



UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section

Email: academicsectionju14@gmail.com

NOTIFICATION

(23/March/Cont./32)

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 Continuation of the existing Syllabi and Courses of Study of **Master Degree Programme in Applied Geology** for **Ist to IVth Semesters** under the **Choice Based Credit System (through regular mode)** for the examinations to be held in the Academic Session 2022-2023, 2023-2024 and 2024-2025.

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

Sd/-


DEAN ACADEMIC AFFAIRS

No. F.Acd/II/23/12947-12956

Dated: 15-3-2023

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.


Deputy Registrar (Academic)

Syllabus and Courses of Study for

M.Sc. (Applied Geology)

PG Department of Geology, University of Jammu

COURSE NO	COURSE TITLE	CREDITS	MARKS	TOTAL CREDITS
SEMESTER – I				
PSAGTC111	Sedimentology	4	100	
PSAGTC112	Stratigraphy	4	100	
PSAGTC113	Structural Geology & Tectonics	4	100	
PSAGTC114	Mineralogy	4	100	
PSAGTC115	Igneous Petrology	2	50	
PSAGLC116	Practical I (111 & 112)	4	100	
PSAGLC117	Practical II (113, 114 & 115)	4	100	
	Week-end Field work			26
SEMESTER – II				
PSAGTC211	Basin Analysis and Sequence Stratigraphy	4	100	
PSAGTC212	Paleontology	4	100	
PSAGTC213	Geomorphology	2	50	
PSAGTC214	Geospatial Techniques	2	50	
PSAGTC215	Metamorphic Petrology	2	50	
PSAGTC216	Geochemistry	2	50	
PSAGLC217	Practical I (211 & 212)	4	100	
PSAGLC218	Practical II (214, 215 & 216)	4	100	
			24	
SEMESTER – III				
PSAGTC311	Micropaleontology and Oceanography	4	100	
PSAGTC312	Fuel Geology	4	100	
PSAGTC313	Ore Geology	2	50	

Handwritten signature

Handwritten signature

1

Handwritten signature

PSAGTC314	Applications of RS and GIS	2	50	
PSAGTC315	Engineering and Environment Geology	4	100	
PSAGTEM351 (MOOC)	SWAYAM	4	100	
PSAGLC317	Practical I (311 & 312)	4	100	
PSAGLC318	Practical II (313, 314 & 315)	4	100	
	Field Work			28
	SEMESTER – IV			
PSAGTC411	Hydrogeology	4	100	
PSAGTC412	Exploration and Mining Geology	4	100	
PSAGTE413/ 414	Gemology / Cryosphere & Climate Change Science	2	50	
PSAGTC415	Dissertation	8	200	
PSAGTO416	Geohazards and Disaster Management	4	100	
PSAGLC417	Practical I (411 & 412)	4	100	
				26

Handwritten signature

Handwritten signature

Handwritten signature

Handwritten signature

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)	30 (for 2 credits)
		3 hour (4 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>

SEMESTER - I DETAILED SYLLABUS

Course No.: PSAGTC111

Credits: 04

Maximum Marks: 100

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

Title: Sedimentology

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

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 textural analysis

- 1.1 Sediment generation and formation of sedimentary rocks
- 1.2 Textural analysis and their significance
- 1.3 Surface textures and their significance
- 1.4 Porosity and permeability pore morphology, effect of texture on porosity and permeability

UNIT-II Sediment movement and sedimentation

- 2.1 Laws of fluid motion and sediment transport
- 2.2 Flow regimes and stability of bedforms
- 2.3 Modes of sediment transport: sediment gravity flows: mudflows, grain flow, liquefied flows, turbidity flows, bedload, suspension and solution transport
- 2.4 Sedimentary structures (Primary, secondary and biogenic) and their formation

UNIT-III Petrogenesis of sedimentary rocks

- 3.1 Classification and petrogenesis of clastic sedimentary rocks: rudaceous rocks, arenaceous and argillaceous rocks
- 3.2 Nomenclature and Classification of carbonate rocks (Folk and Dunham)
- 3.3 Diagenesis of sedimentary rocks
- 3.4 Heavy minerals and their significance

UNIT-IV Petrogenesis of chemical rocks

- 4.1 Carbonate rocks and their allochemical and orthochemical constituents
- 4.2 Petrogenesis of biogenic silica deposits.
- 4.3 Petrogenesis of phosphate deposits.
- 4.4 Evaporites

UNIT-V Domains of sedimentation

- 5.1 Introduction to depositional sedimentary environments
- 5.2 Dolomites and Dolomitization models
- 5.3 Application of carbon and oxygen isotopes in sedimentation studies
- 5.4 Application of Cathodo-luminescence technique in diagenetic studies

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC111

Title: Sedimentology

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

Books Recommended

Miall, Andrew D.	Principles of Sedimentary Basin Analysis
Lindholm, R. C.	A Practical Approach to Sedimentology
Collinson, J. D. & Thompson, D. B.	Sedimentary Structures
Reineck, H. E. & Singh, I. B.	Depositional Sedimentary Environments
Allen, J.R.L.	Physical processes of Sedimentation
Reading, H.G.	Sedimentary Environments
Petijohn, F.J. & Potter	Sand and Sandstone
Petijohn, F.J.	Sedimentary rocks
Friedman, M. Gorale & Sanders	Principles of Sedimentology
Selley, R.C.	Applied Sedimentology
Bjorlykke, K.	Sedimentology and Petroleum Geology
Blatt, