy interaction in the atmosphere, energy interactions with earth's surface, Atmospheric windows, Types of sensors and platforms. Resolution and scanning mechanism. Basic principles of Thermal Remote Sensing. Black body radiation, thermal inertia.

UNIT-II: Passive microwave Remote Sensing: Basics, Physics of Radar waves, Spectral Characteristics. Active microwave Remote sensing: SLR spectroscopy and RADAR geometry. SAR interferometry principles.

UNIT-III: Image processing: Digital data-concepts of image processing. Image rectification and restoration. Geometric correction, Radiometric correction. Image enhancement and filtering. Image Classification. Hyperspectral imaging: Concepts and techniques.

UNIT – IV: Geographic Information System: Definition and basic concepts. Data types and models. Spatial/Geometrical data-Raster data, Vector data, Attribute data, spaghetti and topology model. Advantages and disadvantages of raster and vector data formats. Data sources: map scanning and digitizing, topology building, editing, cleaning, linking of spatial and non-spatial data. Data processing: Updating, correction and map projection. Advanced data models. Grid model, TIN model and Network model

UNIT-V Logic, general arithmetic, statistical and geometric operations. Query and report generation from attribute data. Overlay, buffer zones, raster and vector overlay methods. Spatial interpolation. Web GIS: overview advantages and limitations.

Application of Remote Sensing and GIS: in landform and land use mapping, structural mapping, hydrogeological studies, Natural hazard management and mineral exploration.

Books Recommended

- Curran, P, (1985), Principles of Remote sensing, Longman, London.
- Drury, S.A, (1987), Image interpretation in Geology, Allen and Unwin. Drury, S.A. 1990, A guide to Remote Sensing, Oxford Science Publication.
- Gupta, R.P, (1991), Remote sensing geology, Springer - Verlag, Heidelberg.
- Lillesand, T.M and keifer, R.W, (1987), Remote sensing & Image interpretation, 3rd Ed., John Wiley and sons.
- Miller, F.H. and Kikhail, E.M. (1980), Photogrammetry, Harper and Row publishers, New York.
- Miller, V.C. (1961), Photogeology, Mc Graw Hill, New York.
- Pandey, S.N. (1987), Principles of applications of photogeology, Wiley Eastern Ltd., New Delhi.

- Paul R. Wolf and Bon A. Dewitt, (1974), Elements of Photogrammetry, Mc Graw Hill, New York, Tokyo.
- Ray.R.G, (1969), Aerial photographs in geological interpretation, USGS proc., Pap.373. Rampal; Handbook of aerial photography and image interpretation for resource management, John Wiley & sons, New York.
- Sabbins, F.F, (1985), Remote sensing principles and application, Freeman, Sanfrancisco.
- Schanda, E, (1976), Remote sensing for Environmental sciences, Springer-Verlag.
- Verstappan, T.H, (1977), Remote sensing in Geomorphology, Elsevier scientific publishing co., Amsterdam.

IGYT 83 HYDROGEOLOGY AND ENGINEERING GEOLOGY

OBJECTIVE: To know and understand about the distribution and abundance and threat to water resources, relationship of water to rock properties, techniques to find ground water resource its exploration and exploitation. Isotopic signatures in hydrological cycle. To know about the engineering properties and rocks and geological features.

UNIT -I: Origin of water: meteoric, juvenile, magmatic and sea waters, Hydrologic cycle - precipitation, runoff, infiltration and evapotranspiration, Hydrographs. Subsurface movement and vertical distribution of groundwater, Springs, Classification of aquifers, Concepts of drainage basin and groundwater basin. Hydrological properties of rocks - specific yield, specific retention, porosity, hydraulic conductivity, transmissibility, storage coefficient, water table fluctuations -causative factors, water table contour maps, Water bearing characteristics of different geological formations, Hydro-stratigraphic units, Groundwater provinces of India.

UNIT-II: Theory of groundwater flow, Darcy's law and its applications, methods of determination of permeability in laboratory and in field. Types of wells, drilling methods, construction, design, development and maintenance of wells. Specific capacity and its determination. Unconfined, confined, steady, unsteady and radial flow conditions, Pumps tests - methods, data analysis and interpretation for hydrogeologic boundaries, Evaluation of aquifer parameters using Thiem, Theis, Jacob and Walton methods

UNIT-III: Groundwater quality - Physical and chemical properties of water, Quality criteria for different uses, Graphical representation of water quality data, Groundwater quality in different provinces of India - Problems of arsenic and fluoride, Saline water intrusion in coastal aquifers and its prevention. Groundwater development in urban areas and rain water harvesting, Artificial recharge methods, Groundwater problems in arid regions and remediation. Groundwater balance and methods of estimation. Groundwater legislation.

UNIT-IV: Stable isotopes in water cycle: Relation between $^{18}\text{O}/^{16}\text{O}$ and $^2\text{H}/^1\text{H}$ in natural waters,. Isotope effects in precipitation: The latitude / annual temperature effect, Seasonal

effect, Oceanic and continental precipitation. Altitude effect, Amount effect, Inter-annual variations, Small-scale variations, Palaeoclimate reconstruction. Tritium in the atmosphere, Atmospheric CO₂ concentrations, Stable carbon isotopes in atmospheric CO₂. Radiocarbon in atmospheric CO₂. Water Sampling and storage for isotope analysis. Laboratory treatment of water samples : ¹⁸O/¹⁶O analysis , ²H/¹H analysis, ³H analysis of water , ¹⁴C analysis of dissolved inorganic carbon , ¹³C/¹²C analysis of dissolved inorganic carbon.

UNIT-IV: Role of geology in Engineering projects: Engineering properties of rocks. Choice of rocks as constructional, road metals and their distribution in India, Nature and properties of building stones. Seismic zones and designing structures. Soil mechanics. Stability of slopes.

UNIT-V: Geological considerations in the construction of tunnels, dams, bridges, roads and reservoirs. Dams classification and parts of dams. Systematic dam site investigation. Geological, geomorphologic and geophysical investigations for foundation studies. Water fitness of reservoirs and, failure of dams. Important river valley projects of India. Tunnels: types, systematic investigations of sites and problems in the construction of tunnels.

Books Recommended

- Davie and De Weist, (1965), Hydrology, John Wiley and Sons.
- Gautam Mahajan, (1995), Groundwater Surveys and Investigations, Ashes Publishing House, New Delhi.
- Geohydrology, Rogar, J.M.Deweist, (1965), John Wiley and sons.
- Howrman Bower, (1965), Ground water Hydrology, Mc Graw Hill Book Co.
- Karanth, K.R. (1986), Hydrology, S.R.Technico Book house, Ashok Raj path, patna-6.
- Karanth, K.R. (1998), Groundwater Management, S.R.Technico Book house, Ashok Raj path, patna-6.
- Krynine, D.P. and Judd, W.R. (1957), Principles of Engineering and Geotechniques, Mc Graw Hill Book co.
- Legget, H.F. (1962). Geology and Engineering, Mc Graw Hill Book co.
- Ragnath, H.M. (1983). Ground water, John wiley & sons,
- Rogar, J.M. Deweist, (1965), Geohydrology John wiley and sons,
- Subramanya, K. (1994). Engineering Hydrology, Tata Mc Graw Hill.
- Todd, D.K. (1980).Groundwater Hydrology, John Wiley and Sons, 2nd Ed.
- Tolman, C.P. (1998), Ground water, Mc Graw Hill Book Co.
- Zaruba, Q. and Menci, V. (1976). Engineering Geology, Elsevier Scientific Publishing Co.,

IGYP 84 PRACTICAL-VI MINERALOGY AND MINERAL OPTICS

Objective: to understand the optcial properties of miernals in thin section

- a. Microscopic study of Feldspathoid group, Pyroxene group, Amphibole group and important silicates: Tourmaline, Topaz, Beryl, Zircon, Rutile, Apatite. Calcite, Gypsum.
- b. Metamorphic minerals: Garnet, Cordierite, Kyanite, Sillimanite, Andalusite, Sphene, Staurolite, Chondrodite.
- c. Calculation of molecular and structural formulae of some important minerals.
- d. Determination of plagioclase orientation in thin section and its Anorthite content from extinction angle measurements.
- e. Birefringence of minerals-using Berek compensator.
- f. Pleochroic scheme,
- g. 2V by Mallards method,
- h. Optic signs of uniaxial and biaxial minerals.
- i. Determination of cell dimensions and identification of minerals from X-Ray diffractogram

IGYP 85 PRACTICAL-VII - REMOTE SENSING, DIGITAL IMAGE

PROCESSING AND GIS

Objectives: To interpret the geological features, lithology, drainage patterns, engineering structures by using aerial photographs, Satellite products and Preparation of different thematic maps through Remote sensing. To know the application of different GIS softwares in hydrogeology, engineering geology and environmental geology. To interpret the geostatistical interpretation of Geological data.

REMOTE SENSING:

- a. Satellite imageries-visual and stereoscopic methods, Drainage Pattern
- b. Preparation and interpretation of Coastal and Fluvial landforms
- c. Preparation of Lineaments map
- d. Preparation of land use map
- e. Demarcation of Groundwater Potential zones

DIGITAL IMAGE PROCESSING

- a. Starting ERDAS imagine, and exploring the viewer interface
- b. Identifying image statistics, Histogram, contrast enhancement
- c. Band ratios, filters, georeferencing/ rectification & principal component analysis
- d. Unsupervised classification/supervised classification and mosaicing
- e. View images and Map composer

GEOGRAPHIC INFORMATION SYSTEM:

- a. Digital Mapping
- b. Registration
- c. Digitized coverage

- d. Edited coverage
- e. Labelling and Annotation
- f. Projection and Transformation
- g. Generation of Grid map
- h. Scaling/ Area determination

GEOLOGICAL MODELLING

- a. Exercise on data input to geological modeling software,
- b. Model Exercise with Modflow and PHREEQC.

IGYP- 86 PRACTICAL VIII - GEOPHYSICS, HYDROGEOLOGY, ENGINEERING GEOLOGY & SURVEYING

OBJECTIVE: Aimed to do exercises in hydrogeology and engineering geology for better understanding of ground water chemistry and process. Application of geology in civil engineering project. To know the basics of engineering surveys.

GEOPHYSICS:

- a. Interpretation of Gravity data
- b. Interpretation of Magnetic data
- c. Electrical resistivity field survey and data analysis,(resist software.& IP2win).
- d. Interpretation of Seismic data
- e. Preparation of geophysical anomaly maps
- f. Preparation and Interpretation of Isoresistivity maps
- g. Interpretation of Self Potential, resistivity, Gamma , Neutron, Sonic, Caliper, Dipmeter , and temperature logs in oil wells and water wells

HYDROGEOLOGY:

- a. Calculation of Rainfall by Arithmetic method.
- b. Determination of catchment area by Thiessen polygon method and calculation of rainfall
- c. Determination of catchment area by Isohyetal method and calculation of rainfall
- d. Determination of catchment area by Geometric method and calculation of rainfall.
- e. Basinwise Groundwater Budgeting.
- f. Calculation of Specific yield and transmissibility from the given data
- g. Interpretation of well inventory data from pump test data
- h. Interpretation of water well logs.
- i. Identification of groundwater zones from resistivity data.
- j. Chemical analysis of major dissolved constituent of groundwater by titrimetric method
- k. Chemical analysis of major dissolved constituent of groundwater by spectrophotometric method
- l. Chemical analysis of major dissolved constituent of groundwater by flame photometric method.
- m. Determination and calculation of Water quality parameters pH, EC, TDS.
- n. Calculation of SAR, TH, NCH, TDS, EC and interpretation for various uses
- o. Graphical representation of chemical data and identification of type of water.
- p. Classification of water for drinking water by using WHO standards.

ENGINEERING GEOLOGY:

- a. Selection of suitable places for construction of dams from the map.
- b. Selection of suitable places for the construction of tunnels from the map.
- c. Selection of suitable places for the construction of reservoirs from the map.
- d. Construction of retaining walls-Problems and solutions.

SURVEYING:

- a. Chain survey, Compass surveying, Theodolite, Demo: Theodolite and Total station.

SEMESTER –VII

IGYT 91 ECONOMIC GEOLOGY AND MINING GEOLOGY

OBJECTIVES: To know about the economic mineral processes and the distribution of metallic and non-metallic minerals deposits in India. Ores and their genesis. Emphasizing to understand the various techniques in mining, mine environment and mineral economics.

UNIT-I: Classification of mineral deposits. Process of formation of mineral deposits - Magmatic concentration, sublimation, contact metasomatism, hydrothermal process, sedimentation, evaporation, residual and mechanical concentration, oxidation and supergene enrichment and metamorphism. Controls and localization of mineral deposits. Metallogenic epochs and provinces. Geological thermometry.

UNIT-II: Study of following metallic mineral deposits, their origin, occurrence & distribution in India and uses: Gold, Silver, Platinum, Aluminum, Iron, Manganese, Chromium, Nickel, Cobalt and Titanium, Copper, Lead, Zinc, Magnesium and atomic minerals. Study of important non-metallic industrial minerals including origin, occurrence, distribution in India and uses - talc, Refractory materials and abrasive minerals,

Unit-III: Principles of Ore microscopy and Ore microscope. Polishing and mounting of ores. Physical and optical properties of ore minerals. Ore textures and paragenesis. Micro chemical techniques and application of ore microscopy. Mineral economics and its concept. Peculiarities inherent in mineral industry. Strategic, critical and essential minerals. Tenor, grade, cut-off grades and specification of minerals with relevant to domestic examples. National mineral policy – India's mineral production, export & import and price of major minerals in India and mineral taxation.

UNIT –IV: Methods of investigation of ore bodies: rock sampling techniques. Ore reserve estimation. Introduction to mining. Classification of mining methods. Cycles of mining operation. Surface mining, drilling methods and types of drills. Mine explosives and bench parameters, mine haulage.

UNIT –V: Subsurface mining methods. Basic concepts. Shaft, adit, winze, raise, stope, mine support and ventilation. Outline of underground coal mining methods. Mine machineries, organization and structure of a mine. Role of geologist in mining industry. Mining legislations. Preparation of mine plan, mining scheme. Environmental impact assessment and management plans, mine accidents, miner's diseases.

Books Recommended

- Aiyengar, N.K.N. (1964), Minerals of Madras, Dept. of Industries and Commerce, Madras.
- Alan M. Bateman, (1961), Economic mineral deposits, Asia Publishing House.
- Arogyaswami, R.N.P. (1970). Course in Mining Geology, Oxford and IBH Publishing house,
- Deb, S. (1980), Industrial minerals and Rocks of India, Allied Publishers Pvt. Ltd.
- Eugene N. Cameron .(1961) Ore Microscopy, John Wiley & Sons, Inc.
- Gokhale, K.V.G. K. and T.G. Rao, (1972), Ore deposits of India, Thompson press Ltd., Delhi – 6, India.
- James R.Craig, David J. Vaughan (1981). Ore microscopy and Ore Petrography, John Wiley & Sons
- Jaya Prakash Shrivastava & Nishi Rani, (2012). Introduction to Ore Microscopy
- Krishnaswamy, S. (1972). India's mineral Resources, Oxford & IBH Publishing Co.,
- Lindgren, W. (1933), Mineral deposits, Mc Graw Hill Book Co.
- Mc Kinsty, H.E. (1960). Mining Geology, Asia publishing house,
- Sinha, R.K. and Sharma, B.N.L (1973). Mineral Economics, Oxford and IBH Publishing Co.,
- William, C.Peters, (1989) Exploration and Mining Geology, John Wiley and sons, Second Ed.
- Young, C.J. (1940). Elements of Mining, Mc Graw Hill Book co.,

IGYT 92 GEOLOGICAL AND GEOCHEMICAL EXPLORATIONS

OBJECTIVE: To develop skill in the exploration of Earth resources using geological, and geochemical tools. To know the different sampling methods and sample preparation for exploration of mineral resources.

UNIT –I: Reconnaissance Vs detailed mapping, surface mapping. Degree of precision, choice of scales, isolation of outcrops. Sampling, general principles. Methods of sampling: channel, chip, grab, pitting, trenching, digging. Sampling errors and precautions. Topographic expression of ore bodies: Physiographic relations of placer deposits, guides to channels, location of pay streaks. Physiography in relation to oxidation and enrichment. Residual ores, supergene sulphide zones

UNIT –II: Mineralogical guides. Rock alteration: nature of alteration, target rings of mineral distribution. Stratigraphic and lithological guides, reasons for favorability, competent Vs incompetent formations. Examples of favorable formations-applications. Fracture pattern

as guides: (Structural guides): Mechanical principle of fracturing, vein patterns. Contacts and folds as guides: Contacts, folds, folds younger than the ore; folds older than ore; dislocated ore bodies.

UNIT –III: Geochemistry, Introduction, definition, aim and scope. Origin and abundance of elements. Distribution of elements in lithosphere. Geochemical cycle-Geochemical classification of elements. Geochemical differentiation of elements in exogenic and endogenic cycle. Redox reactions and Eh-pH diagrams and their applications.

UNIT-IV: Geochemical Exploration: Introduction, Principles of geochemical exploration, geochemical environment. Study of geochemical dispersion, mobility, geochemical association. Methods of surveying and sampling: Anomalies, background value, threshold value, path finder elements.

UNIT-V: Methods of geochemical exploration: (a) Lithogeochemical prospecting (b) Hydrogeochemical prospecting (c) Biogeochemical prospecting (d) Geobotanical prospecting. Anomalies in Residual overburden. Leached ore outcrops, Gossans and Residual soils transported overburden. Geochemical anomaly map and interpretation of data. Geochemical trace element indicators and their significance. Problems in geological interpretation of geochemical data.

Books Recommended

- Arthur Brownlow 1982, Geochemistry, Prentice Hall,
- Fyfe, W.S.1964, Geochemistry of solids. Mc Graw Hill Book Co.,
- Goldschmidt, V.M.1954, Geochemistry, Oxford University press.
- H.E. Hawkes, J.S. Webb. 1979. Geochemistry in Mineral Exploration,: Academic Press, London
- Henderson, P.Inorganic geochemistry.
- Jenners, 1987. Geochemical exploration, Universal Books Distributors Co.,
- Kovalevskii, A.L. 1979, Biogeochemical exploration for mineral deposits, Oxonian press.
- Krauskopf.K.B , 1986, Introduction to geochemistry, , Mc Graw Hill.
- Mason, B.1971, Principles of Geochemistry, John Wiley & Sons.
- Mason,B. and Moore.C.B. 1991, Introduction to Geochemistry, Wiley Eastern
- Rankama and Sahama, (1950), Geochemistry, University of Chicago Press,

IGYT 93 ADVANCED PETROLOGY

Objective: Understanding the origin, classification and nature of igneous and metamorphic rocks

UNIT-I: Petrography of igneous rocks- -
Petrography and petrogenesis of Granites,
Pegmatites, Alkaline rocks, Mono-mineralic
rocks. Anorthosites and Dunites, Lamprophyres,
Carbonatites, Charnockites and Ultra-mafics.

UNIT-II: Mineralogical, chemical
classification. C.I.P.W, Niggli and
Streikeisen-IUGS Classification. Tabular
classification Plate tectonics and magmatic
evolution. Trace elements in igneous rocks and
their significance. Fluid inclusion studies
of igneous rocks. Plate tectonics in relation
to magma.

UNIT-III: Metamorphic textures, structures and their significance. Grades, zones and facies of metamorphism. Zones, grades and facies concepts of metamorphism: Eskola, Turner-Verhoogen, Winkler's concepts. Graphical representation of facies, A.C.F., A.F.M. and A.K.F. diagrams. Cataclastic metamorphism and its products.

