



UNIVERSITY OF JAMMU
NOTIFICATION
(11/July/ ADP/22)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, has been pleased to authorize the adoption of the revised Syllabi and Courses of Study in the subject of Geology for B.A./B.Sc. Part I of Three Year (General) Degree Course and for M.A./M.Sc. I Semester of Master's Degree Programme, for the examination to be held in the years as under alongwith %age of change:-

<u>Class</u>	<u>Part</u>	<u>For the Examinations to be held in the year</u>	<u>%age of change</u>
B.A./B.Sc.	I	2012, 2013 and 2014	Paper-A- 25% Paper-B- 75%

M.A./M.Sc. Semester-I

S.No.	Course No.	For the examinations to be held in the year	%age of change
1.	420	Dec 2011,2012,2013	100%
2.	421	Dec 2011,2012,2013	100%
3.	422	Dec 2011,2012,2013	100%
4.	423	Dec 2011,2012,2013	100%
5.	424	Dec 2011,2012,2013	100%
6.	425	Dec 2011,2012,2013	100%
7.	426	Dec 2011,2012,2013	100%
8.	427	Dec 2011,2012,2013	100%

The alternative question papers are required to be set as per the regulations given below:-

- i). If the change in the Syllabi and Courses of Study is less than 25%, no alternative Question papers to be set.
- ii). If the change is 25% and above but below 50% alternative Question Papers to be set for one year.
- iii). If the change is 50% and above or whole scheme is changed, alternative Question Papers be set for two years.

Sd/-
REGISTRAR

F.Acd./26/11/ 4435-69
Dated: 01-08-2011

Copy for information and necessary action to:

1. Special Secretary to Vice-Chancellor, University of Jammu;
2. Sr.P.A. to Registrar/Controller of Examinations;
3. Dean, Faculty of Science;
4. Convener, Board of Studies in Geology;
5. Members of the Board of Studies concerned;
6. Principals of the concerned Colleges;
7. C.A. to Controller of Examinations;
8. Deputy/ Asstt. Registrar (Conf./Exams. P.G/U.G./Inf./Pub./Admission/DDE);
9. S.O (Confidential); and
10. Content Manager, University Website.

Asst. Registrar (Academics)

UNIVERSITY OF JAMMU

Syllabi and Courses of study in Geology for B.Sc. Part – I Examinations
to be held in the years 2012, 2013 & 2014

There shall be two theory papers and one practical paper of 50 marks each. Each theory paper shall be of three hours duration and the practical paper shall be of four hours duration. 20% of the marks shall be reserved for internal assessment in each theory paper and 50% in practical paper. Each theory paper will be set for 40 marks and practical paper for 25 marks. In case of regular students, internal assessment received from the colleges will be added to the marks obtained by them in the University Examination and in case of private candidates, marks obtained by them in the University Examination shall be increased proportionately in accordance with the statutes/regulations.

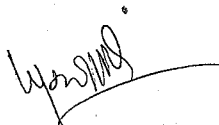
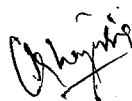
PAPER – A

UNIT – 1

- 1.1 The earth's origin theories of Kant-Laplace, Jeans and Jeffrey's, Big Bang Theory, Formation of core, mantle and crust, conversion in earth's core, earth's magnetic field.
- 1.2 Geochronology and its application in Geology, Radioactive Dating Methods, C¹⁴ and U-Pb methods.
- 1.3 Earthquakes – predictions, earthquake belts of the world, seismic zones of India. Volcanoes – types and distribution.
- 1.4 Rock weathering – types, factors favouring weathering, erosional and depositional Features produced by wind and river. Karst topography.
- 1.5 Glaciers – types, erosional and depositional features, glaciations through geological ages.

UNIT – 2

- 2.1 Concept of continental drift, plate tectonics, types of margins with reference to Himalaya.
- 2.2 Sea floor spreading, island arcs and trenches.
- 2.3 Identification of bedding, methods of measuring strike, dip and thickness of beds.
- 2.4 Unconformity – types and recognition in the field.
- 2.5 Classification of Folds and Faults.



UNIT- 3

- 3.1 Minerals – definition, classification of silicate minerals based on silicate structures.
- 3.2 The significance of physical properties and their utility in identification of minerals , Mohs scale of hardness and its significance.
- 3.3 Physical properties and the chemical composition of Feldspar and Mica Groups.
- 3.4 Physical properties and the chemical composition of Amphibole and Pyroxene Groups.
- 3.5 Physical properties and the chemical composition of Garnet and Olivine Groups.

UNIT – 4

- 4.1 Crystal structure , morphology of crystals, faces, edges, solid angle and zones.
- 4.2 Crystallographic axes and axial angle, notation of faces on parameters of Weiss and Miller Indices.
- 4.3 Crystal symmetry and forms of normal Classes of Cubic, Tetragonal and Hexagonal Systems.
- 4.4 Crystal symmetry and forms of Normal Classes of Orthorhombic, Monoclinic and Triclinic Systems.
- 4.5 Elementary idea about crystal twinning and their types with examples of common laws based on six crystal systems.

UNIT – 5

- 5.1 Petrological microscope, its parts and behaviour of light through microscope. Polarized light, Pleochroism, Birefringence, Interference, Colours, Extinction angle.
- 5.2 Isotropism, Anisotropism, Double Refraction, Nicol Prism, its construction and function.
- 5.3 Reflection, Refraction, Refractive index and methods of its determination, critical angle.
- 5.4 Concept of optic axis, uniaxial and biaxial minerals.

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Note for paper setting

The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total questions to be attempted will be five) i.e. there will be internal choice within each unit.

Books Recommended

- | | |
|---------------------------|---------------------------------------|
| 1. A. Holmes | - Principles of Physical Geology |
| 2. Thornburry | - Geomorphology |
| 3. Deer, Hawie & Zuessman | - Rock forming minerals |
| 4. Bagley, P.C | - Structure and tectonics. |
| 5. Gosh, S.K | - Structural Geology |
| 6. Dana, E.S | - A text book of mineralogy. |
| 7. Kerr, P.G | - Optical mineralogy |
| 8. Condie | - Plate tectonics & crustal evolution |

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PAPER – B

UNIT – 1

- 1.1 Igneous rocks- definition, classification, tabular and normative.
- 1.2 Origin of igneous rocks, magmatic differentiation and assimilation
- 1.3 Magma – definition and its composition, Bowen's reactions series.
- 1.4 Textures and structure of igneous rocks.
- 1.5 Description of important igneous rocks i.e, Granite, Rhyolite, Basalt, Gabbro, Syenite, Trachyte, Pegmatite and Peridotite.

UNIT – 2

- 2.1 Felsic, femic, mafic and salic minerals, colour index and its significance.
- 2.2 Chemical composition of minerals and elementary idea about phase rule.
- 2.3 Use of phase rule in two and three component silicate systems, crystallization of albite-anorthite, plagioclase series, di-ab-an system.
- 2.4 Minerological characteristics of acid and alkaline igneous rocks.
- 2.5 Minerological characteristics of basic and ultramafic igneous rocks.

UNIT – 3

- 3.1 Sedimentary rocks- origin, transportation and deposition.
- 3.2 Diagenesis and Lithification.
- 3.3 Classification of clastic rocks
- 3.4 Classification of non-clastic rocks

UNIT – 4

- 4.1 Textures of sedimentary rocks.
- 4.2 Structures of sedimentary rocks.
- 4.3 Concept of sedimentary facies.
- 4.4 Depositional environments of sedimentary rocks.
- 4.5 Description of important sedimentary rocks i.e. Sandstone, Shale, Limestone, Conglomerate and Breccia.

UNIT- 5

- 5.1 Metamorphism, agents and types.
- 5.2 Textures and structures of metamorphic rocks.
- 5.3 Concept of ACF & AKF diagrams.
- 5.4 Metamorphic facies - greenstone, granulite and eclogite facies.
- 5.5 Description of important metamorphic rocks i.e. Slate, Phyllite, Schist, Gneiss, Quartzite and Marble.

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Note for paper setting

The question paper will contain two questions from each unit (total ten questions) and the candidates will be required to answer one question from each unit (total questions to be attempted will be five) i.e. there will be internal choice within each unit.

Books Recommended

- | | |
|--------------------------------|---|
| 1. H.H.Reed | - Rutley's Mineralogy |
| 2. Tyrrel | - Principles of Petrology |
| 3. Deer, Hawie & Zuessman | - Rock forming minerals |
| 4. Myron, G | - Igneous & Metamorphic Petrology |
| 5. Turner | - Metamorphic Petrology |
| 6. Dana, E.S | - A text book of mineralogy. |
| 7. Wilson | - Carbonate Rocks in Geologic History. |
| 8. Petijohn | - Sedimentary Rocks |
| 9. Reineck & Singh, I.B | - Depositional Sedimentary Environments |
| 10. Friedman, Gorale & Sanders | - Principles of Sedimentology. |

PRACTICALS:

1. Megascopic study of minerals as per syllabus.
2. Megascopic study of rocks as per syllabus.
3. Preparation of cross section of geological map and writing of geological history.
4. Field work and its report – an essential component of 05 marks.
5. Viva- Voce.

Issued to

W. J. M. S.

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Annexure - I

PORPOSED COURSE STRUCTURE FOR M. Sc. GEOLOGY (From 2011 onward)

SEMESTER - I

<u>Course No.</u>	<u>Title of the course</u>	<u>Credits</u>
420	Structural Geology	2
421	Geomorphology	2
422	Optical Mineralogy	2
423	Principles of Stratigraphy & Precambrian Stratigraphy	2
424	Clastic Sedimentology	2
425	Essentials of Invertebrate Palaeontology	2
426	Fundamentals of Remote Sensing	2
427	Field Geology	2
428	Practical related to course No's. 420, 422 & 425	4
429	Practical related to course No's. 423, 424 & 426	4

*Week end Field work of 1-2 weeks for Geological/Structural mapping and the report of the Field work will be evaluated for 15 marks each in both the External Practical Examinations.

