



UNIVERSITY OF JAMMU

Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

No. F.Acd./II/19/

Dated:

NOTIFICATION (19/Jan./Adp/83)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the revised Syllabi and Courses of Study in the subject of **Applied Geology** of **Master Degree Programme** for II to IV Semesters under the **Choice Based Credit System (through regular mode)** in the main campus for the examinations to be held in the years as per the details given below: -

Subject	Semester	for the examination to be held in the years
M.Sc (Applied Geology)	Semester-II	May 2019, 2020 and 2021
	Semester-III	December 2019, 2020 and 2021
	Semester-IV	May 2020, 2021 and 2022

The Syllabi of the courses is available on the University website: www.jammuuniversity.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/19/13150-13162
Dated: 28-1-2018

Copy for information and necessary action to:

1. Dean, Faculty of Science
2. HOD/Convener, Board of Studies in Geology
3. C.A to the Controller of Examinations
4. I/c Director, Computer Centre, University of Jammu
5. Asst. Registrar (Conf. /Exams. PG/Pub.)
6. Incharge, University Website for necessary action please.


Assistant Registrar (Academic)


24/1/2018

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the
Sessions 2018-19, 2019-20 and 2020-21

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

**Syllabus and Courses of study for
M.Sc. (Applied Geology) UNDER CBCS
for the Sessions 2018-19, 2019-20 and
2020-21**

CHOICE BASED CREDIT SYSTEM

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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	
SEMESTER – I							
	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			
SEMESTER – II							
	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& report)	4	CORE			
SEMESTER – III							
	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& report)	4	CORE			
SEMESTER - IV							
	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	For students from other departments
	PSAGTO418	Geohazards and Disaster Management	4	OPEN CHOICE	
	PSAGLC419	Practical ó 1 (411,413 and weekly seminar)	4	CORE	
	PSAGLC420	Practical ó 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>Minor test -1 (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>Minor test 2 (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>Minor test 1 (25% weightage for 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)</p> <p>Minor test 2 (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>Major Test (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</p>	<p>Major Test (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.</p>

**Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the
Sessions 2018-19, 2019-20 and 2020-21**

**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)

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

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

- 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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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)

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.

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

- 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 (Upto 50% Syllabus)

- (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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTC113

Title: Geomorphology

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)

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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 ó 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 ó 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 ó historical perspective, nature, generation and spectra.
- 3.2 X-Ray crystallography (diffraction ó 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.

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

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

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|-----|-----------------------|---|
| 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 |
| 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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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 ó 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 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.

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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

- 4.3 Significance of marine transgressions in Mesozoic and the development of coastal facies in India.
- 4.4 Cretaceous óTertiary 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 ó 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 & Vadhyathan | 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 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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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

Course No.: PSAGTC116

Title: Structural Geology

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)

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

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

- 2.1 Fractures ó timing, formation, nomenclature, interaction and relationships. Boudinage ó 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 ó evolution, types, markers and kinematic indicators.

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

- 3.1 Lines and Planes ó 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 ó 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 ó 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 |

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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

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)

**Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the
Sessions 2018-19, 2019-20 and 2020-21**

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: 4 hours

(Internal 50 and External 50)

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

*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) ó 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) ó 15 marks

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

Viva ó 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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

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: 4 hours

(Internal 50 and External 50)

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

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 ó 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

SEMESTER – II

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

SEMESTER - II **DETAILED SYLLABUS**

Course No.: PSAGTC211

Title: Environmental Geology

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 May, 2019, May 2020 & May 2021)

Objectives To introduce the concept and role of geology in the study of environment. To study the various aspects of Geo-hazards and their mitigation. To impart knowledge about pollution and their remedial measures. To introduce the awareness and legislative measures in the mitigation of environmental problems.

UNIT-I (Earth system and biosphere)

- 1.1 Inter-relationship of Earth, Man and Environment - population and environment, population and limited resources, disruption of natural system, causes and consequences of growth rates, population control strategies.
- 1.2 Ecological spectrum - biotic communities; food chains, stratification in biotic communities, community stability, species diversity. Anthropogenic changes in ecosystem. Preserving gene pools and conserving endangered species.
- 1.3 Components of the geosphere and environment - lithosphere, biosphere, hydrosphere and atmosphere.
- 1.4 Biogeochemical cycles ó nitrogen cycle, carbon cycle and phosphorous cycle.

UNIT-II (Earth processes and geological hazards)

- 2.1 Conditions promoting the hill slope instability, rockslides and avalanches, monitoring mass movements, slope control and stabilization.
- 2.2 Factors governing floods, flood characteristics, flood hazards and urbanization, flood management, flood forecasting.
- 2.3 Seismic hazards - causes and consequences, awareness and public response, coping with seismic hazards. Seismic conditions in India - Himalayan and Peninsular India. Tsunami generation mechanism and its impact on the coasts.
- 2.4 Volcanic hazards - volatiles, pyroclasts, flows, lahars, toxic gases, Nature, prediction and mitigation of volcanic hazards.

UNIT-III (Energy resources and pollution)

- 3.1 Energy resources- consumption and production trends of energy resources, environmental effects of various energy resources i.e. petroleum, natural gas, nuclear, hydropower, wind and solar.
- 3.2 Mineral resources and reserves. Environmental impact of exploitation, processing and smelting of minerals. Conservation of mineral resources.
- 3.3. Waste and its disposal - surface and subsurface disposal of toxic, metallic and radioactive wastes. Planning and management of hazardous waste. Domestic refuse and landfill.
- 3.3.1. Global warming - increase of CO₂ and N₂O due to industrialization, urbanization, burning of fossil fuels, volcanic activity and deforestation. Magnitude of ozone depletion and its impact. Suggestive measures.

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May, 2019, May 2020 & May 2021)

UNIT-IV (Environmental management)

- 4.1 Environmental impact of mining - hazards of opencast and underground mining, effects on air, water and land. Disposal of mining waste, environmental management of mining.
- 4.2 Desertification - causes and extant. Drylands of the Indian subcontinent - Thar desert, aggravation of desertic conditions. Signs of desertification in Himalaya. Measures to combat desertification.
- 4.3 Environmental Laws ó Water Reserves Law, Mineral and Fuel Resources Law, Pollution Control Law, Natural Hazard Mitigation Law, International Resources Dispute i.e. Law of the Sea and Antarctica.
- 4.4 Medical Geology ó trace elements and health; controls on elemental intake, iodine, fluorine, zinc, selenium. Radioactivity and cigrates, regional variations in heart disease.

Books Recommended

1. Montgomery, C.W. Environmental Geology
2. Casale, R. & Margottini, C. Natural Disaster and Sustainable Developments
3. Turk, J. Introduction to Environmental Studies
4. Cutter, S.L. & Renwick Exploitation-Conservation-Preservation
5. Hsai ó Yang Fang Environmental Geotechnology
6. Keller, E.A. Environmental Geology
7. Valdiya, K.S. Environmental Geology
8. Merritts, D., Wet, A.D. & Menking, K. Environmental Geology
9. Lutgen, F.K. & Tarbuck, E.J. The Atmosphere: An introduction to meteorology
10. Gaudie & Cuff (Editors) Encyclopedia of Global Change (Vol 1 and Vol 2)
11. Holechek, C, F. & Valdez Natural Resources
12. Santra, S.C Environmental Science

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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTC-212

Title: Geohydrology

Credits: 04

No. of teaching hours: 60

Maximum Marks: 100

Duration of Examination: 3 hours

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

(Syllabus for the examination to be held in May, 2019, May 2020 & May 2021)

OBJECTIVES: To acquaint the students with the various methods employed in the groundwater exploration, water wells conduction, development and completion, well Hydraulics and varying problems being faced in the field under different geomorphological and climatological conditions.

UNIT-I Groundwater Exploration

- 1.1 Global tectonics in distribution of groundwater repositories, surface indicators of groundwater.
- 1.2 Lithological and structural mapping, fracture trace analysis, Hydrogeological- lithological classification with respect to hydrologic properties. Hydraulic continuity in relation to groundwater structures.
- 1.3 Subsurface geophysical method- well logging techniques for delineating aquifer thickness and estimation of groundwater quality; electric radiational both natural and induced caliper and temperature logs.
- 1.4 Mode of occurrence of groundwater in unconsolidated and semi- consolidated formations, Hydrogeology of arid and wet land zones of Indian Sub-continent

UNIT-II Well Hydraulics

- 2.1 Effluent and influent seepage, laminar and turbulent flow, force and laws of groundwater movement, Darcy's law - assumptions, derivation, applications and limitations, Reynolds number, Rugosity and Manning factor.
- 2.2 Differential equation governing groundwater flow.
- 2.3 Unconfined, confined, steady, unsteady and radial flow to the well-Thiem's and Thies equations.
- 2.4 Pump testes method data analysis and interpretation of hydrogeologic boundaries, Evaluation of Aquifer parameter using Thiem's, Thies Cooper-Jacob, Walton and Jacobb-Lohmen's methods. Slug tests.

UNIT-III Well Hydraulics (contd)

- 3.1 Step-draw down test (SDT), determination of aquifer parameter, formation and well characteristics and their material relationship.
- 3.2 Aquifer-well relationship, Partially penetrating well, well interference and criteria for spacing of wells.
- 3.3 Volume elasticity of confined aquifers, $BE + TE = 1$
- 3.4 Groundwater basin studies and safe yield determination.

UNIT-IV Water Well construction and completion

- 4.1 Different drilling methods used in the construction of water wells; Shallow, deep penetrating and non-penetrating types, various groundwater structures.
- 4.2 Different well development methods, well construction and completion.
- 4.3 Geological controls in water well drilling technology with Indian examples.
- 4.4 Maintenances of water wells and causes of their abandonment sanitary protection of wells.

UNIT-V Groundwater Resource Behaviour

- 5.1 Over pumping and land subsidence.
- 5.2 Groundwater recharging methods

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

- 5.3 Groundwater balance and methods of optimization.
- 5.4 Radioisotopes in hydrological studies

Books Recommended

- | | |
|---------------------------------------|--|
| 1. Todd, D.K | : Groundwater Hydrology |
| 2. Hariwarayan | : Exploration techniques for groundwater. |
| 3. Lynch, R.J | : Formation of Evaluation |
| 4. Davis & Wiest | : Hydrology |
| 5. Chow | : Handbook of Applied Hydrology |
| 6. Johwon | : Groundwater and Wells |
| 7. Watton | : Groundwater Resource Evaluation |
| 8 Linsley ehal | : Applied Geology |
| 9. Linsley and Frangini | : Water Resource Engineering |
| 10. H. Bouwar | : Groundwater Hydrology |
| 11. Patrick. A Dommenica | : Concepts and Models in Groundwater Hydrology |
| 12. Freeze, R.A and Cherry, J.A. 1979 | : Groundwater |
| 13. Fetter, C.W. 1990 | : Applied Hydrogeology |
| 14. Alley, W.M. 1993 | : Regional Groundwater Quality |
| 15. Subramaniam, V. 2000 | : Water |
| 16. Singhal, B.B.S. 1986 | : Engineering Geosciences. |
| 17. Black W. and others (Ed.) 1989 | : Hydrogeology Geol.Soc.of America Pub. |
| 18. Davis | : Geohydrology |

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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTC213

Title: Geotectonics

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 May 2019, May 2020 & May 2021)

Objectives To introduce the advanced ideas of internal structure of earth. To introduce the latest concept of geomagnetism and its application. To equip with the latest knowledge on tectonic evolution of Himalaya and Indian craton.

UNIT-I (Internal structure and mechanics of earth)

- 1.1 Seismic investigations of the earth's interior, waves velocity, velocity curves, density distribution, elastic properties, pressure and temperature within the earth.
- 1.2 Bulk composition of the earth and of its various zones.
- 1.3 Composition of the earth's crust and upper mantle and crust-mantle relationship.
- 1.4 Gravity anomalies.

UNIT-II (Sea floor spreading and plate movement)

- 2.1 Concept of continental drift, evidences of movement of continents, modern concept of plate tectonics, fitting of continents together, palaeoclimatic units.
- 2.2 Evidences of sea floor spreading, magmatic anomaly patterns, age of ocean sediments, oceanic ridges and trenches, benioff zone.
- 2.3 Geomagnetism-magnetization, types, magnetic field reversals, polar wandering curve, application in geology.
- 2.4 Nature of plate margins, constructive and destructive geometry of plate motion, mosaic of plates, direction of motion, causes of plate motion, convection plumes and other classical hypothesis.

UNIT-III (Tectonic evolution of Himalaya)

- 3.1 Convergence of continents, pre-Himalayan sedimentation, closing of continents, rotation of continental block, phases of deformation, shifting of depositional basins, vertical tectonics.
- 3.2 Drift and subduction of Indian plate, Andaman subduction zone, Andaman sea spreading centre and Makran subduction zone.
- 3.3 Indus-Tsangpo suture zone, Main Central Thrust, Main Boundary Fault, Siwalik structure, Himalayan Frontal Fault, evolution of Himalaya.
- 3.4 Neotectonic evidences in parts of Himalaya.

UNIT-IV (Evolution of Indian Craton)

- 4.1 Evolutionary history and structural layout of Dharwar/ South Indian craton.
- 4.2 Evolutionary history and structural layout of Bhilwara/ Central Indian craton.
- 4.3 Evolutionary history and structural layout Sighbhum/ East India craton.
- 4.4 Gravity conditions in Indian craton/s.

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

Books Recommended

- | | | |
|----|-----------|---|
| 1. | Condie | Plate Tectonics and Crustal Evolution |
| 2. | Cox | Plate Tectonics and Geomagnetic Reversals |
| 3. | Balanssov | Basic problems in Geotectonics |
| 4. | Wadia | Geology of India |
| 5. | Gansser | Geology of the Himalaya |
| 6. | Valdiya | Aspects of Geotectonics |
| 7. | Wyllia | Dynamics of Earth |

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTC214

Credits: 02

Maximum Marks: 50

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

Title: Igneous Petrology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

Objectives To acquaint the students of varied types of igneous rocks, their tectonic environment and petrogenesis.

UNIT-I

- 1.1 Magma composition, evolution and diversification; factors controlling evolution of magma, influence of volatiles and role of oxygen fugacity in magmatic crystallization, nucleation and crystal growth in magmatic system.
- 1.2 Generation of magma in mantle and crust and their relation to plate tectonics.
- 1.3 Phase, Phase rule, Phase diagram, Phase equilibrium studies of binary system with eutectic (Di-An), peritectic (Fo-Silica) and solid solution relation (Ab-An) and ternary system (Di-Ab-An) and their significance.
- 1.4 Different classification schemes of igneous rocks, IUGS classification of plutonic and volcanic rocks.

UNIT-II

- 2.1 Classification of basalts: IUGS, Kuno, Yoder and Tilley, Macdonald and Katsura, Chayes, Pearce and Cann.
- 2.2 Generation of basalts: parent materials, primary origins, secondary origins.
- 2.3 Petrogenesis of basalts in relation to tectonic environment: ORB (OFB), WPB (IPB), IAB and OCMB (subduction zone).
- 2.4 Lunar basalts; Ophiolite suite; Andesites and their petrogenesis.

UNIT-III

- 3.1 Petrology and classification of granites: Alphanumeric and tectonic.
- 3.2 Granite in various tectonic environments, Use of trace elements in tectonic discrimination.
- 3.3 Petrogenesis of granites: source materials, sediments and metasediments, basalt or andesites.
- 3.4 Petrological and geochemical characters of pegmatites and their petrogenesis.

UNIT-IV

- 4.1 Petrological characters, classification and petrogenesis of Lamprophyres.
- 4.2 Mineral composition, classification and petrogenesis of Carbonatites and Nepheline Syenites.
- 4.3 Mineralogy of Kimberlites and their petrogenesis.
- 4.4 Petrography, composition and petrogenesis of Komatiite and Anorthosites.

Books Recommended

- | | | |
|---|----------------------|--|
| 1 | Alexander McBirney | Igneous Petrology. |
| 2 | Anthony Hall | Igneous Petrology. |
| 3 | Anthony R. Philpotts | Principles of Igneous and Metamorphic Petrology. |
| 3 | Daniel S. Barker | Igneous Rocks. |

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

4	Loren A. Raymond	Petrology.
5	Marjorie Wilson	Igneous Petrogenesis.
6	Mihir K. Bose	Igneous Petrology.
7	Myron G. Best	Igneous and Metamorphic Petrology.
8	John D. Winter	Principles of Igneous and Metamorphic Petrology

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTC215

Title: Invertebrate Palaeontology

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 May 2019, May 2020 & May 2021)

Objectives:

1. To understand the basic principles of organic evolution and their application in palaeontology.
2. 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. Diversity of life on the earth with major adaptive events ó origin of metazoan, skeletalizations, predation, terrestrialization, trees and forests, flight and consciousness.
2. Classification and Nomenclature, distribution and dispersal of organisms.
3. Mass extinctions ó patterns, selectivity, timing, periodicity and causes of mass extinction.
4. Type specimens, fixing and nature of type specimens, methods of fossil identification and description, law of priority, homonymy and synonymy.

UNIT-II

1. Trace Fossils: classification ó Morphology, Preservation, Taphonomic, Ethological and Phylogeny; Preservation of Trace fossils.
2. Groups of trace fossils - borings as trace fossils and marine bio- erosion, traces of predation, fossil tracks and impressions of vertebrates.
3. Paleontological significance of trace fossils
4. Stratigraphical significance of trace fossils

UNIT-III

1. Arthropods groups ó Morphology, classification, evolution, cephalic sutures, faunal provinces and stratigraphical use of trilobites.
2. Brachiopoda ó Morphology, classification, evolution, faunal provinces and stratigraphical use of brachiopods.
3. Bryozoa ó Morphology, classification, evolution, ecology and distribution, shallow water bryozoans, reef-dwelling bryozoans.
4. Mollusca ó Morphology, classification and evolution of bivalves. Predation of molluscs.

UNIT-IV

1. Cephalopods and Gastropods- Morphology, classification, evolution and distribution
2. Echinoderms ó Morphology, classification and evolution of echinoids, earliest echinoderms and their radiations.
3. Graptolites ó Morphology, classification, biological affinities, evolution, graptolite faunal provinces, graptolites as stratigraphical indicators.
4. Cnidarians ó Morphology, classification and evolution, Use of corals as stratigraphical indicators and geochronometers.

Books Recommended

1. Morley Davis & Stubblefield, S.J. In Introduction to Palaeontology

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(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

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
14. Amal Dasgupta Introduction to Palaeontology

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTC216

Title: Non-Clastic Sedimentology

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 May 2019, May 2020 & May 2021)

Objectives- To impart knowledge about the genesis of carbonate rocks. To study the sedimentary structures in carbonate rocks. To discuss the microfacies concept and techniques used for staining the carbonate minerals.

UNIT-I

- 1.1 Allochemical and orthochemical constituents of carbonate rocks and their origin.
- 1.2 Nomenclature and Classification of carbonate rocks (Folk and Dunham).
- 1.3 Petrogenesis of biogenic silica deposits.
- 1.4 Petrogenesis of phosphate deposits.

UNIT-II

- 2.1 Diagenesis ó Types and its role in shaping carbonate rocks.
- 2.2 Diagenesis and porosity evolution of carbonate rocks.
- 2.3 Chemically formed sedimentary structures and their geological significance.
- 2.4 Biogenic sedimentary structures and their geological significance..

UNIT-III

- 3.1 Introduction to modern carbonate sedimentary environments.
- 3.2 Carbonate evaporate shorelines, shelves and basins.
- 3.3 Introduction to evaporates and Subkha Model.
- 3.4 Dolomitization models and dedolomitization.

UNIT-IV

- 4.1 Staining techniques for carbonate minerals.
- 4.2 Microfacies concept and techniques.
- 4.3 Cathodoluminescence principles and techniques.
- 4.4 Plate tectonics vis-a-vis oil prospecting.

Books Recommended

1. Balatt, Middleton and Murray Carbonate sediments and their origin
2. Bathurst, R.G.C. Carbonate sediments and their diagenesis
3. Knut Bjorlykke: Sedimentology and Petroleum Geology
4. Carozzi, A.V. Carbonate rock depositional models: A Microfacies Approach
5. Wilson, J.L. Carbonate rocks in Geologic History
6. Carver, R.F. Procedures in Sedimentary Petrology
7. Leeder, M.R. Sedimentology: Process and Product
8. Prothero and Schwab Sedimentary Geology
9. Reading, H.G. Sedimentary Environments
10. Collinson and Thomson Sedimentary Structures

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTC217

Title: Ore Geology

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 May 2019, May 2020 & May 2021)

Objectives - To impart the knowledge and understanding about the various processes of the ore formations. To introduce the modern concepts of the ore genesis. To understand the formation, mode of occurrences and types of various petrological ore associations.

UNIT-I

- 1.1 Introduction to ore microscopy; Qualitative and Quantitative methods in the identification of Ore minerals.
- 1.2 Mode of occurrences of ore bodies ó morphology of ore body, attitudinal relation with host rock and secondary structures in the host rocks
- 1.3 Spatial and temporal distribution of ore deposits ó a global perspective
- 1.4 Ore deposits in global tectonic context

UNIT-II

- 2.1 Chromite deposit associated with mafic and ultramafic rocks : their types and genetic models.
- 2.2 Genesis of Cu-Ni ± Co sulfides deposits associated with magmatic processes.
- 2.3 Diamond deposits associated with Kimberlites their characteristics and genetic models.
- 2.4 Mineralization associated with Carbonatites- their characteristics and genesis.

UNIT-III

- 3.1 Disseminated and stockwork deposits associated with acid and intermediate rocks. Pegmatites and associated mineralization.
- 3.2 Porphyry copper deposits- types, characteristics, associated alterations and origin.
- 3.3 Hydrothermal processes and related ore deposits- Hydrothermal fluids; Classification, general characteristics of the hydrothermal deposits and associated wall rock alterations; Mineralisation associated with greisens.
- 3.4 Volcanic hosted massive sulfide deposits ó types, characteristics and mode of occurrences.

UNIT-IV

- 4.1 Placers and paleoplacers ó process and mechanism of development, tectonic and temporal aspects of placer deposition and origin of ores.
- 4.2 Sedimentary and syngenic iron ore deposits ó types, general characteristics and origin.
- 4.3 Stratabound carbonate hosted base metal deposits ó types, general characteristics and genetic models.
- 4.4 Ores related to weathering processes ó bauxite, laterite and Ni/Au-laterite deposits, general characteristics and process of formation. Supergene enrichment.

Books Recommended

- | | | |
|----|--------------------|---|
| 1. | Barnes, H L | Geochemistry of Hydrothermal Ore Deposits |
| 2. | Edwards & Atkinson | Ore Deposit Geology |
| 3. | Evans A M | Ore Geology and Industrial Minerals |
| 4. | Evans A M | An Introduction to Ore Geology |
| 5. | Klemm & Schneider | Time and Strata Bound Deposits |

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(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

6.	Mishra K C	Understanding Mineral Deposits
7.	Mukerjee A	Ore Genesis: A Holistic Approach
8.	Robb, L J	Introduction to Ore Forming Processes
9.	Park & Macdiarmid	Ore Deposits
10.	Pohl, W	Economic Geology: Principal and Practice
11.	Smirnov	Geology of Ore Deposits
12.	Pirajno Franko	Hydrothermal Mineral Deposits

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGLC218

Title: Practical - I

(related to courses PSAGTC-212, 213, 214 &

Two weeks geological field)

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 3 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

Course No. PSAGTC212 (Geohydrology) 10 marks*

Selection of gravel ; Size and slot size for sieve analysis data. Designing of tube well assembly from electric log.; Interpretation of three layer resistivity curve by Taggø method. Computation of aquifer parameters from SDT and APT data. Identification of aquifer boundaries. Groundwater Budgeting. Computation of intergranular pressure changes with declining water table. Problems based on the principles of groundwater flow in porous media; Steady and Unsteady flow to a well.

Course No.: PSAGTC213 (Geotectonics) 10 marks*

Study of geological maps and drawing of cross sections and profiles of the geological map.

Course No. PSAGTC214 (Igneous Petrology)* - 10 marks

Spotting and description of various igneous rocks; Identification of rocks under the microscope, Calculation of CIPW norm.

Geological Field Work/ geological mapping in Himalayan Terrain of 2-3 weeks duration and submission of field report ó 15 marks*.

Viva ó 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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGLC219

Title: Practical -II

(related to courses PSAGTC-215, 216 & 217 & Two weeks geological field's report)

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 3 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in May 2019, May 2020 & May 2021)

Course No. PSAGTC215 (Invertebrate Palaeontology)** -10 marks

Application of zoological code of nomenclature for taxonomic studies. Study of mega and microfossils of various invertebrate groups. Univariante and bivariante analysis of fossils using regression analysis and major axis equations. Study of methods of preservation of fossils.

Course No. PSAGTC216 (Non Clastic Sedimentology)** - 10 marks

Microfacies identification and interpretation, staining techniques of identification of carbonate minerals, hand specimens, XRD and SEM study of carbonates, etc.

Course No. PSAGTC205 (Ore Geology)** - 10 marks

Spotting and description of ores specimens; Identification and study of optical properties of ores under the microscope,

Geological Field Report for Geological field work/ geological mapping in Himalayan Terrain of 2-3 weeks ó 15 marks**.

Viva ó 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

SEMESTER – III

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

SEMESTER - III DETAILED SYLLABUS

Course No.: PSAGTE311

Credits: 02

Maximum Marks: 50

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

Title: Applied Hydrology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

OBJECTIVES: To study the origin and causative factors, occurrence, distribution, quality and general behaviour of water under varying geological and geographical conditions.

Unit-I : Origin, Occurrence and distribution of water

- 1.1 Origin of water: Methods, magmatic, metamorphic, juvenile, connate marine, volcanic plutonic water, Subsurface movement and vertical distribution of groundwater and governing physical laws; surface ground water relationship, Renewable and non-renewable groundwater resources.
- 1.2 Hydrological properties of formations: porosity and permeability their determination in the laboratory, Physical properties of the reservoir rocks-intrinsic permeability.
- 1.3 Hydraulic conductivity, transmissivity, storativity, specific yield specific retention. Formation constants, Genetic and hydrologic classification of reservoirs rocks and boundary conditions.
- 1.4 Hydrostratigraphic units, water table contour maps and flow net analysis. Concepts of drainage basin and groundwater basin. Hot water springs-origin, their origin, distribution and economic importance

UNIT-II : Hydrometeorology

- 2.1 Precipitation: Process, causes, types and measurements, computation of average rainfall.
- 2.2 Evapotranspiration: Process, causes, factors influencing and measurements in the field and of empirical equations.
- 2.3 Infiltration: Process, factors affecting, measurement, relation to runoff and computation of runoff, Hydrographs.
- 2.4 Elements of snow Hydrology: Factors influencing snow melt and determination of runoff (snowmelt)

UNIT-III : Water Quality

- 3.1 Physical and chemical properties of water quality criteria for domestic, irrigation and industrial use and Graphical presentation of water quality data.
- 3.2 Groundwater quality in different provinces of India. Water containments and pollutants; arsenic, fluorides and nitrates, Relationship of water quality to use change in water quality.
- 3.3 Seawater Intrusion in coastal aquifers and remedial measures. Upcoming Ghyben-Herzberg relation.
- 3.4 Influence of aquifer material on groundwater quality. Water quality estimation and methods of treatment for various uses.

UNIT-IV : Water Resource Behaviour

- 4.1 Drainage mapping and morphometric analysis
- 4.2 Watershed management-watershed conservation, planning and management
- 4.3 Runoff estimates and future surface discharge simulation for watershed Management
- 4.4 Flood and flood plain mapping, monitoring and zoning

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(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Books Recommended

- | | |
|---------------------------------------|--|
| 1. Todd, D.K | : Groundwater Hydrology |
| 2. Hariwarayan | : Exploration techniques for groundwater. |
| 3. Lynch, R.J | : Formation of Evaluation |
| 4. Davis & Wiest | : Hydrology |
| 5. Chow | : Handbook of Applied Hydrology |
| 6. Johwon | : Groundwater and Wells |
| 7. Watton | : Groundwater Resource Evaluation |
| 8 Linsley ehal | : Applied Geology |
| 9. Linsley and Frangini | : Water Resource Engineering |
| 10. H.Bouwar | : Groundwater Hydrology |
| 11. Patrick. A Dommenica | : Concepts and Models in Groundwater Hydrology |
| 12. Freeze, R.A and Cherry, J.A. 1979 | : Groundwater |
| 13. Fetter, C.W. 1990 | : Applied Hydrogeology |
| 14. Alley, W.M. 1993 | : Regional Groundwater Quality |
| 15. Subramaniam, V. 2000 | : Water |
| 16. Singhal, B.B.S. 1986 | : Engineering Geosciences. |
| 17. Black W. and others (Ed.) 1989 | : Hydrogeology Geol.Soc.of America Pub. |

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE312

Title: Coal Geology

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 December 2019, December 2020 & December 2021)

Objectives: To impart knowledge about the genesis and distribution of coal in space and time.

UNIT-I

- 1.1 Introduction to coal geology: coal use, origin of coal; accumulation of vegetable matter; formation of coal
- 1.2 Physical description of coal: macroscopic and microscopic description of coal
- 1.3 Types of coal, coalification (rank); causes of coalification; structures in coal seams
- 1.4 Coal quality: physical and chemical properties of coal

UNIT-II

- 2.1 Petrography of coal: lithotypes, macerals and microlithotypes.
- 2.2 Stages and methods of coal exploration
- 2.3 Coal preparation for different industrial uses.
- 2.4 Seyler's Classification of coal, grading of coking and non-coking coals of India.

