

**P G DEPARTMENT OF GEOLOGY  
UNIVERSITY OF JAMMU**

**SYLLABUS AND COURSES OF STUDY  
FOR M.Sc. (APPLIED GEOLOGY)  
SEMESTER I**

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**CHOICE BASED CREDIT SYSTEM**

**COURSE STRUCTURE FOR M.Sc. (Applied Geology) UNDER CBCS  
for the Sessions 2018-19, 2019-20 and 2020-21**

Semester	Proposed *Course No	Course Title	Credit	Type of Course	Total Credit	Remarks	
<b>SEMESTER – I</b>							
	PSAGTC111	Clastic Sedimentology	2	CORE	24		
	PSAGTC112	Fundamentals of Remote Sensing & GIS	2	CORE			
	PSAGTC113	Geomorphology	2	CORE			
	PSAGTC114	Mineralogy	4	CORE			
	PSAGTC115	Stratigraphy	4	CORE			
	PSAGTC116	Structural Geology	2	CORE			
	PSAGLC117	Practical (111,112 &116)	4	CORE			
	PSAGLC118	Practical (114,115 & local weekend field report)	4	CORE			
<b>SEMESTER – II</b>							
	PSAGTC211	Environmental Geology	2	CORE	24		
	PSAGTC212	Geohydrology	4	CORE			
	PSAGTC213	Geotectonics	2	CORE			
	PSAGTC214	Igneous Petrology	2	CORE			
	PSAGTC215	Invertebrate Palaeontology	2	CORE			
	PSAGTC216	Non-Clastic Sedimentology	2	CORE			
	PSAGTC217	Ore Geology	2	CORE			
	PSAGLC218	Practical (212,213,214 & Two weeks geological field)	4	CORE			
	PSAGLC219	Practical (215,216, 217 & two weeks geological field's report)	4	CORE			
<b>SEMESTER – III</b>							
	PSAGTE311	Applied Hydrology	2	ELECTIVE	24	Student will have to select one elective out of 312 and 316	
	PSAGTE312	Coal Geology	2	ELECTIVE			
	PSAGTE313	Geochemistry	2	ELECTIVE			
	PSAGTE314	Metamorphic Petrology	2	ELECTIVE			
	PSAGTE315	Oceanography	2	ELECTIVE			
	PSAGTC316	Petroleum Geology	2	ELECTIVE			
	PSAGTE317	Vertebrate Palaeontology	2	ELECTIVE			
	PSAGTO318	Fundamentals of Geology	4	OPEN CHOICE			For students from other departments
	PSAGLC319	Practical (311, 312/316, 313 & Two weeks geological field)	4	CORE			
	PSAGLC310	Practical (314,317 and two weeks geological field's report)	4	CORE			
<b>SEMESTER - IV</b>							
	PSAGTE411	Application of Remote Sensing in Geology	2	ELECTIVE	24	Student has to choose two elective papers selecting at least one paper	
	PSAGTE412	Cryosphere & Climate Change Science	2	ELECTIVE			
	PSAGTE413	Engineering Geology	2	ELECTIVE			

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	PSAGTE414	Geo-exploration	4	ELECTIVE	each out of 412 & 417 and 415 & 416
	PSAGTE415	Micropalaeontology and Palaeobotany	2	ELECTIVE	
	PSAGTE416	Gemology	2	ELECTIVE	
	PSAGTE417	Sedimentary Basin Analysis	2	ELECTIVE	
	PSAGTO418	Geohazards and Disaster Management	4	OPEN CHOICE	For students from other departments
	PSAGLC419	Practical – 1 (411,413 and weekly seminar)	4	CORE	
	PSAGLC420	Practical – 2 (414, 415/416)	4	CORE	

### Evaluation Scheme

The students shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

Examination (theory)	Syllabus to be covered in the examination	Time allotted for the examination	Total Marks
Minor Test I (after 30 days)	Up to 25 %	1 hour (2 credits)	10 (for 2 credits)
Minor Test II (after 60 days)	Up to 50 %	1½ hour (4 credits)	20 (for 4 credits)
Major Test (after 90 days)	Up to 100 %	2½ hour (2 credits) 3 hour (4 credits)	30 (for 2 credits) 60 (4 credit course)