Goldschmidt's mineralogical phase rule and its application - stress and anti-stress minerals. Geothermometry and Geobarometry, Fluid inclusion studies in metamorphic rocks. Petrogenetic aspects of important rock suites of India, such as the Deccan Traps, layered intrusive complexes, anorthosites, carbonatites, charnockites, khondalites and granitoids.

UNIT-IV: Introduction, Aqueous, Eolian, Glacial, Gravitational processes. Heavy mineral zones and their provenance. Paleocurrents and paleogeography and their significance. Biogenic and chemical sedimentary structures. Tectonics and sedimentation.

UNIT-V: Environmental analysis: Sedimentary environment and facies concept, parameters and classification of environments. Facies model and environmental reconstruction - Alluvial Environments, Shore environment and cyclic sequences. Concept of sedimentary model- Walther's law. Sedimentary basins: Concept and classification: crustal sag, Arc-related and divergent plate boundary basins-basin evolution.

Books Recommended

- Alex S.D. Maltman, (1994). The geological deformation of sediments, Chapman Hall,
- Anthony Hall, (1987), Igneous petrology, ELBS publishers.
- Barkar, S. (1983), Igneous rocks, Daniel, Prentice Hall, Englewood Cliffs, New Jersey
- Barker, A.J.Chapman and Hill, (1989). Introduction to metamorphic textures and microstructures,
- Barth, T.F.W. 1962. Theoretical petrology, John & Wiley and sons.
- Bose, M.K. (1997), Igneous petrology, World Press.
- Edwin Roedder, (1986), Fluid inclusions Publisher Mineralogical Society of America, Printed by Book Crafters, Inc. Chelsea, Michigan.
- Folk, R.L. (1961). Petrology of Sedimentary rocks, Hemphills,
- Galloway. W.C. and D.K.Hobdew, (1996). Terrigenous clastic sedimentary systems, Springer, Verlag, New York.
- Gary Nichols, (1999). Sedimentology and Stratigraphy, Blackwell Science Ltd., London,
- Hess, H.H. and Poldervaart, A. (1967), Basalts, Vols, I and II, Ed., Interscience pub.

- Myron G.Best, (1982), Igneous and Metamorphic petrology, W.H.Freeman and Co., New York.
- Nockolds, S.R, Knox, R.W.O.B, Chinner, G.A. (1979), petrology for students, Cambridge University Press.
- Paul, C.Hess, (1989), Origin of Igneous rocks, Harvard University press, Cambridge, London, England.
- Pettijohn, F.J, (1975). Sedimentary rocks, Harper & Bros. 3rd Ed.
- Phillipotts, A. (1992) Igneous and Metamorphic petrology, Prentice Hall.
- Reineck, H.E., and Singh.J.P. (1980). Depositional sedimentary environments, Springer Verlag, New York.
- Roy Lindholm, (1989), A Practical Approach to Sedimentology, Allen and Unwin, USA.
- Sanders, G.M, (1978). Principles of Sedimentology, Friedman, E.J.John Wiley and sons, New York,
- Turner, F.J. & Verhoogen, J. (1960). Igneous and Metamorphic petrology, Mc Graw Hill Book Co.,
- Twenhofel, W.H. (1950). Principles of sedimentation, Mc Graw Hill Book Co.,
- Wahlstrom, E.E. (1961). Theoretical Igneous petrology, John Wiley & Sons,
- Winkler, H.G.S. (1979). Petrogenesis of Metamorphic rocks, Springer Verlag Vth Ed

IGYO 94 – Optional-II - ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT (Internal)

Objective: To know about the application of environmental Geoscience and to understand natural and man made environmental hazards, pollutions, controls and their remedial measures. The Course would focus on types of Environmental hazards & Disasters. The main objective is to study the emerging approaches in Disaster Reduction & Management. The emphasis will be on programmes of National & International organizations for Disaster preparedness, Mitigation and awareness.

UNIT-I: Principles of Environmental Geology: Components of Environment, Atmosphere, hydrosphere, lithosphere, biosphere, their interactions and related problems. Renewable and non-renewable resources- types of alternative renewable energy sources- their advantages. Natural hazards – Endogenic: Tectonism, Volcanoes, Earthquakes, landslides and Exogenic: cumulative atmospheric hazards, cyclones, lightning, hailstorms, drought, cold waves, heat waves and floods. Drought and flood hazards in India.

UNIT-II: Man's influence on earth's energy balance. Pollution-Concept and definition. Acid rain, greenhouse effect, Ozone depletion. Deforestation and erosion, global warming and climatic change concepts. Air pollution: Ambient air quality standard, Influence of nitrous oxide, sulphur dioxide, suspended matters on human health. Pollution-Water pollution- drinking water quality standards, Industrial discharge, municipal sewage discharge,

agriculture run off. Types of pollutants: Organic, inorganic and radioactive materials-their fate in the environment.

UNIT-III: Environmental impacts due to mining and mineral processing: Occupational hazards, control measures on noise and air in mines. Impact assessment of anthropogenic activities such as urbanization, river- valley projects, disposal of industrial and radioactive waste, excess withdrawal of ground water, use of fertilizers, dumping of ores, mine waste and fly-ash. Land reclamation and rehabilitation of mined out areas

UNIT-IV: Environment legislation, International environmental agreements, Indian Environmental laws. Environmental Impact Assessment Techniques (EIA). Environmental Management Plan (EMP), concepts and components of environmental auditing. Environmental Gradients, Tolerance and Adaptation. Environmental Education(EE).

UNIT-V: Introduction, Theoretical concepts and developments of disaster management. The role of coordination in disaster management, Different approach to disaster recovery. Planning, Prevention and preparedness. The essential strategic planning for emergency management for natural and manmade hazards. The role of disaster mitigation institution- Meteorology, seismological, volcanology, hydrology, industrial safety inspectorate- institution of urban and regional planners, awareness conservation movement, education and training of disaster.

Books Recommended

- Harsh .K. Gupta (2003), Disaster Management, University Press
- Ignacimuthu.S (1998), Environmental Awareness and Protection, Phoenix Publishing House Pvt. Ltd., New Delhi
- Keller.E.A, (1978), Environmental Geology, A. Charles E.Merrill Pub. Co., A. Bell & Howell Co., London, 4th Ed.
- Lawrence Lundgren, 1986, Environmental Geology, Prentice-Hall.
- Mukesh Dhunna (2009) Disaster Management, Vayu Education of India, New Delhi
- Nadhi Gauba Dhawan & Ambrina Sardar Khan (2014).Disaster Management and Preparedness, CBS Publishers & Distributors Pvt Ltd
- R.B Singh(Ed) (2000) Disaster Management, Rawat Publication, New Delhi.
- S.Mukherjee (2015) Disaster Management for General studies Mains,Visalaya Publications Pvt. Ltd.
- Strahler.A.N and Strahler.A.N, A.H. (1973). Environmental Geosciences, Wiley International Edition,
- Thomas D. Schneid and Larry Collins (2001), Disaster management and preparedness: Occupational safety and health guide series, CRC Press
- Upendra Kumar Sinha, (1986), Ganga-Pollution & Health Hazard Inter-India publication, New Delhi.