SEMESTER - II

<u>Course No.</u>	<u>Title of the course</u>	<u>Credits</u>
475	Elements of Hydrogeology	2
476	Non-Clastic Sedimentology	2
477	Igneous Petrology	2
478	Indian Phanerozoic Stratigraphy	2
479	Geotectonics	2
480	Ore Geology	2
481	Descriptive Mineralogy	2
482	Environmental Geology	2
483	*Practicals relating to Course Nos. 475, 476, 477	4
484	*Practicals relating to Course Nos. 479, 480, 481	4

*Geological Field work of 2-3 weeks in the Himalayan Terrain. The report will be evaluated for 15 marks each in both the External Practical Examinations.

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SEMESTER - III

<u>Course No.</u>	<u>Title of the course</u>	<u>Credits</u>
520	Metamorphic Petrology	2
521	Vertebrate Palaeontology & Palaeobotany	2
522	Ground Water	2
523	Petroleum Geology	2
524	Coal Geology	2
525	Geochemistry	2
526	Mining Geology	2
527	Oceanography	2
528	*Practicals relating to Course Nos. 520,521,522	4
529	*Practicals relating to Course Nos. 523, 524,526	4

*Geological Field work for 2-3 weeks. The Field Report will be evaluated for 15 marks each in both the External Practical Examinations.

SEMESTER - IV

<u>Course No.</u>	<u>Title of the course</u>	<u>Credits</u>
580	Geo-physical Exploration	2
581	Geo-chemical Exploration	2
582	Applied Micropalaeontology	2
583	Sedimentary Basin Analysis	2
584	Application of Remote Sensing & G I S in Geology	2
585	Engineering Geology	2
586	Natural Hazards & Disaster Management	2
587	Glaciology	2
588	*Practicals relating to Course Nos. 580, 582	4
589	*Practicals relating to Course Nos. 583, 584	4

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SYLLABUS

M.Sc. Geology

FIRST SEMESTER

(Examinations to be conducted in December 2011, December 2012 and December 2013)

Course No.	Title	Credits
Theory		
420	Structural Geology	2
421	Geomorphology	2
422	Optical Mineralogy	2
423	Principles of Stratigraphy & Precambrian Stratigraphy	2
424	Clastic Sedimentology	2
425	Essentials of Invertebrate Palaeontology	2
426	Fundamentals of Remote Sensing, GIS and GPS	2
427	Field Geology	2
Practical		
428	Practical related to course No's. 420, 422 & 425	4
429	Practical related to course No's. 423, 424 & 426	4

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DETAILED SYLLABUS

SEMESTER - I

Course No.- 420

STRUCTURAL GEOLOGY

Credits – 2

Maximum Marks : 50

Duration of Examination : 2 ½ Hours

(Syllabus for the examinations to be held in December 2011, December 2012 & December 2013)

Objectives To impart knowledge about the behaviour of rocks under stress and strain, foliation-lineation fabric elements and mechanics of folding and faulting.

UNIT-I

- 1.1 Mechanical principles and behavior of rocks under stress.
- 1.2 Concept of stress and strain, components of stress, state of stress at a point.
- 1.3 Concepts of stress and strain ellipses and ellipsoids.
- 1.4 Strain markers in naturally deformed rocks.

UNIT-II

- 2.1 Translations, rotation, dilation and distortion, measurement of strain, displacement.
- 2.2 Strain analysis by Moh's Circle Technique and Wellman Diagram.
- 2.3 Concept of petrofabrics and the role of symmetry, indicator minerals and fabric diagrams.
- 2.4 Rockfabric field relations, planar and linear fabric elements (foliation and lineation), tectonic significance.

UNIT-III

- 3.1 Mechanics of folding and buckling.
- 3.2 Fold development and distribution of strain in folds.
- 3.3 Geometry of boundinage structure and its significance.
- 3.4 Geometrical relation of boundins with folds.

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UNIT-IV

- 4.1 Nomenclature and age relationship of joints and faults.
- 4.2 Joints in relation to stresses and their geometrical relationship with folds and faults.
- 4.3 Orientation analysis and their relationship with tectonic cycle.
- 4.4 Mechanical aspects of faulting.

Books Recommended

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|----|-----------------------------------|--|
| 1. | Bagley, P.C. | Structure and Tectonics |
| 2. | Ramsay, J.G. | Folding and fracturing of Rocks |
| 3. | Hobbs, B., Means W. & William, P. | An Outline of Structural Geology |
| 4. | Gosh, S.K. | Structural Geology: Fundamentals & Modern Developments |
| 5. | Dennis, J.G. | Structural Geology: An Introduction |

Note for Paper Setter

The paper setter is required to set the question paper as per the scheme given below.
The candidate has to attempt all the three questions.

Q.No. 1:- Ten multiple choice questions with four options, selecting from all the four units of the syllabi uniformly as far as possible. *(1 mark for each question)*

Q.No. 2:- Four short answer questions selecting uniformly from all the four units of the syllabi. *(5 marks for each question)*

Q. No.3:- Two essay type question with internal choice selecting from all the four units of the syllabi. *(10 marks for each question)*

(Paper setter has to provide the key for objective type questions)

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(Convenor)*

Course No.- 421

GEOMORPHOLOGY

Credits – 2

Maximum Marks : 50

Duration of Examination : 2 ½ Hours

(Syllabus for the examinations to be held in December 2011, December 2012 & December 2013)

Objectives: To introduce the fundamental concepts governing the landforms. Acquaintance with the concept of various geomorphological processes and landform evolution. Introduce the latest concept of chronology based on geomorphological studies in tectonic zones.