UNIT-III

- 3.1 Coal forming epochs, coal and lignite resources of India
- 3.2 Geological and geographical distribution of coal in India
- 3.3 Detailed geology of Jharia coalfield
- 3.4 Detailed geology of Raniganj coalfield

UNIT-IV

- 4.1 Combustion and carbonization of coal
- 4.2 Coal as an alternative energy resource: coal bed methane (CBM); coal as a liquid fuel; underground coal gasification (UGC)
- 4.3 Coal and the Environment: watercourse diversions; water pollution; runoff, erosion and sedimentation; dust suppression; subsidence; health hazards, future implications of coal
- 4.4 Coal marketing: factors of coal marketing.

Books Recommended

1. Chandra, D., Singh, R.M & Singh, M.P. A Text Book of coal.
2. Singh, M.P. (Ed.) Coal and Organic Petrology.
3. Sharma, N. L. Introduction to the Geology of Coal and Indian Coalfields.
4. Acharyya, S.K. Coal and Lignite Resources of India
5. Thomas, Larry Coal Geology

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE313

Credits: 02

Maximum Marks: 50

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

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Title: Geochemistry

No. of teaching hours: 30

Duration of Examination: 2½ hrs

Objectives To impart the knowledge about the concept of geochemistry and classification of elements.

UNIT-I

- 1.1 Concept of geochemistry, geochemical classification of elements.
- 1.2 Geochemical constitution of earth; Washington's, Goldschmidt's, Kuhn and Ritmann Hypothesis.
- 1.3 Meteorites: mineralogy and classification.
- 1.4 Geochemical cycles; endogenic and exogenic cycles.

UNIT-II

- 2.1 Geochemistry of the lithosphere.
- 2.2 Geochemistry of the hydrosphere.
- 2.3 Geochemistry of the atmosphere; structure and composition of atmosphere.
- 2.4 Geochemistry of the biosphere; geochemical role of bacteria, organogenic sediments.

UNIT-III

- 3.1 Radiogenic isotopes, isotopic decay and growth of daughter isotopes, cosmogenic radionuclides.
- 3.2 Radiometric dating of single mineral and whole rock by various methods and their limitations.
- 3.3 Stable isotopes, nature, abundance and fractionation.
- 3.4 Oxygen, hydrogen, sulfur and carbon isotopes and their application in geology.

UNIT-IV

- 4.1 Significance of crystal chemistry in geochemistry, isomorphism and diadochy, camouflage, capturing and admission of trace elements.
- 4.2 Laws of thermodynamics, entropy and enthalpy, Gibb free energy.
- 4.3 Elemental partitioning in minerals/rocks, partition coefficient, simple and exchange reactions, application in petrogenetic studies.
- 4.4 Rare earth geochemistry, general geochemical properties of REE's and their abundance and mobility in crust.

Books Recommended

1. Alberede F. Geochemistry: An introduction.
2. Barnes Geochemistry of Hydrothermal Ore Deposits.
3. Faure Principle of Isotope Geology.
4. Henderson Inorganic Geochemistry.
5. Henderson Rare Earth Element Geochemistry.
6. Mason & Moore Introduction to Geochemistry.
7. Mishra K C Introduction to **Geochemistry**: Principles And Applications
8. Ottonello Principles of Geochemistry
9. Wedepohl Handbook of Geochemistry.

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(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Guidelines for the paper setters

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE314

Credits: 02

Maximum Marks: 50

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

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Title: Metamorphic Petrology

No. of teaching hours: 30

Duration of Examination: 2½ hours

Objectives: - To discuss the process of metamorphic reactions and paragenesis.
To study the various aspects of metamorphic facies.
To acquaint the students with latest metamorphic processes.

UNIT-I

- 1.1 Metamorphic reactions, polymorphic transition, solid-solid, solid-gas application to geothermobarometry.
- 1.2 Composition-paragenesis diagrams, ACF and AKF diagrams, AFM projections.
- 1.3 Metamorphic differentiation and anatexis in metamorphic rocks.
- 1.4 The process of metasomatism and its types.

UNIT-II

- 2.1 The concept and system of metamorphic facies.
- 2.2 Systematic description and characteristics of Sanidinite Facies.
- 2.3 Systematic description and characteristics of Hornfels Facies.
- 2.4 Systematic description and characteristics of Green Schist Facies.

UNIT-III

- 3.1 Ocean floor metamorphism and its types.
- 3.2 Shock metamorphism.
- 3.3 Paired metamorphic belts and their significance.
- 3.4 Plate tectonics and regional metamorphism.

UNIT-IV

- 4.1 Mineralogy, texture, chemical composition, types and petrogenesis of Amphibolites.
- 4.2 Characters, composition, classification and genesis of Eclogites.
- 4.3 Characters, composition, types and origin of Charnokites.
- 4.4 Characters, types and origin of Migmatites.

Books Recommended

- | | |
|-------------------------|---|
| 1. Turner, F.J. | Metamorphic Petrology |
| 2. Bhaskar Rao, B. | Metamorphic Petrology |
| 3. Best, M.G. | Igneous and Metamorphic Petrology |
| 4. Bowes, D.R. | Eyclopedia of Igneous and Metamorphic Petrology |
| 5. Philipots, A. | Igneous and Metamorphic Petrology |
| 6. Yardley, B.W. | An Introduction to Metamorphic Petrology |
| 7. Bucher, K & Frey, M. | Petrogenesis of Metamorphic Rocks |
| 8. Miyashiro, A. | Metamorphic Petrology |

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Guidelines for the paper setters

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE315

Credits: 02

Maximum Marks: 50

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

Title: Oceanography

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

- Objectives**
- To study the modern concepts regarding the topographic features of ocean basins their evolution in space and time.
 - To study the dynamics of ocean water and sedimentation.
 - To study the geochronometry of marine sediments.
 - To study the physical and biological resources of the marine realm

UNIT I

- 1.1 Oceanography-introduction; origin and evolution of ocean basins; paleoceanography - Mesozoic, Palaeogene, and Neogenepalaeoceans, sea level fluctuations and their causes
- 1.2 Topographic features of the ocean floor: continental margin provinces, ocean basin provinces, hpsography of the continents and ocean floor
- 1.3 Classification of marine sediments, sediment budget, sediment transport, accumulation of sediments in the ocean, deep-sea sediments
- 1.4 Coral reefs; geochronology of oceanic sediments

UNIT II

- 2.1. Origin and evolution of the Indian Ocean, structure and physiography of the Indian Ocean, bathymetry and bottom characteristics, sediment distribution on the Indian Ocean floor
- 2.2. Direct marine exploration methods; sea - bed deposits, oil and gas, petroleum potential of sea-bed provinces beyond the continental slope; petroleum occurrences and exploration activity around the margins of the Indian Ocean
- 2.3. India's Exclusive Economic Zone (EEZ) and its marine minerals resources.
- 2.4. Wave dynamics, deep water waves, shallow water waves, wind waves; wave reflection, refraction and diffraction

UNIT III

- 3.1 Ocean circulation: forces driving currents; surface currents ó flow within a gyre, geostrophic gyres, current within gyres, counter currents and under currents, effects of surface currents on climate
- 3.2. Thermohaline circulation - thermohaline circulation patterns, global heat connection; Wind induced vertical circulation - equatorial upwelling, coastal upwelling, downwelling
- 3.3. Heat budget and Atmospheric Circulation- Composition and properties of the atmosphere, wind patterns, storms, jet streams, El Nino, land effects on winds
- 3.4. Tides - equilibrium theory of tides, dynamic theory of tides, tidal currents in coastal areas, observation and prediction of tides

UNIT IV

- 4.1 Seawater chemistry - salinity, components of salinity, sources of ocean's salts, processes controlling the composition of sea water, determining salinity, dissolved gases - Nitrogen, Oxygen, Carbondioxide; Density structure of ocean, density stratification and water masses
- 4.2 Phytoplankton dynamics in the marine food web: inputs of organic carbon, concept of food chain; primary production, measuring productivity, factors limiting productivity-grazing pressure, losses to

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

deep water, factors affecting growth rates - light, temperature, nutrients, physiological adaptations; application of remote sensing

- 4.3 Marine resources: Physical Resources - Petroleum and Natural Gas, sand and gravel, magnesium and magnesium compounds, salts, manganese and phosphate nodules, metallic sulfides and muds; Biological Resources - fish, crustaceans, molluscs, whaling, fur-bearing mammals, botanical resources, aquaculture
- 4.4. Marine pollution - pollutants: oil, heavy metals, synthetic organic chemicals, eutrophication, solid waste, sediment, sewage, waste heat, introduced species, the cost of pollution; habitat destruction: bays and estuaries, coral reefs, other habitats; global changes - ozone layer depletion, global warming, acid rain

RECOMMENDED BOOKS

1. Garrison, T. 1996 Oceanography- An invitation to Marine Science. *Wadsworth Publishing Company*.
2. Qasim, S.Z. & Roonwal, G.S. (eds). 1996 India's Exclusive Economic Zone. *Omega Scientific Publishers*.
3. Gross, M.G. 1972 Oceanography - A view of the Earth. *Prentice-Hall*.
4. S. Davis, R.A. Jr. 1972 Principles of Oceanography. *Addison -Wesley Publishing Company*.
5. Roonwal, G.S. 1986 The Indian Ocean: Exploitable mineral & petroleum Resources. *Narosa Pub. house*
6. Haq, B.U. & Milliman, J.D. 1984 Marine Geology and oceanography of Arabian Sea and coastal Pakistan. *Elite Publishers Limited*.
7. Francis P. Shepard Geological Oceanography.
8. Bhatt, J.J. 1978 Oceanography - Exploring "the planet Ocean. *D. van Nostrand Company*.
9. Duxbury, A.B. & Duxbury, A.C. 1993 Fundamentals of Oceanography. *Wm. C. Brown Publishers*.
11. Turekian, K.K. Oceans.
12. A.P. Trujillo & H.V. Thurman 2012 Essentials of Oceanography. *PHI Learning Private Limited*

Guidelines for the paper setters

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE316

Credits: 02

Maximum Marks: 50

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

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Title: Petroleum Geology

No. of teaching hours: 30

Duration of Examination: 2½ hours

Objectives: To This course contrives to introduce the history of the geology of petroleum with a futuristic vision, also bearing in mind the importance of present energy challenges of which oil and gas form an important and inseparable part. Stress will be on inculcating the classical ideas and, imparting the latest knowledge and practical ideas about conventional and unconventional petroleum systems ó their origin, distribution, exploration, exploitation and production. Students should see this an opportunity to explore energy options in India that are intricately based on the conditions created by geology.