- Valdiya, K.S. (1987), Environmental Geology, Indian context, Tata Mc Graw Hill. Bombay.
- Valdiya, K.S., 1987 & 2015, Environmental Geology, Indian context, Tata Mc Graw Hill. Bombay.

- J.P.Sinhal (2010) Disaster Management, University Science Press, Delhi

IGYP 95 PRACTICAL-IX- ECONOMIC GEOLOGY AND GEOCHEMICAL EXPLORATION

Objective: the content focuses on identification of economic minerals in hand specimen and polished sections, estimation of ore reserves, geochemical analysis of the samples and geochemical anomaly maps

ECONOMIC GEOLOGY:

- Megascopic identification of ores and economic minerals,
- Preparation of polished ore specimens
- Identification of ore minerals by reflected microscope
- Interpretation of textures and paragenesis of ore minerals
- Computation of ore reserves from sampling data
- Estimation of ore reserves by traditional methods:
 - included area method
 - extended area method
 - triangle method
 - polygonal method
 - cross section method.
- Computation of ore reserves from maps

GEOCHEMISTRY:

- Sample preparation for geochemical analysis.
- Preparation of A solution and B for silicate analysis
- Preparation of rock sample for AAS
- Preparation of Geochemisty anomaly maps
- Determination of background, threshold values from maps and geochemical interpretations

IGYT 101 COAL AND PETROLEUM GEOLOGY

OBJECTIVE: To gain knowledge about the hydrocarbons, their formation, varieties and distribution. To understand the different sedimentary basins of India and methods of exploration of petroleum.

UNIT-I: Geological basis of coal formation. Physical and chemical properties of coal. Varieties and ranks of coal. Development of coal facies. Types of deposition and diagenesis of coal. Coalification and bituminization. Sampling of coal, Coal petrography.

UNIT-II: Coal bed methane and gas hydrates. Prospecting and valuation of coal lands, Carbonization and gasification of coal,. Production of coal: export and import, conservation of coal. Distribution of Gondwana and Tertiary coal fields in India. Lignite deposits in India

UNIT-III: Physical and Chemical properties of Petroleum. Origin, of petroleum and natural gas, source rocks, reservoir rocks and traps. Migration and accumulation of oil and gas. Porosity and permeability of reservoir rock. Types of petroliferous basins, relations between basin type and hydrocarbon richness. Classification of petroliferous basins of India, Detailed

study of stratigraphy, structure and petroleum geology of Assam shelf, Cambay, Bombay, Krishna-Godavari and Cauvery Basins.

Unit–IV: Introduction to drilling methods: types of drilling operations, designing of oil well. Down hole equipment: drilling rigs, its components and functions. Drilling fluids, well-heads, casing and cementing operations. Principles of kick control, fishing jobs. Drilling methods and equipment for directional, horizontal and multilateral wells. Types of offshore drilling rigs.

UNIT–V: Duties of a well-site geologist. Geotechnical order. Mud logging. Fundamentals of Petrophysics. Archie's Formula- porosity, permeability, Preparation of composite logs. Principles of formation testing. Well completion, Enhanced oil recovery techniques. Gas hydrates and coal bed methane.

Books Recommended

- Asquith, G. and Gibson, C (1982), Basic Well Log, Analysis for Geologists, Academic Press, London.
- Baker, R. A. (2001), Primer of Oil well Drilling: A Basic Text of Oil and Gas Drilling, Petroleum Extension Service, University of Texas at Austin.
- Biswas, S.K., Dave, A., Garg, P., Pandey, J., Maithani, A. and Thomas, N.J. (Eds.). (1993) Proceedings of 2nd Seminar on Petroliferous Basins of India, Dehra Dun, Dec.18-20, 1991, Vol. 1, 2 & 3 Indian Petroleum Publishers, Dehradun.
- Bjorkee, K.o., (1989). Sedimentology and Petroleum Geology, Springer Books (India),
- Chilinger, G.V. and Vorabutr, P. (1981), Drilling and Drilling Fluids. Elsevier Science, Amsterdam.
- Darling, T. (2005), Well Logging and Formation Evaluation, Elsevier Science, Amsterdam.
- Ganju, P.N. (1955), Memoirs of the GSI Petrology of Indian coals, Vol.83.
- Gupta, P.K. and Nandi, P.K. (1995), Wellsite Geological Techniques and Formation Evaluation: A User's Manual, Vol. I, Oil and Natural Gas Corporation, Dehra Dun.
- Hunt J.M. (1996), Petroleum Geochemistry and Geology, 2nd Edition, W.H. Freeman, San Fransisco.
- Hyne, N.J. (2001), Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production, 2nd edition, Pennwell Corporation, Tulsa, Oklahoma.
- Levorson, A.L. Vakils, (1972), Geology of Petroleum, Peter and Simon Limited, Bombay,
- Moore, E.S. (1980). Coal, John Wiley & Sons,
- North, F.K. (1985), Petroleum Geology, Allen & Unwin, London.
- Ross C.A, (1984), Geology of Coal, Narosa book distributors.
- Selley, R.C. (1997), Elements of Petroleum Geology, 2nd Edition, Academic Press, London.
- Serra, O. (1984), Fundamentals of Well Log Interpretation, Vol.1 and 2. Elsevier, Amsterdam.

IGYT 102 ATMOSPHERIC SCIENCES AND METEOROLOGY

Objective: To know and understand the atmospheric process and fundamentals and concepts of Meteorology.

UNIT-I: Principles of Meteorology, Thermal Structure of the Atmosphere and its Composition. Radiation: Basic Laws - Rayleigh and Mie scattering, Multiple scattering, Radiation from the Sun, Solar Constant, Effect of Clouds, Surface and Planetary Albedo. Emission and Absorption of Terrestrial Radiation, Radiation windows, Radiative Transfer, Greenhouse effect, Net radiation budget;, Moisture variables, Virtual temperature; Vertical stability of the atmosphere:. Tropical convection.

UNIT-II: Cloud classification, Condensation Nuclei, Growth of Cloud drops and ice-crystals, Precipitation Mechanisms: Precipitation of warm and mixed clouds, Artificial precipitation, Hail suppression, Fog and Cloud –. Basic equations and fundamental forces: Pressure, Gravity, Centripetal and Coriolis forces, Continuity equation in Cartesian and Isobaric coordinates

UNIT-III: Low frequency variability, MJO (Madden-Julian oscillation), ENSO, QBO (quasi-biennial oscillation) and Sunspot cycles. Basic principles of general circulation modelling; Grid-point and Spectral GCMs; Role of the ocean in climate Modeling; Internal variability of ocean fields (SST, winds, circulation, etc.) and its Relationship with Monsoon.

UNIT-IV: Tropical Meteorology: Trade wind inversion, ITCZ; Monsoon trough tropical cyclones; Monsoon depressions; Western disturbances; SW and NE monsoons; Synoptic features associated with onset, Withdrawal, Break active and Weak monsoons and their prediction. Air masses and fronts: Sources, Origin and Classification of Air masses; and Fronts, Extratropical Cyclones and Anticyclones.

UNIT-V: Meteorological Satellites – Polar orbiting and Geostationary Satellites, Visible and Infrared radiometers, Multiscanner radiometers; Identification of Synoptic systems, Fog and Sandstorms, Detection of Cyclones, Estimation of SST, Cloud top Temperatures, Winds and Rainfall: Temperature and Humidity soundings.

Books Recommended

- Bar Charts, (2012). Meteorology (Quick Study: Academic).
- C. Donald Ahrens , (2008), Meteorology Today: An Introduction to Weather, Climate, and the Environment. Study Guide/Workbook .
- C. Donald Ahrens, (2011) Essentials of Meteorology: An Invitation to the Atmosphere.
- Donald Ahrens, C. (2008) Meteorology Today.
- Donald Ahrens. C. (2008) Essentials of Meteorology.
- Frank R. Spellman , (2012). The Handbook of Meteorology.
- Frederick K. Lutgens, Edward J. Tarbuck, Dennis Tasa, (2006) The Atmosphere: An Introduction to Meteorology (10th Edition).
- Frederick K. Lutgens, Edward J. Tarbuck, Dennis Tasa , (2009) The Atmosphere: An Introduction to Meteorology (11th Edition).
- Frederick K. Lutgens, Edward J. Tarbuck, Dennis Tasa, (2012) The Atmosphere: An Introduction to Meteorology (12th Edition).

- James R. Holton, (2004). An Introduction to Dynamic Meteorology (International Geophysics).
- Roland B. Stull, (1988). An Introduction to Boundary Layer Meteorology (Atmospheric Sciences Library).
- Steven A. Ackerman, Meteorology, John A. Knox, (2011) Third Edition.
- Storm Dunlop, (2008). Guide to Weather Forecasting: All the Information You'll Need to Make Your Own Weather Forecast (Firefly Pocket series).
- Storm Dunlop, (2003). The Weather Identification Handbook: The Ultimate Guide for Weather Watchers.
- Sverre Pettersen, (2008) Introduction To Meteorology.
- Roland B. Stull, (1999). Meteorology for Scientists and Engineers.

IGYP 103- Practical X- PETROLOGY AND PETROCHEMISTRY

OBJECTIVE: Aimed to do exercises in petrology and petrochemistry, for better understanding of rocks.

PETROLOGY:

- a. Preparation of thin sections of rocks.
- b. Microscopic identification of important igneous (except Acid igneous rocks) Metamorphic and sedimentary rocks.
- c. Determination of roundness and sphericity of grains.
- d. Granulometric analysis by sieving and determination of transport and depositional condition
- e. Separation of heavy minerals, their microscopic characteristics

GEOCHEMISTRY:

- a. Calculation of C.I.P.W. Norm, Niggli values
- b. Variation diagrams of Harker and Niggli
- c. ACF, AKF diagrams

IGYP -104 DISSERTATIONS AND VIVA –VOCE

Each student in the beginning of X –semester should choose a topic of dissertation in the field related to their Industrial / institutional training and work with a guide, who one among the teacher, in the department. At the end of the semester should submit a dissertation not exceeding **150** pages inclusive of tables and illustrations. Evaluation will be made on the basis of merit of the dissertation and performance in the viva-voce.

IGYO105.1-Optional III - ISOTOPE GEOLOGY AND NUCLEAR GEOLOGY (Internal)

OBJECTIVE: To know the basic principles of Isotopes, Types of isotopes and their applications in the mineral exploration techniques. To become familiar about exploration of Isotopes. To gain knowledge in the isotope Analytical Instruments used in Atomic Mineral Exploration

UNIT – 1: Basic principles of Isotope Geology: Mechanism of radioactive decay and decay series, stable and radioactive isotopes. Stable isotopes, isotope ratios and concentrations, isotope fractionation, Relation between atomic and molecular isotope ratios. Radionuclide and nuclear instability, Nuclear structure, atomic weights, nuclear decay and radiation.

Nuclear reactions, natural production - Anthropogenic releases of radionuclides. Distribution of Radioactive elements in Igneous, Sedimentary and Metamorphic rocks, sediment and waters.

UNIT - II : Nuclear devices and techniques: Ionisation chamber, preparational counters, scintillation counters, nuclear fission and fusion techniques. Mass spectrometer and isotopic dilution.

UNIT – III : Isochron method, model/mineral ages, Fission track, ^{40}Ar - ^{39}Ar , U-Th disequilibrium, concordia method, ^{14}C , Be and Al. Interpretation and geological significance of ages. Radiometric dating methods – Lead method, Rb-Sr, K-Ar, C^{14} methods, fission track dating.

UNIT – IV: Oxygen, Hydrogen, Carbon, Nitrogen, Sulphur. Fractionation of stable isotopes in lithosphere, hydrosphere and atmosphere and their applied aspect. Stable isotope geothermometry and geobarometry.

UNIT – V : Isotopes in mineral exploration, petroleum exploration, palaeoclimate evaluation, health and environmental aspects. Distribution of Uranium and Thorium deposits in India. Nuclear power projects and power stations in India. Advantages and Issues on the use of the nuclear power.

Books Recommended

1. Aswathnarayana, U. 1982, Principles of Nuclear Geology, Allied Pub.,
2. Doe, B.R. 1970, Lead Isotopes, , Springer-Verlag.
3. Faure, G. 1986, Principles of Isotope geology, John Wiley & sons.,
4. Faure, G. and Powell, J.L. 1972, Strontium Isotope Geology, Springer-Verlag.
5. Henry Faul, 1993, Nuclear Geology, Academic press.
6. Hoefs, J. 1980, Stable isotope geochemistry, Springer-Verlag.
7. Rankama, T.H. and Sahama, G. 1963. Geochemistry, John Wiley & Sons, New York,
8. Robert D. Ninninger, D, 1955, Minerals of Atomic energy, Van Nostrand Co.,
9. Virnave, S.N. 1999, Nuclear Geology and Atomic Mineral Resources, Bharati Bhawan Publishers & Distributors,

IGYO105.2-Optional III – INSTRUMENTATION TECHNIQUES IN GEOSCIENCE (Internal)

OBJECTIVE: To know the basic principles of techniques and instrumentation to identify the isotopes and radionuclides. To gain knowledge in the isotope Analytical Instruments used in Atomic Mineral Exploration

UNIT – I : Rock sample collection, sediment sample collection, water sample collection, samples for geochemical study. Collection of samples from exposed materials. Samples acquired from drilling operations, bottom of water samples. Sampling apparatus-Scraper or drag bucket type of sampler, coring tube samplers, Snapper or grab bucket samplers, Rod samplers, Chambered weight samplers,

UNIT – II : Sample preparation for thin section of hard rocks and sediments. Preparation of Polished ore section Petrographic study of thin sections. Sample etching, staining and modal count techniques. Techniques of photomicrography. Thin section preparation of heavy minerals.

UNIT - III Separation of minerals-Magnetic separation-Dielectric separation of mineral particles. Electrostatic separation-Separation; panning- rolling, sieving and hand picking.

UNIT – IV : Determination of major and minor elements. Principles of geological application of cathodoluminescence, atomic absorption spectrophotometry, inductively coupled plasma-atomic emission spectrometry.

UNIT – V : X-ray fluorescence spectrometry, Scanning and Transmission electron microscopy, Micro probe analysis. X-ray diffractometry, thermal ionization and gas source mass spectrometry. Chromatograph.

Books Recommended

- Galen.W.Ewing, 1975, Instrumental methods of chemical analysis, , 4th Ed. International student Ed. Mc Graw Hill, Book Co.,
- Manual of Mineralogy, John Wiley, Klein, C and Hurlbut,Jr. C.S. John Wiley, 1983.
- Phillips, W.M.R. and Griffen, D.T. . 1986, Optical Mineralogy, CBS EdLaboratory Handbook of Hutchinson, C.S. , 1974, Petrographic techniques, John Wiley,
- Putnis, Andrew, 1992, Introduction to Mineral Sciences, , Cambride University press,
- Sharma, B.K.1998, Instrumental methods of chemical analysis, GOEL, Publishing House, Meerus.
- Spear,F.S,1993, Mineralogical phase Equilibria and pressure-Temperature-Time paths. . Mineralogical Society of America Pub
- Deer, W.A., Howie, R.A., and Nuclear structure, atomic weights, Zussman. 1996.The Rock forming minerals, Longman, London.

IGYO106.1-Optional IV MEDICAL GEOLOGY (Internal)

OBJECTIVE: The geochemistry of the environments have a marked influence on their health, giving rise to diseases that affect millions of people This paper aims to expose the students on the interaction of Human beings with the geochemistry of the earth environment.

UNIT-I General characteristics of tropical , subtropical environments, arid zone, seasonally dry tropics and sub-tropics, humid tropics, and sub-tropics zone and mountainous zone. Rock weathering and soil formation, weathering of mineralized terrains, weathering profiles. Weathering and formation of secondary minerals. Chemistry of weathering of ultra-basic rocks.

UNIT-II Medical Geology- Perspectives and Prospects, Public Health and Geological Processes: An Overview of a Fundamental Relationship. Environmental Biology-Natural Distribution and Abundance of Elements, Anthropogenic Sources, Uptake of Elements on Chemical and Biological Perspective and its functions, Geological Impacts on Nutrition.

UNIT-III Pathways and Exposure- Volcanic Emissions and Health, Radon in Air and Water, Arsenic in Groundwater and the Environment. WHO and BIS Standards for drinking water. Fluoride in Natural Waters, soils, sediments, plants. Fluorides and health: Bioavailability of fluoride, Dental fluorosis, Skeletal fluorosis, Dental fluorosis in India, source, nature, cause and extent. Water Hardness and Health Effects, Geochemical basis for tropical endomyocardial fibrosis (EMF), Effect of water hardness on urinary stone formation

(urolithiasis), Types of stones: Calcium oxalate, Calcium phosphate, Uric acid, Magnesium ammonium phosphate stones, Cysteine.

UNIT-IV Iodine and health: The iodine cycle in the environment, Iodine in drinking water, Iodine in food, Iodine Deficiency Disorders (IDD), Endemic cretinism, Goitrogens .The nitrogen cycle, Nitrate as fertilizers and environment, Nitrogen loading in rice fields, Nitrates from human and animal wastes, Nitrates and health, Nitrates and Methemoglobinemia, Nitrates and cancer. Bioavailability of Elements in Soil, Selenium Deficiency and Toxicity in the Environment, Soils and Iodine Deficiency, Natural Aerosolic Mineral Dusts and Human Health, Animals and Medical Geology. The Impact of Micronutrient Deficiencies in Agricultural Soils and Crops on the Nutritional Health of Humans.

UNIT-V : Environmental Toxicology, Environmental Epidemiology, Environmental Medicine, Environmental Pathology, Speciation of Trace Elements. Techniques and Tools- GIS in Human Health Studies, Investigating Vector-Borne and Zoonotic Diseases with Remote Sensing and GIS. Mineralogy of Bones, Inorganic and Organic Geochemistry Techniques, Histochemical and Microprobe Analysis in Medical Geology.

Books Recommended

- C.B. Dissanayake and R.Chandrajith (2009). Introduction to Medical Geology, Springer, London
- H.Catherine, W.Skinner, Antony R. Berger(2003). Geology and Health: Closing gap, Oxford Univ. press, New York.
- Iosif F.Volfson (2010). **Medical Geology: Current Status and Perspectives, 2010.**, Russian Geological Society (ROSGEO) Publisher. Moscow.
- K.S. Valdiya (2004). Geology, environment, Society, University press(India), Hyderabad.
- Lawrence K. Wang, Jiaping Paul Chen, Yung-Tse Hung, Nazih K. Shammass (2009). Heavy Metals in the Environment , CRS Press, Taylor & Francis Group, Boca Raton, FL
- M.M. Komatica, (2004) Medical Geology, Vol.2, Effects of geological environment on Human health , Elsevier, U.K.
- Oile Selinus, B. Elsevier(2003). Essentials of Medical Geology (2005), Acemedita Press., U.K.
- Oile Selinus, B. Finkleman, R.B., A.Jose (2010) Medical Geology- Regional synthesis(2010), Springer, London.
- Scott S. Olson, (1999) International Environmental Standards Handbook , CRC Press, London.
- William N.Rom, (2012). Environmental Policy and Public Health - Air Pollution, Global Climate Change, and Wilderness, by John Wiley & Sons, Inc. Published by Jossey-Bass A Wiley Imprint.

IGYO106.2-Optional IV APPLICATION OF SOFTWARE IN GEOSCIENCES (Internal)

Objective: to understand applications of the basic softwares used in the interpretation of the geological data

UNIT I: Interpretation and analysis of Geological data using MS- office, IGPET, WATEQ4F

UNIT II:Applications, Principles of data input, processing, interpretation in software like PHREEQC and MODFLOW

UNIT III:ARCGIS, Mapinfo for spatial analysis and integration of complex geological and geophysical data. ERDAS IMAGINE as image-processing tools for analyzing remotely sensed data.

UNIT IV:Overview of geostatistical analysis using statistical package SPSS, Graphical analytical packages like Surfer and RockWorks for both 2-D surfaces.

UNIT – Data Interpretation: Toposheets, Aerial photographs, Satellite imageries. Interpretation of Meteorology data: rainfall, temperature, wind, humidity; Interpretation of borehole logs, litho log, SP log, Resistivity log, Gamma log, neutron log.

M.Sc. GEOLOGY
(CBS) (FIVE YEAR INTEGRATED PROGRAMME) (2017-2018)
SCHEME OF SYLLABUS

SEMESTER – I

Course code	Theory & Practical	L	P	C
ITAC 11	Language- I Tamil / Hindi/French	3		3
IENC 12	Language- II English	3		3
ICEC 13	Civics, Environmental awareness & Health	3		3
IGYT 14	Physical & Dynamic Geology	5		5
CHEA	Ancillary I Chemistry-I (Compulsory)	5		5
	Total	19		19

SEMESTER – II

Course code	Theory & Practical	L	P	C
ITAC 21	Language- I Tamil / Hindi/French	3		3
IENC 22	Language- II English	3		3
ICAC 23	Computer Application	3		3
IGYT 24	General Geology	5		5
CHEA	Ancillary- I Chemistry –II	5		5
CHEAP	Practical – I Chemistry Practical		8	3
	Total	19	8	22

SEMESTER – III

Course code	Theory & Practical	L	P	C
ITAC 31	Language- I Tamil / Hindi/French	3		3
IENC 32	Language- II English	3		3
IGYT 33	Physics of the earth (Dept. of Physics)	5		5
IGYT 34	Paleontology and Micropalaeontology	5		5
PHA-I	Ancillary - II Physics-I	5		5
IGYP 35	Practical –II Paleontology and Micropaleontology		10	4
	Total	21	10	25

Field visit to various Paleontological significant areas

SEMESTER – IV

Course code	Theory & Practical	L	P	C
ITAC 41	Language- I Tamil / Hindi/French	3		3
IENC 42	Language- II English	3		3
IGYT 43	Mineralogy and crystallography	5		5
PHA-II	Ancillary- II Physics –II	5		5
IGYP 44	Practical - III Mineralogy & Crystallography		11	5
PHA	Practical - IV Physics		8	3

	Total	16	19	24
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Field visit to various structural & Mineralogical features

SEMESTER – V

Course code	Theory & Practical	L	P	C
IGYT 51	Igneous Petrology	5		5
IGYT 52	Industrial Minerals and Mineral Economics	5		5
IGYT 53	Field Geology	5		5
IGYP 54	Practical – V Igneous Petrology and Industrial Minerals		11	5
	Total	15	11	20

SEMESTER – VI

Course code	Theory & Practical	L	P	C
IGYT 61	Global Tectonics	5		5
IGYT 62	Aerial photography, Cartography and GPS	5		5
IGYT 63	Metamorphic and Sedimentary Petrology	5		5
IGYT 64	Mineral Beneficiation	5		5
IGYP 65	Practical – VI Metamorphic, Sedimentary petrology, Aerial Photography and Mineral Beneficiation		11	5
	Total	20	11	25

TOTAL CREDITS UPTO VI TH SEMESTER = 135

Semester-VII

Course code	Theory & Practical	L	P	C
IGYT 71	Geomorphology and Structural Geology	4		4
IGYT 72	Advanced Crystallography, Mineralogy and Mineral Optics	4		4
IGYT 73	Indian Stratigraphy and Marine Geology	4		4
	Soft Skills	4		4
IGYP 74	Practical – VII Structural geology, Crystallography and Field reports		10	4
	Total	16	10	20

Geological Mapping training - two week's duration

Semester- VIII

Course code	Theory & Practical	L	P	C
IGYT 81	Geophysical Exploration	4		4
IGYT 82	Remote Sensing and GIS	4		4
IGYT 83	Hydrogeology and Engineering Geology	4		4
IGYP 84	Practical – VIII Mineralogy, Mineral Optics		10	4
IGYP 85	Practical –IX. Remote Sensing, Digital Image processing		10	4

	and GIS			
IGYP86	Practical- X Geophysics, Hydrogeology, Engineering Geology and Survey		10	4
	Optional - I Statistics Applications	4		4
	Total	16	30	28

Industrial/ institutional training –Three/four week’s duration.

Semester- IX

Course code	Theory & Practical	L	P	C
IGYT 91	Economic Geology and Mining Geology	4		4
IGYT 92	Geological and Geochemical Exploration	4		4
IGYT 93	Advanced Petrology	4		4
IGYO 94	Optional –II Environmental Geology and Disaster management (Internal)	4		4
IGYP 95	Practical – XI Economic Geology and Geochemistry		10	4
	Total	16	10	20

Short Field visits to nearby geologically interesting places during week end & holidays

Semester-X

Course code	Theory & Practical	L	P	C
IGYT 101	Coal and Petroleum Geology	4		4
IGYT 102	Atmospheric sciences and Meteorology	4		4
IGYP 103	Practical X Petrology and Petrochemistry		10	4
IGYP 104	Dissertations and Viva –Voce		6	2
IGYO 105.1 105.2	Optional III Isotope Geology and Nuclear Geology (internal) (OR) Instrumentation Techniques in geosciences (Internal)	4		4
IGYO 106.1 106.2	Optional – IV Medical Geology (OR) Application of Software in Geosciences	4		4
	Total	16	16	22

OVERALL TOTAL CREDIRTS = 225 (CORE 149: OPTIONAL =16: SOFT SKILL =4 ANCILLARY =26: LANGUAGE= 24: COMPUTER APPLICATION = 3: CIVICS, ENVIRONMENTAL AWARENESS & HEALTH =3).