### Guidelines for setting of question papers

For TWO Credit Courses	For FOUR Credit Courses
<p><b>Minor test -1</b> (25% weightage for unit 1), Time - 01 hour Question 1: 5 multiple choice type question (5 marks) to be set from Unit 1 Question 2: Two short answer types questions (5 marks) to be set from Unit 1</p> <p><b>Minor test 2</b> (Up to 50% syllabus) Time: 01 hour (80% weightage for unit 2 and 20% for Unit 1), Question 1: 5 multiple choice type question (5 marks) Question 2: 2 short answer types questions (5 marks)</p>	<p><b>Minor test 1</b> (25% weightage for first 5 sub-units (1.1 - 2.1), Time : 1½ hour Question 1: 10 multiple choice type question (10 marks) to be set from first 5 sub-units(1.1 - 2.1) Question 2: Two short answer types questions (10 marks) from first 5 sub-units (1.1 - 2.1)</p> <p><b>Minor test 2</b> (Up to 50% syllabus) Time : 1½ hour 80% weightage for second 5 sub-units (2.2 - 3.2) and 20% weightage for first 5 sub-units i.e. 1.1 -2.1). Question 1: 10 multiple choice type question (10 marks) to be set from second 5 sub-units(2.2 - 3.2) Question 2: Two short answer types questions (10 marks) from second 5 sub-units (2.2-3.2)</p>
<p><b>Major Test</b> (80% weightage for units 3 &amp; 4 and 20% weightage for units 1 &amp; 2), Time allowed : 2 ½ hours Question 1: 10 multiple choice type question (10 marks) to set equally from Units 3 &amp; 4 Question 2: 4 short answer questions (a-d, 10 marks) to be set from Units 1 &amp; 2 (6 marks) and from Units 3 &amp; 4 (4 marks) Question 3: One long answer type question (Essay type) with internal choice (10 marks) to be set from Units 3 &amp; 4 only</p>	<p><b>Major Test</b> (80% weightage for last 10 sub-units (3.3 - 5.4), and 20% weightage for the first 10 sub-units (1.1 to 3.2). Time allowed 03 hours Question 1: 10 multiple choice type question (15 marks) to be set from the first 10 sub-units (3 marks) and from the last 10 subunits (12 marks) Question 2: 5 short answer questions (15 marks) to be set from first 10 sub-units (09 marks) and from the last 10 sub-units (06 marks) Questions 3 &amp; 4: two long answer type questions (Essay type) with internal choice (15 marks each) to be set from the last 10 sub-units only.</p>

**SEMESTER - I**  
**DETAILED SYLLABUS**

**Course No.: PSAGTC111**

**Credits: 02**

**Maximum Marks: 50**

**(Minor I-10+Minor II 10+Major 30)**

**Title: Clastic Sedimentology**

**No. of teaching hours: 30**

**Duration of Examination: 2½ hours**

**(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)**

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**Objective:** This course is about deciphering the earth's history from the pages of the earth's past written in the sedimentary rocks. This course is about the sediments, sedimentary rocks and the processes operating in their formation to arm the students with the knowledge of ancient events and environments on the ever evolving face of earth.

**UNIT-I      Sediments and sediment analysis**

- 1.1 Formation and nature of sediments; distribution of sedimentary rocks in space and time
- 1.2 Sediment analysis (grain size, grade-scale, phi-scale; techniques of size analysis) and morphology (shape forms, sphericity, roundness; grain fabric)
- 1.3 Graphical representation, application and uses of grain size data; Textural parameters and their significance
- 1.4 Indicators of sediment maturity: mineralogy and textures; surface textures and their significance

**UNIT-II      Sedimentation: sediment transport and deposition**

- 2.1 Fluid motion, forces acting on fluids, basic properties of fluids and flow types
- 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 and permeability