UNIT- I

- 1.1 Introduction: historical overview and the context of petroleum geology ó origin, occurrence and exploration. .
- 1.2 Petroleum: composition, classification, physical and chemical properties ó crude oil, natural gases and gas hydrates.
- 1.3 Organic matter (production, accumulation and transformation) and Kerogen (composition and classification): a geological perspective. Palaeobiology and geochemistry of source rocks ó a case history.
- 1.4 Petroleum system: essential elements (source, reservoir and seal/cap rocks) classification and characteristics, and the timing of oil and gas generation.

UNIT- II

- 2.1 Expulsion (protopetroleum, aqueous and gaseous solution), primary migration (physicochemical, geological and geochemical aspects), secondary migration and accumulation of oil and gas.
- 2.2 Petroleum traps: nomenclature, classification and types viz. structural, stratigraphic, diapiric (salt domes etc.), combination and hydrodynamic.
- 2.3 Mechanism and timing of trap development relative to petroleum migration and reservoir development. Critical moment and petroleum system events chart ó a case history from NW Himalaya, India.
- 2.4 Oil and gas exploration ó source rock identification, oil-source rock correlation and locating petroleum prospects.

UNIT-III

- 3.1 Geophysical petroleum exploration, formation evaluation, drilling technology and well operations in petroleum geology.
- 3.2 Crude oil refining and extraction of petroleum products ó processes, procedures and technological advancement.
- 3.3 The petroleum industry, corporate social responsibility and environmental challenges and impacts. Our role ó energy efficiency and conservation, a case history.
- 3.4 Distribution of oil and gas reserves globally and in India ó geological and geochemical implications.

UNIT- IV

- 4.1 Conventional (true and hybrid) and unconventional petroleum systems (e.g. shale gas, oil shales, tar sands) ó understanding from case histories.

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

- 4.2 Petroleum systems and hydrocarbon potential of the North-West Himalaya of India and Pakistan.
- 4.3 Petroleum systems and hydrocarbon potential of northeastern India and Myanmar (Burma).
- 4.4 Petroleum systems and hydrocarbon potential of the east and west coast (onshore and offshore) India.

Books Recommended

- | | | |
|-----|---------------------------------------|-----------------------------------|
| 1. | Mc.Cray, A.W & Frank, W.C. | Oil Well Drilling Technology |
| 2. | Chapman, R.E. | Petroleum Geology |
| 3. | Landes, K.K. | Petroleum Geology |
| 4. | Russel, W.L. | Principles of Petroleum Geology |
| 5. | Chandra, D. & Singh, R. M. | Petroleum (Indian Context) |
| 6. | Hager, D. | Practical Oil Geology |
| 7. | Levorson, A.I. | Geology of Petroleum |
| 8. | Amyx, J.W., Ban, D.M. & Whiting, R.L. | Petroleum Reservoir Engineering |
| 9. | Deshpande, B.G. | The World of Petroleum |
| 10. | Holson, G.D. & Tiratsoo, E.N. | Introduction to Petroleum Geology |
| 11. | Selley, R.C. | Elements of Petroleum Geology |

Guidelines for the paper setters

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 (Upto 50% Syllabus)

- (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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE317

Credits: 02

Maximum Marks: 50

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

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Title: Vertebrate Palaeontology

No. of Teaching hours: 30

Duration of Examination: 2½ hours

- Objectives**
- To provide conceptual knowledge of the evolutionary processes of vertebrates as evidenced from the fossil record.
 - To have detailed knowledge of the evolution of dinosaurs, proboscideans, perissodactyls, and primates.
 - To know about the important fossil vertebrates of India and their significance.

UNIT I

- 1.1. General characters of vertebrates, origin of vertebrates
- 1.2. Modes of vertebrate preservation; collection and preparation of vertebrate fossils
- 1.3. Important landmarks in the evolution of vertebrates (agnathans, fishes, amphibians, reptiles, birds and mammals i.e. evolution of bone and cartilage, jaw and teeth, transition from water to land, development of amniote egg), their classificatory characters and division at the level of class
- 1.4. Evolutionary process and the fossil record: Micro- and Macro-evolution, heterochrony, punctuated equilibrium, Hennigian systematics, molecular clocks and estimation of divergence time

UNIT II

- 2.1. Classification of reptiles; origin of dinosaurs and their classification in brief
- 2.2. Origin of birds, anatomy of *Archaeopteryx*, birds as dinosaurs
- 2.3. Endothermy versus ectothermy in dinosaurs
- 2.4. Extinction of dinosaurs

UNIT III

- 3.1. Gondwana vertebrates of India and their palaeobiogeographic significance
- 3.2. Deccan intertrappean vertebrates of India and their palaeobiogeographic significance
- 3.3. Brief classification of mammals; habitat shift in whales - the fossil record from the Indian subcontinent
- 3.4. Classic trends in the evolution of horse, Cenozoic distribution of horses, evolutionary implications of climatic changes

UNIT IV

- 4.1. Interrelationships of major groups of primates; evolution of man and lithic cultures associated with various stages of human evolution
- 4.2. Classic trends in the evolution of proboscideans, their systematic and phylogeny
- 4.3. Pleistocene extinction of mammoths and other fauna.
- 4.4. Siwalik vertebrate faunal changes and their relation to tectonic and eustatic events.

RECOMMENDED BOOKS

1. A.S. Romer & T.S. Parsons. 1977. The Vertebrate Body. 5th edition. Saunders, Philadelphia, PA.
2. E.H. Colbert. 1980. Evolution of the Vertebrates ó A history of the backboned animals through time. John Wiley & Sons. Pp510.

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

3. R.L. Carroll. 1997. Pattern and Processes of Vertebrate Evolution. Cambridge University Press. Pp 448.
4. M.J. Benton. 2000. Vertebrate Palaeontology. 2nd edition. Blackwell Science Ltd. Pp452.
5. Milton Hildebrand and G.E. Goslow. 2001. Analysis of Vertebrate Structure. 5th edition. John Wiley & Sons, Inc. Pp635.
6. M.J. Benton. 2005. Vertebrate Palaeontology. 3rd edition. Blackwell Science Ltd. Pp455.
7. David E. Fastovsky & David B. Weishampel. 1996. The Evolution and Extinction of the Dinosaurs. Cambridge University Press. Pp460. (Chapter 13 Pp 293-322).
8. R.L. Carroll. 1988. *Vertebrate Palaeontology and Evolution*. Spektrum Akademischer Verlag. Pp698.
9. R.S. Lull. 1976. Organic Evolution. *Macmillan Publishing Co. Inc.*
10. P. Doyle. 1996. Understanding of Fossils. *John Wiley and Sons Ltd.*
11. D.E.G. Briggs & P.R. Crowther. 2001. Palaeobiology II. Blackwell Science Ltd.

Guidelines for the paper setters

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 (Upto 50% Syllabus)

(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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTO318

Credits: 04

Maximum Marks: 100

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

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Title: Fundamentals of Geology

No. of teaching hours: 60

Duration of Examination: 3 hours

Objectives: To acquaint the students with the concept of earth formation, minerals, rocks, processes of landforms, fossils, volcanoes, plate tectonics, groundwater, etc.

Unit – 1

- 1.1 Origin and interior of the Earth. Dating of rocks by various methods
- 1.2 Volcanoes - causes and products; volcanic belts. Earthquakes-causes, effects and distribution, relation to volcanic belts.
- 1.3 Mountains - types and origin, sea-floor spreading and plate tectonics, Isostasy, Island arcs, deep sea trenches and mid-ocean ridges,
- 1.4 Continental drift, Origin of continents and oceans.

Unit – II

- 2.1 Basic concepts and significance of geomorphology. Geomorphic processes and parameters
- 2.2 Geomorphic cycles and their interpretation. Relief features
- 2.3 Topography and its relation to structures and lithology,
- 2.4 Major landforms, Drainage systems, Geomorphic features of Indian subcontinent

Unit - III

- 3.1 Micro and Macro-fossils, Modes of preservation and utility of fossils
- 3.2 General idea about classification and nomenclature of fossils
- 3.3 Principles of Stratigraphy. Stratigraphic classification and nomenclature
- 3.4 Standard stratigraphic scale (2012); General account of various geological systems with special reference to J&K

Unit- IV

- 4.1 Important rock forming minerals - their physical, chemical and optical properties, alteration products of these minerals.
- 4.2 Magma, its generation, nature and composition, Textures and structures and their petrogenetic significance
- 4.3 Classification of igneous rocks. Plutonic, hypabyssal and extrusive igneous rocks
- 4.4 Classification of sedimentary rocks, clastic and non-clastic, heavy minerals and their significance, Elementary concept of depositional environments

Unit- V

- 5.1 Aquifer, types of aquifer, vertical distribution of ground water, porosity, permeability, hydrological cycle
- 5.2 Fold its types and classifications; Fault its type and classification Unconformity-types, and its recognition in the field
- 5.3 Dip, types of dip, strike, outcrop, compass and its uses, interpretation of topographic maps
- 5.4 Geochemical classification of elements in earth, Meteorites and its types.