UNIT-I

- 1.1 Geomorphological processes, elements-physical, chemical and biological.
- 1.2. Landform in relation to lithology and structure.
- 1.3. Landform evolution by geomorphological agencies, namely fluvial and glaciers.
- 1.4. Qualitative and quantitative analysis of basins and drainage density.

UNIT-II

- 2.1 Landform evolution by geomorphological agencies, namely aeolian and marine.
- 2.2. Landform evolution of soluble rock terrain-processes and features.
- 2.3. Landform evolution by mass movements-process, classification, slope failures, subsidence.
- 2.4. Classification of slopes, forms, slope regression, slope maps and slope evolution.

UNIT-III

- 3.1 Factors of weathering-mechanical disintegration, chemical decomposition.
- 3.2. Determination of weathering indices and ratios
- 3.3 Geomorphology and soil formation-effect of latitude and altitude
- 3.4 Palaeopedology-concept and application

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UNIT-IV

- 4.1. Geomorphology and global tectonics-aim and context, Davisian dogma, erosion surfaces, denudational chronology and tectonics, geomorphological evidences of neotectonics in India.
- 4.2. Morphotectonic evolution of Himalaya and Tibetan Plateau.
- 4.3. Evolutionary history of Thar desert of India.
- 4.4. Morphotectonic evolution of Western Ghats of India.

Books Recommended

- | | | |
|----|------------------|--|
| 1. | F.A. Pitty | Introduction to Geomorphology |
| 2. | Donj-Easterbrook | Principles of Geomorphology |
| 3. | C. Ollier | Tectonics and Landforms |
| 4. | C. Ollier | Weathering |
| 5. | Thornbury | Geomorphology |
| 6. | A. Bloom | Fluvial Geomorphology |
| 7. | C.A.M. King | Introduction to Marine Geology and Geomorphology |
| 8. | K.S. Valdiya | Aspects of Tectonics |

Note for Paper Setter

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Q.No. 1:- Ten multiple choice questions with four options, selecting from all the four units of the syllabi uniformly as far as possible. (1 mark for each question)

Q.No. 2:- Four short answer questions selecting uniformly from all the four units of the syllabi. (5 marks for each question)

Q. No.3:- Two essay type question with internal choice selecting from all the four units of the syllabi. (10 marks for each question)

(Paper setter has to provide the key for objective type questions)

Asst. Prof.
(Convener)

Course No.- 422

OPTICAL MINERALOGY

Credits – 2

Maximum Marks : 50

Duration of Examination : 2 ½ Hours

(Syllabus for the examinations to be held in December 2011, December 2012 & December 2013)

Objectives To impart knowledge about the concepts and mechanism of various optical properties of crystals.

UNIT-I

- 1.1 Elements of optics: Nature of light, electromagnetic spectrum, total internal reflection and critical angle, wave and wave front.
- 1.2 Lenses used in petrological microscopes, aberrations in lenses.
- 1.3 Linear, circular and elliptical polarized light; Methods of obtaining plane polarized light.
- 1.4 Phase difference, retardation, interference of light.

UNIT-II

- 2.1 Index of refraction and relief, determination of indices of refraction: Becke line method, central illumination method, oblique illumination method, dark field immersion method, method of minimum deviation.
- 2.2 Pleochroism and determination of pleochroic schemes for uniaxial and biaxial minerals.
- 2.3 Optical accessories and their uses, interference colours, abnormal interference colours.
- 2.4 Extinction and its categories, measurement of extinction angle, uses of extinction angle.

UNIT-III

- 3.1 Optical indicatrix: uniaxial and biaxial indicatrix and their principal sections, optic orientation of biaxial indicatrix.
- 3.2 Conoscopic illumination, formation of isogyres and isochromes in uniaxial minerals, optic axis and off centered optic axis interference figures, determination of optic sign.
- 3.3 Biaxial interference figures: acute and obtuse bisectrix figures, determination of optic sign.
- 3.4 Optic angle determination: Mallord's method, Tobi's method, Kamb's method and Wright's method.

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UNIT- IV

- 4.1 Universal Stage, its construction and uses.
- 4.2 Dispersion in biaxial minerals, anomalous dispersion.
- 4.3 Nature of X-ray, generation and spectra of X-rays, filters, Bragg's Law.
- 4.4 X-ray diffraction: single crystal (stationary and moving) method and powder method.

Books Recommended

- | | | |
|-----|-----------------------|---|
| 1. | Whalstrom, E. E. | Optical Crystallography |
| 2. | Nesse, W.D. | Introduction to Optical Mineralogy |
| 3. | Dana, E.S | A Textbook of Mineralogy |
| 4. | Mitra, S. | Fundamentals of Optics Spectroscopic & X-ray Mineralogy |
| 5. | Ehlers, E.G. | Optical Mineralogy |
| 6. | Kerr, P.G. | Optical Mineralogy |
| 7. | Naidu, P.R.J | Optical Mineralogy |
| 8. | Philips, W.R. | Mineral Optics |
| 9. | Sholley, P. | Manual of Optical Mineralogy |
| 10. | Winchel, A.N | Elements of Optical Mineralogy |
| 11. | Mckie, D. & Mckie, C. | Crystalline Solids |
| 12. | Wolfson M.M. | X-Ray Crystallography |

Note for Paper Setter

The paper setter is required to set the question paper as per the scheme given below.
The candidate has to attempt all the three questions.

Q.No. 1:- Ten multiple choice questions with four options, selecting from all the four units of the syllabi uniformly as far as possible. (1 mark for each question)

Q.No. 2:- Four short answer questions selecting uniformly from all the four units of the syllabi. (5 marks for each question)

Q. No.3:- Two essay type question with internal choice selecting from all the four units of the syllabi. (10 marks for each question)

(Paper setter has to provide the key for objective type questions)

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Course NO: 423

Principles of Stratigraphy & Precambrian Stratigraphy

Credits: 2

Duration of Examination: 2^{1/2} Hrs

Max. Marks: 50

(Syllabus for the examination to be held in Dec.2011, 2012 and 2013)

- Objectives :**
1. To impart working knowledge of stratigraphic methods.
 2. To introduce the concept of the distribution of Precambrian Shield belts and their evolution.
 3. To study the methods of correlation.

UNIT - 1

- 1.1 Stratigraphic concepts and principles of uniformitarianism, measurement of geological time.
- 1.2 Concept of stratum, stratification and vertical sequence, concept of cyclothem and cyclic sequences.
- 1.3 Principles of stratigraphic classification, litho- bio-, and chronostratigraphy and their mutual relationships.
- 1.4 Types of biostratigraphic zones, code of stratigraphic nomenclature, general rules, informal names and stratotypes.

UNIT - 2

- 2.1 Geological record and its imperfections, types of unconformities and their significance.
- 2.2 Concept of facies and variations, lateral and vertical variations, lithological, structural and thickness variation.
- 2.3 Principles and methods of litho- bio- and chronostratigraphic correlation.
- 2.4 Magnetostratigraphy and its application, application and problems of C14, fission track and absolute age dating.

UNIT - 3

- 3.1 Precambrian time scale its classification and correlation.
- 3.2 Shield areas of the world, their distribution, tectonic setting and stratigraphic significance.
- 3.3 Evolution of Indian shield in space and time.
- 3.4 Major Precambrian belts of Peninsular India and their tectonic setting.

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UNIT - 4

- 4.1 Stratigraphy of Archean rocks of Karnataka, Madhya Pradesh, Singhbhum & Rajasthan and their geochronological relationship.
- 4.2 Distribution of Proterozoic rocks in India viz. Cuddapah, Vindhyan, Kaladgi, Kurnool, and Bhima.
- 4.3 Stratigraphic significance and distribution of Precambrian rocks in the Himalaya viz. Vaikrita, Haimanta, Salkhala, Dogra Slate, Jutogh, Chail, Shimla Slate and Darjeeling Formations.
- 4.4 Stratigraphic relationship of the rock formations of Lesser Himalaya viz. Chandpur, Mandhali, Nagthat, Jaunsar, Blaini, Infra-Krol, Krol and Shali.

Books recommended :

- 1 Weller, J.M. Stratigraphic Principles and Practice.
- 2 Dubbar and Rodger Principles of stratigraphy.
- 3 Hedberg International Stratigraphic Guide.
- 4 GSI Publ. 20 Code of Stratigraphic Nomenclature.
- 5 Krishnen, M.S Geology of India and Burma.
- 6 Pasco, E.H Manual of Geology of India & Burma, Vol. 1
- 7 Wadia, D.N Geology of India.
- 8 Ravinder Kumar Fundamentals of Historical Geology & Stratigraphy of India.
- 9 Naqvi Precambrian Geology of India.
- 10 Pichamuthu Archean Geology.

Note for paper setting:

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The candidate has to attempt all the three questions.

Q.No. 1:- Ten multiple choice questions with four options, selecting from all the four units of the syllabi uniformly as far as possible. *(1 mark for each question)*

Q.No. 2:- Four short answer questions selecting uniformly from all the four units of the syllabi. *(5 marks for each question)*

Q. No.3:- Two essay type question with internal choice selecting from all the four units of the syllabi. *(10 marks for each question)*

(The paper setter has to provide the key for the objective type questions)

Issued by
(Convenor)

Course No.- 424

CLASTIC SEDIMENTOLOGY

Credits – 2

Maximum Marks : 50

Duration of Examination : 2 ½ Hours

(Syllabus for the examinations to be held in December 2011, December 2012 & December 2013)

Objectives: To impart knowledge about the processes operating in clastic sedimentology.