**UNIT-III      Petrology of clastic sedimentary rocks**

- 3.1 Classification of sedimentary rocks, their formation and identification; Heavy minerals and their significance
- 3.2 Texture, structure and classification of rudaceous rocks
- 3.3 Texture, structure, classification and diagenesis of sandstones
- 3.4 Texture, structure and classification of mud rocks

**UNIT-IV      Sedimentary structures: formation and analysis**

- 4.1 Nature and significance of bedding, Graded beds



- 4.2 Mode of formation and types of ripple marks, dunes and cross beddings
- 4.3 Sole marks: types, mode of formation, significance
- 4.4 Deformational sedimentary structures and their significance

**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

**Guidelines for setting of question papers :**

**Minor test -1**

(25% weightage),

Time - 01 hour

- Question 1: 5 multiple choice type question (5 marks) to be set from Unit 1
- Question 2: Two short answer types questions (5 marks) to be set from Unit 1

**Minor test 2**

(80% weightage for unit 2 and 20% for Unit 1), Time: 01 hour

- Question 1: 5 multiple choice type question (5 marks)
- Question 2: 2 short answer types questions (5 marks)

**Major Examination**

(80% weightage for units 3 & 4 and 20% weightage for units 1 & 2), Time allowed : 2 ½ hours

- Question 1: 10 multiple choice type question (10 marks) to set equally from Units 3 & 4
- Question 2: 4 short answer questions (a-d, 10 marks) to be set from Units 1 & 2 (6 marks) and from Units 3 & 4 (4 marks)
- Question 3: One long answer type question (Essay type) with internal choice (10 marks) to be set from Units 3 & 4 only

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

# SEMESTER-I

**Course No.:** PSAGTC112

**Title:** Fundamentals of Remote Sensing & GIS

**Credits:** 02

**No. of teaching hours:** 30

**Maximum Marks:** 50

**Duration of Examination:** 2½ hours

**(Minor I-10+Minor II 10+Major 30)**

**(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)**

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**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 landuse.

## **UNIT-III Thermal and Microwave Remote Sensing**

- 3.1 Introduction, TIR region of electro-magnetic 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.

## **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

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|----------------------------|--|
| 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 & application of photo-geology                |
| 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                                |

### Guidelines for setting of question papers :

#### Minor test -1

- (25% weightage), Time - 01 hour
- Question 1: 5 multiple choice type question (5 marks) to be set from Unit 1
- Question 2: Two short answer types questions (5 marks) to be set from Unit 1

#### Minor test 2

- (80% weightage for unit 2 and 20% for Unit 1), Time: 01 hour
- Question 1: 5 multiple choice type question (5 marks)
- Question 2: 2 short answer types questions (5 marks)

#### Major Examination

- (80% weightage for units 3 & 4 and 20% weightage for units 1 & 2), Time allowed : 2 ½ hours
- Question 1: 10 multiple choice type question (10 marks) to set equally from Units 3 & 4
- Question 2: 4 short answer questions (a-d, 10 marks) to be set from Units 1 & 2 (6 marks) and from Units 3 & 4 (4 marks)
- Question 3: One long answer type question (Essay type) with internal choice (10 marks) to be set from Units 3 & 4 only.

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



# SEMESTER - I

Course No.: PSAGTC113

Credits: 02

Maximum Marks: 50

(Minor I-10+Minor II 10+Major 30)

Title: Geomorphology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)

Objectives: To introduce the fundamental concepts governing the landforms; understand 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 Historical background and development of Geomorphology, elements of geomorphological processes - physical, chemical and biological.
- 1.2 Landforms in relation to lithology and structure.
- 1.3 Landform evolution by fluvial processes, qualitative and quantitative analysis of basins and drainage density.
- 1.4 Glacier, types, mass balance, elements of dynamics of glacier movement, landforms as a result of glacial and fluvio-glacial processes

## UNIT-II

- 2.1 Landform evolution by aeolian activity in hot arid regions
- 2.2 Landform evolution by sea wave activities along the coast
- 2.3 Landform evolution of soluble rock terrain-processes and features.
- 2.4 Classification of slopes, forms, slope regression, landforms formed by mass movement processes, slope failures

## UNIT-III

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

## UNIT-IV

- 4.1. Geomorphology and global tectonics-aim and context, denudation 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

**Guidelines for setting of question papers :**

**Minor test -1**

(25% weightage), Time - 01 hour

Question 1: 5 multiple choice type question (5 marks) to be set from Unit 1

Question 2: Two short answer types questions (5 marks) to be set from Unit 1

**Minor test 2**

(80% weightage for unit 2 and 20% for Unit 1), Time: 01 hour

Question 1: 5 multiple choice type question (5 marks)

Question 2: 2 short answer types questions (5 marks)

**Major Examination**

(80% weightage for units 3 & 4 and 20% weightage for units 1 & 2), Time allowed : 2 ½ hours

Question 1: 10 multiple choice type question (10 marks) to set equally from Units 3 & 4

Question 2: 4 short answer questions (a-d, 10 marks) to be set from Units 1 & 2 (6 marks) and from Units 3 & 4 (4 marks)

Question 3: One long answer type question (Essay type) with internal choice (10 marks) to be set from Units 3 & 4 only.

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



# SEMESTER - II

Course No.: PSAGTC114

Credits: 04

Maximum Marks: 100

(Minor I-20+Minor II 20+Major 60)

Title: Mineralogy

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)

**Objectives:** This course will lay the foundation for the broader understanding of the geology by imparting the basic knowledge about the rock forming minerals, their formation, complexity, associations, identification and allied technical contexts. This course will also inculcate the basic idea of mineral interaction with light, and its utility for their understanding involving their 'optical properties'.

## UNIT I – Introduction to Mineralogy and optics

- 1.1 Mineralogy fundamentals- minerals and crystals, patterns and structures; Identifying and classifying minerals. Understanding light- nature of electromagnetic radiation and spectrum; the components of light.
- 1.2 Interaction of light with matter/minerals (isotropic and anisotropic). Optical phenomena - colour, refraction, reflection, total internal reflection and refractive index. Light vibration and interaction - phase, interference, interference colours, retardation and resolution of light waves.
- 1.3 Optical instruments and accessories. Polarization of light – methods and applications. Mineral extinction - causes, categories, measurement and application
- 1.4 The science of Refractometry; Refractive indices and vibration directions.

## UNIT II – The optics of uniaxial and biaxial minerals

- 2.1 Optical Indicatrix - uniaxial and biaxial; evolution, construction and application.
- 2.2 Interference figures – uniaxial and biaxial; parts, formation, types and applications.
- 2.3 Methods and mechanism of determining the actual and apparent optic angle ( $2V$  and  $2E$ ) in biaxial minerals.
- 2.4 Pleochroism and Pleochroic schemes for uniaxial and biaxial minerals. Dispersion in biaxial minerals. .

## UNIT III–The internal structure and classification of minerals

- 3.1 Internal structure (atomic arrangement) of minerals and crystals. X-Rays – historical perspective, nature, generation and spectra.
- 3.2 X-Ray crystallography (diffraction – scattering and interference). Bragg's Law - derivation and practical application. X-Ray diffractometry- single crystal method and powder method.
- 3.3 Classification of minerals: Silicates, Oxides, Sulphates, Halides, Carbonates, Native Metals. Silicate structures: formation (an insight from Bowen's Reaction Series), evolution and categories.
- 3.4 General structure, distinguishing features and paragenesis of native elements, major oxides and hydroxides, sulphates and sulphides, carbonates and phosphates, and atomic minerals.

## UNIT IV- Determinative Mineralogy of Silicate Minerals - I

- 4.1 Olivine Group: Structure, classification, distinguishing features and paragenesis.
- 4.2 Garnet Group: Structure, classification, distinguishing features and paragenesis.
- 4.3 Pyroxene and Pyroxenoid Group: Compositional changes and nomenclature, structure and paragenesis of ortho-and-clino-pyroxenes, and pyroxene thermometry.
- 4.4 Amphibole Group: Nomenclature, structure and paragenesis of amphibole minerals, exsolution textures in amphiboles.