Recommended Books:

1. Fundamentals of Geology by A Holmes and D Holmes

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(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

2. Sedimentary rocks by F J Pettijhon
3. Applied Sedimentology by R. C. Shelly
4. Sedimentology by M R Leeder
5. Optical Mineralogy by Kerr, P G
6. Text Book of Mineralogy by Dana, P S
7. Igneous Petrology by Anthony Hall
8. Igneous and Metamorphic Petrology by M G Best
9. Metamorphic Petrology by B Baskar Rao
10. Encyclopedia of Igneous and Metamorphic Petrology by Bowes, D R
11. Ore Genesis ó A Holistic Approach by Ashok Mookherjee
12. Fundamentals of Palaeontology by Raup and Stanley
13. Basic Palaeontology by Benton and Harper
14. Geology of India by Wadia
15. Geology of India by Balakrishnan and Vaidyanathan Vol I & II
16. Structural Geology by Billings
17. Structural Geology by S K Gosh
18. An Outline of Structural Geology by Hobbs, Means and Williams
19. Structure and Tectonics by Bagley P C
20. Practical in Geology by A K Sen
21. Ground water hydrology by D.K. Todd
22. Basic methods of structural geology by Stephen Marshak and Goutam Mitra
23. Introduction to Geochemistry by Mason & Moore

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)

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGLC319

Title: Practical - I

(related to courses PSAGTC-311, 312/316,313 & Two weeks geological field)

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 3 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Course No. PSAGTE311 (Applied Hydrology)** -10 marks

Estimation of potential evapotranspiration and water balance through empirical equation; Drainage mapping and Morphometric analysis; Determination water equivalent in snow hydrology; Presentation of Hydrogeochemical data. Flow net analysis

Course No. PSAGTE312 (Coal Geology)** -10 marks

Study of physical properties of coal samples, spotting and description of coal samples, Calculation of reserves, determination of various tenors and grade of coals.

OR

Course No. PSAGTE316 (Petroleum Geology)** -10 marks

Determine porosity and permeability of the reservoir rock samples, Draw and describe various stratigraphic and structural traps, Identify the characteristic minerals on the given x-ray diffractograms of shales, Exercises on calculation of oil and gas reserves. Evaluation of bore hole data and their interpretation. Logging exercises and their application in petroleum exploration.

Course No. PSAGTE313 (Geochemistry)** -10 marks

Preparation of various solutions for determination of major and trace elements of igneous rocks, Determination of alkali elements by Flame photometer, staining techniques for identification of silicate minerals.

Two to three week geological field work (out of state) and submission of field Report -15 marks**.

Viva ó 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

**Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the
Sessions 2018-19, 2019-20 and 2020-21**

Course No.: PSAGLC319

Title: Practical - II

(related to courses PSAGTC-314, 317 & Two weeks geological field's report)

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 3 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in December 2019, December 2020 & December 2021)

Course No. PSAGTC314 (Metamorphic Petrology)** -15 marks

Spotting and description of hand specimens of important foliated and non foliated metamorphic rocks, identification of important metamorphic rocks under the microscope.

Course No. PSAGTC317 (Vertebrate Palaeontology)** -15 marks

Megascopic and microscopic study, identification and description of important vertebrate fossils

Geological Field work (out of state) Report -15 marks**.

Viva ó 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

SEMESTER – IV

**Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the
Sessions 2018-19, 2019-20 and 2020-21**

**SEMESTER - IV
DETAILED SYLLABUS**

Course No.: PSAGTE411

Credits: 02

Maximum Marks: 50

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

Title: Application of Remote Sensing in Geology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Unit-1

- 1.1 Remote Sensing in geology ó an overview
- 1.2 Basic concept of geomorphology, earth surface process and resultant landforms
- 1.3 Spectral characteristics of rocks and minerals
- 1.4 Interpretation of drainage patterns ó types and its significance in geologic interpretation

Unit -2

- 2.1 Lithological interpretation of Igneous rocks, Sedimentary rocks and Metamorphic rocks
- 2.2 Structure ó Definition, types and structural mapping Interpretation of folds, faults, unconformities and lineaments
- 2.3 Interpretation of fluvial landforms
- 2.4 Interpretation of glacial and volcanic Landforms

Unit – 3

- 3.1 Interpretation of Karst landforms
- 3.2 Interpretation of structural and denudational landforms ó cuesta, hogback , butte, mesa etc
- 3.3 Interpretation of landforms related to igneous, sedimentary and metamorphic rocks
- 3.4 Geomorphological mapping and terrain evaluation

Unit – 4

- 4.1 Remote Sensing in surface water exploration-Role of Remote Sensing in watershed conservation, planning and management
- 4.2 Remote Sensing in Groundwater exploration- Groundwater flow and groundwater interaction, control and occurrence of groundwater movement
- 4.3 Remote Sensing in Mineral exploration - An overview and application of Remote Sensing in Mineral Exploration ó Indian Examples
- 4.4 Remote Sensing in Oil Exploration ó Features helpful in detection of target areas for oil exploration

Books Recommended

- Drury, S.A., 1987: Image Interpretation in Geology. Allen and Unwin
- Gupta, R.P., 1990: Remote Sensing Geology. Springer Verlag.
- Jensen, J.R. 2000 : Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall
- Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation , John Wiley.
- Paine, D.P., 1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
- Pandey, S.N., 1987: Principles and Applications of Photogeology. Wiley Eastern.,

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Miller, V.C., 1961: Photogeology. McGraw Hill.

Ray, R.G., 1969: Aerial Photographs in geologic Interpretations. USGS Prof, Paper 373.

Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H.Freeman and company

Skidmore A.2002: Environmental modeling with GIS and Remote Sensing. Taylor and Francis

Guidelines for setting of question papers

Minor test -1 (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

Minor test 2 (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)

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

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE412

Credits: 02

Maximum Marks: 50

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

Title: Cryosphere & Climate Change Science

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Objectives: To introduce the fundamental concepts climate change in the past: understand the concept of various processes and dynamics of glacier formation, movement and chronology. Introduce the concept of climate change and various global oceanic and wind circulation patterns.

Unit I

(7 lectures)

- 1.1 Elements of the cryosphere; importance of the cryosphere, role of the cryosphere, in the climate system; ice ages.
- 1.2 Glacier types, dry and wet based glaciers and factors responsible, sediment transport and deposition by glaciers, physics of glacier ice and snow.
- 1.3 Techniques employed for the dating of glaciogenic deposits and their limitations, sediment discharge by meltwater and chemistry of meltwater.
- 1.4 Movement of glacier, surface and subsurface features of glacier.

Unit II

(7 lectures)

- 2.1 Meteorological parameters vis-a-vis glacier, affect of debris/aerosols on glacier surface.
- 2.2 Energy balance, mass balance study of glaciers, various methods of mass balance study, Snout monitoring techniques.
- 2.3 Isotope study of glacier ice and snow vis-a-vis climate change, chemistry of snow/ice.
- 2.4 Characteristics of permafrost areas, rock and soil characters in cryosphere, mass movement in permafrost areas ó causes and mitigation.

Unit III

(8 lectures)

- 3.1 Definition of Quaternary, duration of the Quaternary and development of Quaternary studies.
- 3.2 Quaternary stratigraphy- Oxygen isotope stratigraphy, biostratigraphy and magnetostratigraphy, application of pollen, spores and phytoliths in Quaternary stratigraphy
- 3.3 Continental records (fluvial, glacial, aeolian, paleosols) and marine Quaternary climate change records: continental- marine correlation.
- 3.4 Decadal, centennial and millennial climate change cycles, Milankovitch (Astronomical) cycle of climate change.

Unit IV

(8 lectures)

- 4.1 Carbon Cycling: physical carbon pump, biological carbon pump, marine carbon cycle, terrestrial carbon cycle.
- 4.2 El Niño and the Southern Oscillation, El Niño and its Effects, upwelling and climate.
- 4.3 Global Ocean Circulation ó Introduction and Overview, Strawberries in Norway, Icelandic Whirlpool, Origin of the Gulf Stream, The Deep Atlantic Conveyor.
- 4.4 Global Wind Systems: Trade Winds, Hadley Cell, Highs and Lows of Westerlies, Vital Importance of Indian Summer Monsoon rains.

Books Recommended

1. Maher and Thompson 2000 Quaternary climates, environments and magnetism. Cambridge Univ. Press

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(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

2. Williams, D. et al. 1998 Quaternary Environments. Wiley & Sons.
3. Bigg, G., 1999 Ocean and Climate. Springer- Verlag
4. Bradley, F., 2000. Paleoclimatology: Reconstructing Climates of the Quaternary. Springer- Verlag.
5. Williams, Durnkerley, Decker, Kershaw and Chhappell, 1998, Quaternary Environments. Wiley and Sons.
6. Evelyn Brown et al. 2001 Ocean Circulation. Elsevier.
7. David Randall 2015 Introduction to the Global Circulation of the atmosphere. Princeton Press.
8. M. Satoh 2014 Atmospheric Circulation dynamics and general circulation models. Springer- Verlag.

Guidelines for setting of question papers

Minor test -1 (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

Minor test 2 (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)

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

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No. PSAGTE413

Credits: 02

Maximum Marks: 50

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

Title: Engineering Geology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Course objective: This introductory course engineering geology provides an understanding of how earth materials and geologic processes influence various civil engineering works. It not only described and classified the earth materials for engineering purposes but also described the fundamental aspects of soil and rock mechanics, methods of site investigation and role of geology in various engineering projects with an emphasis on making construction decisions.