UNIT-I

- 1.1 Concept of grain size, grade-scale, phi-scale; Techniques of size analysis: sieve and pipette analysis.
- 1.2 Graphic presentation of grain size data; Textural parameters and their significance.
- 1.3 Particle morphology; shape forms, sphericity, roundness, surface textures and their significance.
- 1.4 Primary grain fabric: orientation of sand grains, gravels and fossils

UNIT-II

- 2.1 Basic properties of fluids, laminar and turbulent flows, rapid and tranquil flows
- 2.2 Streamlines, flow regimes, flow separation
- 2.3 Sediment transport modes; sediment gravity flows: mud flows, grain flow, liquefied flows, turbidity flows
- 2.4 Porosity and permeability, pore morphology, effect of texture on porosity

UNIT-III

- 3.1 Texture, structure and classification of shales
- 3.2 Classification of Conglomerates and sandstones
- 3.3 Sandstone petrography and diagenesis
- 3.4 Mineralogical and textural maturity of sediments, heavy minerals and their significance

UNIT-IV

- 4.1 Nature and significance of bedding, Graded beds
- 4.2 Sole marks: types, mode of formation, significance
- 4.3 Mode of formation and types of ripple marks and cross beddings
- 4.4 Deformational sedimentary structures and their significance.

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Books Recommended

- | | | |
|----|------------------------------------|--|
| 1 | Miall, Andrew D. | Principles of Sedimentary Basin Analysis |
| 2 | Lindholm, R. C. | A Practical Approach to Sedimentology |
| 3 | Collinson, J. D. & Thompson, D. B. | Sedimentary Structures |
| 4 | Reineck, H. E. & Singh, I. B. | Depositional Sedimentary Environments |
| 5 | Allen, J.R.L. | Physical processes of Sedimentation |
| 6 | Reading, H.G. | Sedimentary Environments |
| 7 | Petijohn, F.J. & Potter | Sand and Sandstone |
| 8 | Petijohn, F.J. | Sedimentary rocks |
| 9 | Friedman, M. Gorale & Sanders | Principles of Sedimentology |
| 10 | Selley, R.C. | Applied Sedimentology |
| 11 | Bjorlykke, K. | Sedimentology and Petroleum Geology |

Note for Paper Setter

The paper setter is required to set the question paper as per the scheme given below.
The candidate has to attempt all the three questions.

Q.No. 1:- Ten multiple choice questions with four options, selecting from all the four units of the syllabi uniformly as far as possible. (1 mark for each question)

Q.No. 2:- Four short answer questions selecting uniformly from all the four units of the syllabi. (5 marks for each question)

Q. No.3:- Two essay type question with internal choice selecting from all the four units of the syllabi. (10 marks for each question)

(Paper setter has to provide the key for objective type questions)

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Course No.- 425

ESSENTIALS OF INVERTEBRATE PALAEONTOLOGY

Credits – 2

Maximum Marks : 50

Duration of Examination : 2 ½ Hours

(Syllabus for the examinations to be held in December 2011, December 2012 & December 2013)

Objectives To understand the basic principles of organic evolution and their application in palaeontology. To have an extensive knowledge of evolution and distribution of the important invertebrate fossil organisms. Application of international code of nomenclature for taxonomic studies.

UNIT-I

- 1.1 Diversity of life on the earth with major adaptive events – origin of metazoan, skeletalizations, predation, terrestrialization, trees and forests, flight and consciousness.
- 1.2 Classification of organisms on land and sea, distribution and dispersal of organisms.
- 1.3 Mass extinctions – patterns, selectivity, timing, periodicity and causes of mass extinction.
- 1.4 Type specimens, fixing and nature of type specimens, methods of fossil identification and description, law of priority, homonymy and synonymy, statistical methods and their limitations.

UNIT-2

- 2.1 Ichnology – history of invertebrate ichnology, realms of ichnology, classification of trace fossils.
- 2.1 Groups of trace fossils, borings as trace fossils and bioerosion, traces of predation, fossil tracks and impressions of vertebrates.
- 2.3 Palaeontological and stratigraphical significance of trace fossils.
- 2.4 Palaeoecological and environmental significance of trace fossils.

UNIT-3

- 3.1 Arthropods groups – classification, ontogenic developments, evolution, enrollment and coaptative structures, cephalic sutures and vision in trilobites. Faunal provinces and stratigraphical use of trilobites.
- 3.2 Brachiopoda – classification, ontogeny, evolutionary history, ecology, faunal provinces and stratigraphical use of brachiopods.
- 3.3 Bryozoa – classification, evolution, ecology and distribution, shallow water bryozoans, reef-dwelling bryozoans, living bryozoans.
- 3.4 Mollusca – classification, evolution and ecology of bivalves and cephalopods. Predation of molluscs.

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(Convenor)

UNIT-IV

- 4.1 Echinoderms – classification, morphological characters and evolution in echinoids, earliest echinoderms and their radiations.
- 4.2 Graptolites – classification, biological affinities, evolution in the shape of rhabdosomes – proximal end - thecal structure, graptolite faunal provinces, graptolites as stratigraphical indicators.
- 4.3 Cnidarians – classification, evolution and ecology of rugosa and tabulate corals. Geological use of corals as stratigraphical indicators and as geochronometers.
- 4.4 Geological history and stratigraphic significance of Ediacara fauna and Burgess shale fauna.

Books Recommended

- | | |
|--------------------------------------|--|
| 1. Morley Davis & Stubblefield, S.J. | In Introduction to Palaeontology |
| 2. Shrock, R.R & Twenhofel, W.H. | Principles of Invertebrate Palaeontology |
| 3. Black, R.M. | The Elements of Palaeontology |
| 4. Fairbridge & Jablonski | The Encyclopedia of Palaeontology |
| 5. Babin, C. | Elements of Palaeontology |
| 6. Clarkson, E.N.T. | Invertebrate Palaeontology and Evolution |
| 7. Raup, D.M. & Stanley, S.M. | Principles of Palaeontology |
| 8. Lull, R.S. | Organic Evolution |
| 9. Benton, M.J. & Harper | Basic Palaeontology |
| 10. Dodd, J.R. & Stenton, R.J. | Palaeoecology-Concept and Applications |
| 11. Frey, R.W. | The study of trace fossils |
| 12. Bromley, R.G | Trace Fossils |
| 13. Seilachers | Trace Fossils |

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(Paper setter has to provide the key for objective type questions)

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(Convenor)

Course No.- 426

FUNDAMENTALS OF REMOTE SENSING, GIS & GPS

Credits – 2

Maximum Marks : 50

Duration of Examination : 2 ½ Hours

(Syllabus for the examinations to be held in December 2011, December 2012 & December 2013)

Objectives: Remote Sensing Technology has emerged as an important tool for scientifically managing resources and environment. The technology enhanced our capability of resources exploration, mapping and monitoring on local and global scale. This course has been designed with the objectives to acquaint the students with basic principles of remote sensing, GIS and GPS.

UNIT-I Principles of Remote Sensing

- 1.1 Introduction and scope of remote sensing in assessment and evaluation of natural resources, developments of remote sensing, advantages and limitations of remote sensing.
- 1.2 Define the basic principles of satellite remote sensing: Electromagnetic Radiation (EMR) and electromagnetic spectrum, earth and atmospheric interaction with EMR
- 1.3 Remote sensing: data resources, platforms and sensors acquisition of remote sensing data.
- 1.4 Satellite remote sensing, global and Indian space mission. Different satellite exploration programs and their characteristics: LANDSAT, METEOSAT, SPOT, JERS-I, IRS.

UNIT-II Aerial photography

- 2.1 Definition and uses, basic information and specification for aerial photography. Planning and execution of photography flights.
- 2.2 Aerial camera, lens, types of aerial photographs and information records on the aerial photographs.
- 2.3 Geometry of the aerial photographs, stereoscopic vision and stereoscope. Measurement of the height difference from aerial photographs.
- 2.4 Recognition of photo-elements and terrain elements like tone, texture, pattern, shape, size; terrain elements like drainage pattern, density, type, landform characteristics, erosion behavior of rock and soil material, vegetation and land use.

UNIT-III Thermal and Microwave Remote Sensing

- 3.1 Introduction, TIR region of electromagnetic spectrum, thermal properties of material.
- 3.2 Interpretation of thermal (radiant temperature) imagery, interpretation of day and night thermal image, advantage of thermal imagery.
- 3.3 Introduction, advantage of microwave remote sensing, microwave sensors, radar operating principle.
- 3.4 Spatial resolution of SLAR system, geometric characteristic of SLAR imagery, transmission characteristic of radar signals, radar return and image characteristic, interpretation of radar image and general application microwave remote sensing.

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(Convenor)

UNIT-IV Digital Image processing and Geographical Information system

- 4.1 Digital image processing: introduction, image rectification and restoration, image enhancements and its application.
- 4.2 Introduction and application of GIS, components of geographical information system (GIS), database structures in raster and vector and its comparison.
- 4.3 Spatial data analysis: introduction to spatial data analysis and various types of spatial data analysis operations in GIS.
- 4.4 Global positioning System (GPS) and its segments, observation principle, parameters effecting the accuracy of result, main components of a GPS receiver and GPS application.

Books Recommended

- | | |
|------------------------------|--|
| 1. P.J. Curran | Principles of remote sensing |
| 2. S.A. Drury | A guide to remote sensing interpretation images of earth |
| 3. R.P. Gupta | Remote sensing in geology |
| 4. T.Lillesand & RW.Kiefer | Remote sensing and image interpretation |
| 5. V.C. Miller | Photogeology |
| 6. S.N. Pandey | Principles and application of photogeology |
| 7. A.N. Patel & S. Sundera | Principles of remote sensing |
| 8. D.P. Rao | Remote sensing for earth resources |
| 9. A. Reddy | Remote sensing and Geographical Information System |
| 10. F.F. Sabins | Remote sensing-principles and interpretation |
| 11. E.S.Seigel & A.Gillespie | Remote sensing in geology |
| 12. W.L. Smith | Remote sensing in geology |

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(Paper setter has to provide the key for objective type questions)

C. Srinivasan
(Convenor)

Course No.- 427

FIELD GEOLOGY

Credits – 2

Maximum Marks : 50

Duration of Examination : 2 ½ Hours

(Syllabus for the examinations to be held in December 2011, December 2012 & December 2013)

Objectives : To impart knowledge to the students about the techniques used in field for geological mapping.