## UNIT V- Determinative Mineralogy of Silicate Minerals - II

- 5.1 Silica Group: Classification, structure, general characteristics and paragenesis.
- 5.2 Feldspar Group: Classification, structure, morphology and twinning and paragenesis of alkali feldspar and plagioclase feldspar; Feldspathoid Group: Structure, phase relations and paragenesis.
- 5.3 Mica Group: Classification and structure, compositional variation and paragenesis; Clay Minerals: Classification, structure, identification and paragenesis.
- 5.4 Epidote Group: structure, distinguishing properties, paragenesis.

### 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. Ehelrs, 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
13. Deer, Howie & Zussman An introduction to the rock forming minerals
14. Cerreves Introduction to mineralogy
15. Berr and Mason Mineralogy
16. Kestov Mineralogy
17. Batckhtin Mineralogy

### Guidelines for setting of question papers :

#### Minor test -1

(Upto 25% of Syllabus i.e. first 5 sub-units (1.1 - 2.1),

Time : 1½ hour

Question 1: 10 multiple choice type question (10 marks) to set from first 5 sub-units(1.1 - 2.1)

Question 2: Two short answer types questions (10 marks) from first 5 sub-units (1.1 - 2.1)

#### Minor test II (Up to 50% syllabus)

(80% weightage for second 5 sub-units (2.2 - 3.2) and

20% weightage for first 5 sub-units i.e. 1.1 -2.1))

Time : 1½ hour

Question 1: 10 multiple choice type question (10 marks) to be set from second 5 sub-units(2.2 - 3.2)

Question 2: Two short answer types questions (10 marks) from second 5 sub-units (2.2-3.2)

#### Major Examination

(80% weightage for last 10 sub-units (3.3 - 5.4), and

20% weightage for the first 10 sub-units (1.1 to 3.2).

Time allowed 03 hours

Question 1: 10 multiple choice type question (15 marks) to be set from the first 10 sub-units (3 marks) and from the last 10 subunits (12 marks)

Question 2: 5 short answer questions (15 marks) to be set from first 10 sub-units (09 marks) and from the last 10 sub-units (06 marks)

Questions 3 & 4: two long answer type questions (Essay type) with internal choice (15 marks each) to be set from the last 10 sub-units only

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

# SEMESTER - I

Course No.: PSAGTC115

Credits: 04

Maximum Marks: 100

(Minor I-20+Minor II 20+Major 60)

Title: Stratigraphy

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)

**Objectives:** To impart working knowledge of stratigraphic methods, concept of the distribution of Precambrian Shield belts and their evolution and to knowledge about Palaeozoic, Mesozoic and Cenozoic strata with faunal and floral elements and the Gondwana successions.

## UNIT - 1

- 1.1 Stratigraphic concepts and principles of uniformitarianism, measurement of Geological time, Concept of stratum, stratification and vertical sequence, concept of cyclothem and cyclic sequences.
- 1.2 Principles of stratigraphic classification, litho- bio-, and chronostratigraphy and their mutual relationships, code of stratigraphic nomenclature, general rules, informal names and stratotypes, biostratigraphic zones
- 1.3 Geological record and its imperfections, types of unconformities and their significance, Concept of facies and variations, lateral and vertical variations, lithological, structural and thickness variation.
- 1.4 Magnetostratigraphy and its application, application and problems of C14, fission track and absolute age dating, Principles and methods of litho- bio- and chronostratigraphic correlation

## UNIT - 2

- 2.1 Precambrian time scale its classification and correlation, Evolution of Indian shield in space and time
- 2.2 Major Precambrian belts of Peninsular India and their tectonic setting
- 2.3 Stratigraphy of Archean rocks of Karnataka, Madhya Pradesh, Singhbhum & Rajasthan and their geochronological relationship, Distribution of Proterozoic rocks in India viz. Cuddapah, Vindhyan, Kaladgi, Kurnool, and Bhima.
- 2.4 Stratigraphic significance and distribution of Precambrian rocks in the Himalaya viz. Vaikrita, Haimanta, Salkhala, Dogra Slate, Jutogh, Chail, Shimla Slate and Darjeeling Formations, Stratigraphic relationship of the rock formations of Lesser Himalaya viz. Chandpur, Mandhali, Nagthat, Jaunsar, Blaini, Infra-Krol, Krol and Shali

## UNIT - 3

- 3.1 Precambrian – Cambrian boundary problem and its fixation in India, Distribution of Palaeozoic rocks in India.
- 3.2 Correlation of the Palaeozoic successions of India, Tethyan and Lesser Himalayan basins and their tectonic history during Palaeozoic times.
- 3.3 Concept of Gondwanaland and global distribution of Gondwana rocks, Nature and distribution of Gondwana outcrops in Peninsular and Extra-Peninsular India
- 3.4 Age limits of Gondwana rocks and climatic fluctuations, Permo-Triassic boundary and its identification in India.

## UNIT - 4

- 4.1 Distribution of Mesozoic rocks of India and the faunal & floral variations.
- 4.2 Correlation of the Mesozoic strata of Peninsular India and Himalaya.

- 4.3 Significance of marine transgressions in Mesozoic and the development of coastal facies in India.
- 4.4 Cretaceous –Tertiary boundary and its identification in India.

### UNIT –5

- 5.1 Deccan volcanic and their age relationship.
- 5.2 Himalayan ophiolites & mélanges and their significance.
- 5.3 Classification and correlation of Cenozoic successions in Himalaya.
- 5.4 Siwalik and Karewa Groups – classification, fauna, flora and age

### **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. I-III              |
| 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.  |
| 11. | Rama Krishna & Vadhyanathan | Stratigraphy Vol I - II                                     |

### **Guidelines for setting of question papers :**

#### **Minor test -1**

(Upto 25% of Syllabus i.e. first 5 sub-units (1.1 - 2.1), Time : 1½ hour  
Question 1: 10 multiple choice type question (10 marks) to set from first 5 sub-units(1.1 - 2.1)  
Question 2: Two short answer types questions (10 marks) from first 5 sub-units (1.1 - 2.1)

#### **Minor test II (Up to 50% syllabus)**

(80% weightage for second 5 sub-units (2.2 - 3.2) and Time : 1½ hour  
20% weightage for first 5 sub-units i.e. 1.1 -2.1))  
Question 1: 10 multiple choice type question (10 marks) to be set from second 5 sub-units(2.2 - 3.2)  
Question 2: Two short answer types questions (10 marks) from second 5 sub-units (2.2-3.2)

#### **Major Examination**

(80% weightage for last 10 sub-units (3.3 - 5.4), and Time allowed 03 hours  
20% weightage for the first 10 sub-units (1.1 to 3.2).

Question 1: 10 multiple choice type question (15 marks) to be set from the first 10 sub-units (3 marks) and from the last 10 subunits (12 marks)  
Question 2: 5 short answer questions (15 marks) to be set from first 10 sub-units (09 marks) and from the last 10 sub-units (06 marks)  
Questions 3 & 4: two long answer type questions (Essay type) with internal choice (15 marks each) to be set from the last 10 sub-units only

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



Course No.: PSAGTC116

Credits: 02

Maximum Marks: 50

(Minor I-10+Minor II 10+Major 30)

Title: Structural Geology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)

**Objectives:** This course intends to impart the fundamental knowledge about the structures in different settings ranging from regional, macroscopic to microscopic scale. This course is about to define and discuss the fundamental concepts and different data sets, and the methods of structural geology and structural analysis. Students will learn to interpret the structures to unfurl the history of deformation in the rocks.

## UNIT I - Fundamentals of Structural Geology

- 1.1 Understanding and approaching structural geology – data sets, structural organisation and analysis.
- 1.2 Deformation and strain in rocks – the need for strain analysis (in one, two and three dimensions).
- 1.3 Stress and its components – from a point in rock, to a surface, and lithosphere.
- 1.4 Rheology – The time aspect of rock deformation.

## UNIT II- Structures formed in extensional, compressional, brittle and plastic regimes

- 2.1 Fractures – timing, formation, nomenclature, interaction and relationships. Boudinage – geometry, types and significance.
- 2.2 The birth and growth of Faults (normal, reverse and strike-slip) - their terminology, geometry, anatomy and identification.
- 2.3 Folds and folding: mechanism, processes and classification. .
- 2.4 Shear zones – evolution, types, markers and kinematic indicators.

## UNIT III - The Analysis, synthesis and visualization of the geological structures

- 3.1 Lines and Planes – attitude, orthographic and stereographic projections.
- 3.2 Graphing the state of stress and strain - Mohr Diagram and Wellman Diagram. Practical utility of strain indicators.
- 3.3 Structural contours and outcrop patterns – mapping and interpretation.
- 3.4 **Rock Fabric: Foliation and Lineation - terminology, development and significance.**

## UNIT IV–Specialised topics and concepts in structural geology

- 4.1 Microstructures - deformation and mechanisms at the microscale.
- 4.2 Salt (Halokinesis) and Shale tectonics – properties, decollement and structures.
- 4.3 Balancing and restoration of geological cross-sections.
- 4.4 Kinematics and palaeostress.

### **Books Recommended**

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



## Guidelines for setting of question papers :

### Minor test -1

(25% weightage);

Time - 01 hour

Question 1: 5 multiple choice type question (5 marks) to be set from Unit 1

Question 2: Two short answer types questions (5 marks) to be set from Unit 1

### Minor test 2

(80% weightage for unit 2 and 20% for Unit 1), Time: 01 hour

Question 1: 5 multiple choice type question (5 marks)

Question 2: 2 short answer types questions (5 marks)

### Major Examination

(80% weightage for units 3 & 4 and 20% weightage for units 1 & 2), Time allowed : 2 ½ hours

Question 1: 10 multiple choice type question (10 marks) to set equally from Units 3 & 4

Question 2: 4 short answer questions (a-d, 10 marks) to be set from Units 1 & 2 (6 marks) and from Units 3 & 4 (4 marks)

Question 3: One long answer type question (Essay type) with internal choice (10 marks) to be set from Units 3 & 4 only

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



# SEMESTER - I

Course No.: PSAGLC117

Title: Practical -I

(related to courses PSAGTC-111,112 &116)

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 2½ hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)

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\*Course No. PSAGTC111 (Clastic Sedimentology) - 15 marks

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

Course No. PSAGTC112 (Fundamentals of Remote sensing) – 15 marks

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 hydro-morphological mapping. Exercises on digital image processing.

Course No. PSAGTC116 (Structural Geology) – 15 marks

Geometric methods used to interpret geological structures, completion and interpretation of geological maps, strain analysis.

Viva – Voce (5 marks)

Note: Internal Assessment shall consist of daily practical assessment (26 marks), terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks

For External Examination:

As per distribution of marks shown in the practical details above\* = total 50 marks



Course No.: PSAGLC118

Title: Practical –II

(related to courses PSAGTC-114 &115 & local weekend field report)

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 2½ hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in Dec. 2018, Dec. 2019 & Dec. 2020)

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Course No. PSAGTC114 (Mineralogy)\*\* - 15 marks

Methods of determination of optical properties of minerals such as pleochroism, extinction angle and optical sign. Identification of rock forming minerals under the microscope and by staining methods, and spotting of hand specimens, etc.

Course No. PSAGTC115 (Stratigraphy)\*\* - 15 marks


Preparation of stratigraphic columns, facies diagrams and correlation charts from field data. Making of fence diagrams from borehole data, calculation of bed thicknesses using trigonometric techniques, development of composite lithologs, etc.

At least seven days local field work and submission of field Report (An essential component of 15 marks)\*\*.

Viva – Voce (5 marks)\*\*

Note: Internal Assessment shall consist of daily practical assessment (26 marks), terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks  
For External Examination:

\*\*As per distribution of marks shown in the practical details above = total 50 marks

  
Prof. P.K. Srivastava  
Convener BOS in Geology