UNIT-I

- 1.1 Introduction and Importance: introduction of engineering geology as a branch of geology; importance and scope of engineering geology
- 1.2 Engineering properties of rocks: specific gravity, porosity, sorption, absorption value, compressive strength, poisson's ratio
- 1.3 Rocks as engineering materials: requirement of a good building stone; requirement of road materials; selection criteria of rock for varied engineering purposes
- 1.4 Methods of geological investigations for civil engineering projects: surface investigations, sub-surface investigations, objectives

UNIT-II

- 2.1 Rock mass classifications: Rock Quality Designation (RQD); Rock Structuring Rating (RSR)
- 2.2 Geomechanics classification: Rock Mass Rating (RMR)
- 2.3 Q-System classification for rock masses
- 2.4 Slope Mass Rating (SMR) geomechanics classification

UNIT-III

- 3.1 Landslides: definition; classification of landslides, causes of landslides, preventive measures of landslides, case history of landslides from India
- 3.2 Earthquakes: introduction, important terminologies of earthquake, classification of earthquake; distribution of earthquakes, seismic zones of India, causes of earthquakes
- 3.3 Tunnels: classification of tunnels, lining in tunnels, influence of various geological factors;
- 3.4 Methods of tunneling: Fore poling method, Needle beam method, English method, Belgian method, heading and bench method, full face method, NATM

UNIT-IV

- 4.1 Dams: terminology and classification, influence of various geological structures on dam, silting problem on dams, various causes of dam failures
- 4.2 Bridges: terminology of bridge, types of bridges, stability of bridges, design of bridges, foundation of bridges
- 4.3 Constructions of roads: hilly regions, marshy regions, roads in water logged areas, permafrost regions, geological problems after road construction

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

- 4.4 Shore line engineering: types of shorelines, erosional features of shorelines, sea water movements, shoreline protection, beach drainage, artificial reef creation

Books Recommended

- | | |
|--------------------------------|--|
| 1. Trefethen, J. M. | Geology for Engineers |
| 2. Richey, J. E. | Elements of Engineering Geology |
| 3. Legget, R. F | Geology and Engineering |
| 4. Arora D. S | A Text Book of Engineering and General Geology |
| 5. Jaeger, C. | Rock Mechanics and Engineering |
| 6. Srinivasan, R | Harbour, Dock and Tunnel Engineering |
| 7. Parbin Singh | A Text Book of Engineering and General Geology |
| 8. Brown, E.T | Rock characterization, Testing and Monitoring |
| 9. Gupta, H .K | Dams and Earthquakes |
| 10. Krynine, P D & Judd, W. R. | Principles of Engineering Geology and Geotechnics |
| 11. B. Singh & R. K. Goel | Rock Mass Classification: A practical Approach in Eng. Geology |
| 12. T Ramamurthy | Engineering in Rocks for Slopes, Foundations and Tunnels |

Guidelines for setting of question papers

Minor test -1 (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

Minor test 2 (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)

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

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE414

Credits: 04

Maximum Marks: 100

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

Title: Geo-Exploration

No. of teaching hours: 30

Duration of Examination: 3 hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Objectives : It is intended to familiarize the students with the principles, methodology and application of important geophysical and Geochemical methods adopted to investigate the surface and subsurface. To introduce the concept of exploratory mining methods.

UNIT-I

- 1.1 Introduction to geophysical exploration. Gravity method - basic principles. Earth's gravitational field and its relation to geophysical exploration.
- 1.2 Instruments used in gravity prospecting - pendulum, torsion balance and gravimeters.
- 1.3 Marine, Airborne and Terrestrial gravity measurements.
- 1.4 Reduction of gravity data, separation of regional-residual gravity anomalies and interpretation of gravity data.

UNIT-II

- 2.1 Seismic method - basic principles, types of elastic waves.
- 2.2 Refraction technique - Time distance relations for horizontal interface, dipping beds and faults. Delay time, shot and detector arrangement and corrections.
- 2.3 Reflection technique - Time distance relations for horizontal and dipping interfaces, shooting procedures and corrections applied to reflection records.
- 2.4 Seismic instruments and records (digital and analog).

UNIT-III

- 3.1 Electrical method - electrical properties. Principle, field procedures and electrode arrays used in electrical resistivity method and its application in groundwater and engineering problems.
- 3.2 Electromagnetic techniques - natural source and inductive type.
- 3.3 Well logging: Electrical, radiational and allied techniques used in petroleum, mineral and groundwater exploration.
- 3.4 Radiational method - basic principles. Instruments used in the detection and measurements of radiations and operating procedures.

Unit IV

- 4.1 Geological guides for the prospecting of mineral deposits; mineralogical, lithological and structural guides, gossans and capping.
- 4.2 Geochemical exploration Principle: mobility and geochemical association of elements, primary and secondary geochemical dispersion patterns.
- 4.3 Geochemical exploration method and Techniques
- 4.4 Geobotanical survey: Uptake of mineral matters by plants, geobotanical indicators, geobotanical survey techniques. Biogeochemical anomalies and biogeochemical method of exploration.

Unit V

- 5.1 Purpose and applications of drilling; Common drilling techniques such as rotary, percussive and diamond drilling and their use
- 5.2 Placer mining methods.

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

5.3 Open cast Mining

5.4 Underground mining methods

Books Recommended

1. Govett, G.J.S. (1983) Rock Geochemistry in mineral exploration, Vol.3. Elsevier Scientific Publishing Company.
2. Govett, W.K., Hoffman, S.J., Merthens, M.B., Sinclair, A.J. and Thomson, I. (1987). Exploration Geochemistry, Design and Interpretation of Soil Survey. Reviews in Economic Geology, Vol.4.
3. Hale, M. and Plant, J.A. (1994) Handbook of Exploration Geochemistry ó Drainage Geochemistry, vol 6, Elsevier Scientific Publishing Company.
4. Levinson, A.A. (1974) Introduction to Exploration Geochemistry, Applied Publishing Ltd. USA.
5. Reedman, J. H. (1979) Techniques in mineral exploration. Applied Science Publishers.
6. Rose, Arthur W., Herbert, E. Hawkes and Webb, John S. (1979) Geochemistry in Mineral Exploration. Acad Press.
7. Solov, A.P. (1987) Geochemical Prospecting. Mir Publishers, Moscow.
8. A.M. Evans (Ed.)1998 Introduction to Mineral Exploration. *Blackwell Science*
9. C. A. Heiland 1940 Geophysical Exploration. *Prentice-Hall Inc.*
10. G. D. Garland 1979 Introduction to Geophysics. *W.B. Saunders Company*
11. Gerhard Dahr 1984 Applied Geophysics. *English Book Depot*
12. L. L. Nettelton 1940 Geophysical prospecting for oil. *McGraw-Hill*.
13. L. L. Nettelton 1976 Gravity and Magnetics in oil prospecting. *McGraw-Hill*
14. M. B. Dobrin 1988 Introduction to Geophysical Prospecting. *McGraw-Hill* & C.H. Savit
15. M. B. R. Rao 1975 Outlines of Geophysical Prospecting ó A Manual for Geologist.
16. P. Kearey 1984 An Introduction to Geophysical Exploration. & M. Brooks
19. T.S. Ramakrishna 2006 Geophysical Practice in Mineral Exploration and Mapping.
20. W. M. Telford, L.P. Geldart, R.E. Sheriff & D. A. Keys 1988 Applied Geophysics.
21. William Lowrie 1997 Fundamentals of Geophysics.
22. Lynch 1976 Formation Evaluation.

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE415

Credits: 02

Maximum Marks: 50

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

Title: Micropalaeontology and Palaeobotany

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Objectives: To provide working knowledge of various microfossil groups and plant fossils with special reference to the Gondwana flora and the geological significance of microfossils and plants.

UNIT-I

- 1.1 Microfossils- Introduction, microfossil record, important microfossils; sampling, techniques for the separation of microfossils from the matrix, picking and mounting of microfossils.
- 1.2 Ostracoda: morphology, ornamentation, orientation of the carapace, classification, ostracodes and sedimentology, significance
- 1.3 Foraminifera: morphology of the test, composition and classification, foraminifera and sedimentology, significance
- 1.4 Siliceous microfossils: Radiolaria:- living radiolarians, classification, distribution and ecology, radiolarians and sedimentology, geological history and significance; Diatoms:- frustule, classification, general history, distribution and ecology and significance.

UNIT-II

- 2.1 Calcareous nannofossils: Coccolithophores:- coccoliths, general history, classification, life history, ecology, coccoliths and sedimentology and significance
- 2.2 Conodont: composition, elements, groups, apparatus and assemblages, biological affinities, general history and significance; Pteropods and tentaculitids
- 2.3 A brief account on the morphology, classification, biological affinities, geological history, ecology and significance of acritarchs and chitinozoans
- 2.4 A brief account on the morphology, classification, biological affinities, geological history, ecology and significance of dinoflagellates

UNIT-III

- 3.1 Charophytes: morphology, classification, ecology and significance
- 3.2 Biozones, biozonation and problems in biostratigraphic interpretations
- 3.3 Definition, origin and key steps in evolution of plants
- 3.4 Modes of preservation of plant fossils; dispersal and migration of plants

UNIT-IV

- 4.1 Modern techniques used in palaeobotanical studies
- 4.2 Spores and Pollens: morphology (shape, aperture, composition and structure, sculpture, size), pollen analysis
- 4.3 Gondwana flora of India and its significance
- 4.4 Application of palaeobotany in palaeoclimatic studies

Books Recommended

- | | |
|----------------------------|---|
| Gerard Bignot 1985 | Elements of Micro Palaeontology. <i>Graham Trotman Limited</i> |
| David G. Jenkins (Ed) 1993 | Applied Micropalaeontology. <i>Kluwer Academic Publishers</i> |
| Danial J. Jones 1956 | Introduction to Microfossils. <i>Harper and Brothers, Harper Geoscience Series.</i> |

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(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Ronald L. Austin (Ed) 1987 Conodonts: Investigative Techniques and Applications. *Ellis Horwood Limited*
M.D. Brasier 1980 Microfossils. *George Allen & Unwin*
P.K. Kathal 1998 Microfossils and their applications. *CBS Publishers*
A.C. Shukla & S.P. Mishra 1975 Essentials of Palaeobotany. *Vikas Publishing House Pvt. Ltd.*
R.H. Tschudy & R.A. Scott 1969 Aspects of Palynology. *John Wiley & Sons*

Guidelines for setting of question papers

Minor test -1 (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

Minor test 2 (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)

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

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE416

Credits: 02

Maximum Marks: 50

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

Title: Gemology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

UNIT - I Basics of Gemology

- 1.1 Gem and gemstones; General characteristics and chemical composition of gemstones; Nature of gem material: quality necessary in gems-beauty, rarity, durability.
- 1.2 Formation of gem stones;. Crystal form and habit.
- 1.3 Nature of crystals: distinction between crystalline and amorphous material, crystal symmetry, Twinning, parallel growth, crystal form, crystal habit, seven crystal system. Identification of rough stones.
- 1.4 Classification of gem stones