UNIT I

- 1.1 **Philosophy and organization of field study:** Field geology in general, Geologic maps and mapping, Selecting a field study, Reconnaissance (Pilot Study), Preparations for the field, Work in the field, Completing a field study.
- 1.2 **Basic equipment used in field study.** Equipment for sampling and recording, Selecting and using a hand lens, Materials and methods for staining rocks, The compass, Taking a compass bearing, Taping and pacing distances.
- 1.3 **Observing and collecting data at the outcrops:** Observations in the field, Interpretation of the outcrop, Taking field notes, drawing and photographing outcrops, Measuring strike and dip, Measuring attitude of linear features, Finding and collecting fossils, collecting rock samples.
- 1.4 **Brunton compass and Global Positioning System (GPS):** General principles involved, Accuracy and Limitations.

UNIT II

- 2.1 **Maps and their interpretation:** Topographic maps, Preparations for mapping project, Interpretation of geologic lines on a topographic base, Determination of attitude from outcrop patterns, stratigraphic thickness in flat terrain and on slopes, nature of contacts.
- 2.2 **Mapping rock units and structures.** A geological pace and compass traverse, Finding and tracing contacts between rock units, Refining and correlating geologic units, Mapping geological structures, Rapid geological mapping, Outcrop maps, Maps of surficial deposits and bedrock maps, Mapping engineering geological units. Care and adjustment in the field.
- 2.3 **Geological cross sections and stratigraphic sections:** Preliminary steps, Subdividing and describing a section, Measurements of the section, Drawing a topographic profile, Constructing cross sections (arc/busk method), Presenting stratigraphic sections.
- 2.4 **Aerial photographs and satellite imageries:** Study and use of aerial photographs and satellite imageries for compilation of geological data, Ground truthing, obtaining satellite imageries from Google Earth.

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(Convenor)

UNIT III

- 3.1 **Primary features of sedimentary rocks:** Beds and bedding, Depositional bed forms and structures, Beach and shelf deposits,
- 3.2 Structures indicating stratigraphic facing, Unconformities, Postdepositional structures, Trace fossils-Bioturbation, Palaeocurrent and palaeoslope direction,
- 3.3 **Continental environments:** Quaternary record; alluvial, lake, eolian and glacial deposits, soils and soil creep
- 3.4 **Rock deformation and features of deformed rocks:** Folds, Foliation, Cleavages and related features, Faults, Joints, Fractures, Mélanges.

UNIT IV

- 4.1 **Volcanic structures and field relations:** Subaerial basalts, subaqueous basaltic lavas and hyaloclastic deposits, flows and domes of viscous lava, pyroclastic deposits, volcanic intrusions, Ash deposits, Bentonite beds.
- 4.2 **Plutons and metamorphic rocks:** Fabric of plutonic rocks, Inclusions in plutons, Banding in plutons, Schlieren and related structures, Fracture system in plutons, Metamorphic zones
- 4.3 **Identification of rocks in the field:** General rationale, Textures and naming of sedimentary, igneous and metamorphic rocks.
- 4.4 **Report writing:** Major illustrations, Photographs, Drawings, Diagrams, Report designing, Format and specific parts of the report.

Books recommended

- a) Geology in the field by Robert R. Compton
- b) Structural Analysis and Synthesis by Stephen M. Rowland
- c) Field Geology by McCullough
- d) Methods for exploration geologist by Peter C. Badgley
- e) Field Geology by Lahee

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(Paper setter has to provide the key for objective type questions)

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Course No. 428

Credits 4

PRACTICAL RELATING TO COURSE NO.'S. 420, 422 & 425

- UNIT-I Course No. 420 (Structural Geology)
Geometric methods used to interpret geological structures, strain analysis.
- UNIT-II Course No. 422 (Optical Mineralogy)
Methods of determination of optical properties of minerals such as pleochroic scheme, extinction angle and optical sign.
- UNIT-III Course No. 425 (Essentials of Invertebrate Palaeontology)
Application of zoological code of nomenclature for taxonomic studies. Study of mega and microfossils of various invertebrate groups. Univariate and bivariate analysis of fossils using regression analysis and major axis equations. Study of methods of preservation of fossils.
- UNIT-IV Field work and submission of field report (**An essential component of fifteen marks**).
- UNIT-V Viva – Voce.

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(Coordinator)

Course No. 429

Credits 4

PRACTICAL RELATING TO COURSE NO'S. 423, 424 & 426

- UNIT-I Course No. 423 (Principles of Stratigraphy & Precambrian Stratigraphy)
Preparation of stratigraphic columns, facies diagrams and correlation charts from field data.
- UNIT-II Course No. 424 (Clastic Sedimentology)
Preparation of histograms, frequency curves from grain size data, calculation of grain size parameters. Measurement of sphericity and roundness. Megascopic study of clastic sedimentary rocks. Microscopic examination of clastic sedimentary rocks.
- UNIT-III Course No. 426 (Fundamentals of Remote Sensing, GIS and GPS)
Stereo test. Study of Aerial Photographs, resolution, mosaics, symbols, gully pattern and drainage analysis, image parallax. Determination of scale, height, dip, slope vertical exaggeration and image distortion. Visual interpretation of satellite imagery for geological structural geomorphic and hydromorphical mapping. Exercises on digital image processing.
- UNIT-IV Field work and submission of field report (An essential component of fifteen marks).
- UNIT-V Viva – Voce.

Sanjay
(Coordinator)