UNIT - II Physical Characteristics of Gemstones

- 2.1 Physical characteristics of gemstones; Cleavage, Fracture, parting, and their importance in gemology and lapidary work. Units of measurement: metric scale, carat, pearl and grain.
- 2.2 Colours in gemstone : causes
- 2.3 Hardness its applications in gemmology and limitations.
- 2.4 Quantitative determination of Specific gravity of gemstones by hydrostatic weighing, heavy liquids, floatation and pycnometer. Inclusions and other features of gemstones

UNIT - III Optical Characteristics of Gemstones

- 3.1 Electromagnetic spectrum, reflection and its importance in gemology, lustre, aventurescence, sheen, chatoyancy, asterism, luminescence, play of colours, labradorescence etc
- 3.2 Principal, Construction and use of refractometer in gemology
- 3.3 Polariscope and Dichroscope: construction and use in gemmology ,
- 3.4 Application of Chelsea colour filter, Infra-red ultraviolet and x-rays in gem identification

UNIT - IV Advance Gemology

- 4.1 Synthetic gemstones, methods of synthesis, and its characteristics. differentiation between natural and synthetic stones
- 4.2 Gem enhancement methods and their identification: colourless/coloured impregnation, heat treatment, coating, irradiation, diffusion, treatment, etc.
- 4.3 Imitation gemstones, glass and plastic imitations; organic materials. Pearls, corals, ivory and shells and amber and others
- 4.4 Grading of diamonds and coloured gemstones

Recommended Books :

Brocardo, G. (1981) Minerals and Gemstones ó An identification Guide

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(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Bruton Eric F.G.A. (1970) Diamonds
Karanth, R. V (, 2000). Gems and Gem Industry, Geological Society of India, Memoir, 45
Max Bauer (1968) Precious stones, Vol. I and II
Orlov Yu L (1973) The Mineralogy of the Diamond
Rajendran S. (2007): Mineral Exploration: Recent Strategies
Wilson, M. (1967) Gems

Guidelines for setting of question papers

Minor test -1 (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

Minor test 2 (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)

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

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTE417

Credits: 02

Maximum Marks: 50

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

Title: Sedimentary Basin Analysis

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Objectives : To understand the depositional mechanism of different sedimentary basins in relation to tectonics.

UNIT-I

- 1.1 Introduction to the sedimentary basins origin and processes ó tectonics, isostasy and eustasy.
- 1.2 Mechanisms of basin formation ó crustal thinning and stretching; lithospheric thickening; tectonic loading; sedimentary and volcanic loading; sub-crustal loading.
- 1.3 Classification of sedimentary basins ó intra-plate basins (pre-rift); divergent-margin basins (syn-rift); intra-plate basins (post-rift); convergent-margin basins; collision and post-collision basins; strike-slip basins.
- 1.4 Basin analysis ó An integrated framework of tectonic, stratigraphic and sedimentological principles.

UNIT-II

- 2.1 Geological aspects ó depositional systems and analysis (mapping, outcrop studies, sediment and sedimentation, facies, palaeo-flow, provenance, logs/wire-line logs, cores).
- 2.2 Geophysical (seismic, gravity, aeromag), geochemical (organic and mineral geochemistry) aspects.
- 2.3 Geochronological and thermo-chronological aspects and, specialized techniques viz. palaeosol, tree-ring, floral-faunal analysis.
- 2.4 Sequence stratigraphy and computer simulation - modelling and data analysis.

UNIT-III

- 3.1 Subsidence history and palaeogeographic evolution of the sedimentary basins.
- 3.2 Preservation potential of the sedimentary basins.
- 3.3 Preservability of the sedimentary basins vis-à-vis tectonostratigraphic assemblages.
- 3.4 Geothermal gradient and heat flow analysis of the sedimentary basins.

UNIT-IV

- 4.1 Shallow clastic seas: depositional system in wave, storm and tide dominated settings.
- 4.2 Deep sea depositional systems.
- 4.3 Applications of sedimentary basin analysis ó from energy to environment and climate modelling.
- 4.4 Contemporary aspects of basin analysis and recent trends.

Books Recommended

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

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(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

- 10 Selley, R.C. Applied Sedimentology
- 11 Bjorlykke, K. Sedimentology and Petroleum Geology
- 12 Blatt, Middleton and Murray Origin of Sedimentary rocks
- 13 Swift, Oertal, Tillman and Thorne Shelf Sand and Sandstone Bodies:
- 14 Zutshi and Panwar Geology of Petroliferous Basins of India
- 15 Bhandari et al. Petroliferous Dasins of India

Guidelines for setting of question papers

Minor test -1 (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

Minor test 2 (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)

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

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

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

Course No.: PSAGTO418

Credits: 04

Maximum Marks:100

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

Title: Geohazards and Disaster Management

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Objective: The main objective of the course is to explain students about the physical and geological processes causing geohazards; methods for quantifying geohazards; factors controlling their uncertainty. It also helps them to understand the possible consequences as well as risk and disaster management.

UNIT-I

- 1.1 Geohazards: meaning and types of geohazards; causes and consequences of geohazards.
- 1.2 Earthquake: Causes of earthquakes; Indian and world scenario of earthquakes.
- 1.3 Earthquake measurement; effect of earthquakes, mitigation and forecasting of earthquakes; preparedness of earthquakes.
- 1.4 Tsunami: physical characteristics of tsunami; generation mechanism and its mitigation measures.

UNIT-II

- 2.1 Landslides: Definition of landslides; types of landslides; features of landslides.
- 2.2 Causes of landslides; hazards associated with landslides; preventive measures of landslides.
- 2.3 Volcanic hazards: Causes and distribution of volcanoes; environmental impacts of volcanic eruptions.
- 2.4 Floods: Nature of floods; causes and its impact; mitigation measures and forecasting.

UNIT-III

- 3.1 Cyclones: characteristics of cyclone; causes of cyclone; preventive measures of cyclones.
- 3.2 Avalanches; formation and classification; mitigation and management plans
- 3.3 Disaster: Importance and scope of studying Disaster Management; basic concepts of disaster management; distinction between hazard, disaster and risk.
- 3.4 Vulnerability; Types of vulnerability ó physical vulnerability, socioeconomic vulnerability, Vulnerability and Disaster Risk.

UNIT-IV

- 4.1 Disaster Management ó Definition; Components of DM; Crisis Management; Risk Management.
- 4.2 Disaster Management Cycle; Impact of disaster on development; Paradigm shift in disaster management policy (policy for reduction of disaster consequences).
- 4.3 Disaster management: stages of disaster management (pre-disaster stage, emergency stage and post disaster rehabilitation).
- 4.4 Understanding of disaster management: national policy on disaster management; India's response to changes in disaster management Policy.

UNIT-V

- 5.1 Approaches to disaster risk reduction, prevention, mitigation and preparedness.
- 5.2 Major disasters in India; regional and seasonal profile of disasters in India.
- 5.3 National disaster management framework: NDMA, NEC, SDMA, DDMA, local authorities, NIDM, NDRF.
- 5.4 Role and responsibilities: Urban and local bodies; social networking and media; NGOs; armed and paramilitary forces.

Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the Sessions 2018-19, 2019-20 and 2020-21

(Syllabus for the examination to be held in May 2020, May 2021 & May 2022)

Books Recommended

- | | | |
|-----|---------------------------------|--|
| 1. | A Rittmann and E A Vincent | Volcanoes and their activity |
| 2. | Vishwas S Kale | Flood studies in India |
| 3. | Gordon A Macdonald | Volcanoes |
| 4. | Ayaz Ahmad | Disaster Management through the New Millennium |
| 5. | S R Singh | Disaster Management |
| 6. | Arvind Kumar | Disaster Management Recent Approaches |
| 7. | G K Ghosh | Disaster Management |
| 8. | Jay Levinson and Hayim Granot | Transportation Disaster Response |
| 9. | Bruce W Clements | Disaster and Public Health Planning and Response |
| 10. | Arun K Talwar and Satish Juneja | Flood Disaster Management |
| 11. | A K Jain | A Practical Guide to Disaster Management |
| 12. | Dr R Nagarajan | Landslide Disaster, Assessment and Monitoring |
| 13. | Guidelines | National Disaster Management Authority 2009 |

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)

**Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the
Sessions 2018-19, 2019-20 and 2020-21**

Course No.: PSAGLC419

Title: Practical - I

(related to courses PSAGTE-411, 413 & Weekly seminar)

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 3 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in May2020, May 2021 and May 2022)

Course No. PSAGTE411 (Application of Remote Sensing in Geology)** -15 marks

Visual interpretation of satellite images to study the Geomorphology, lithology, geology and structure ;
Digital image processing for the study of geomorphology, structure, and lineaments; Geomorphic mapping;
Lineament mapping; Structural mapping; Preparation of Hydrogeomorphology map.

Course No. PSAGTE413 (Engineering Geology)** -15 marks

Stereographic projection of joint data, determine Atterberg's limits for the given soil samples, determine
uniaxial shear strength by point load method of the given rock/core specimens.

Weekly Seminar -15 marks

Viva ó 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

**Syllabus and Courses of study for M.Sc. (Applied Geology) UNDER CBCS for the
Sessions 2018-19, 2019-20 and 2020-21**

Course No.: PSAGLC420

**Title: Practical - II
(related to courses PSAGTE-414, 415/416)**

Credits: 04

No. of hours: 60

Maximum Marks: 100

Duration of Examination: 3 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in May 2020, May 2021 and May 2022)

Course No. 414 (Geo-Exploration)** **-15 marks**

Surface and subsurface gravity, magnetic, resistivity and seismic data interpretation.

Geochemical anomalies and its interpretation.

Course No. 415 (Micropalaeontology and Palaeobotany)** **-15 marks**

Processing of samples, picking and mounting of fauna, study of diagnostic morphological characters of selected microfossils and plant fossils, and construction of biostratigraphic correlation and relative charts.

OR

Course No. 416 (Gemology)** **-15 marks**

Identification of some precious/semiprecious stones, Identification of some of the physical properties.,
Determination of optical properties of some of the gemstone. Determination of Specific Gravity.

Weekly Seminar** **-15 marks**

Viva ó 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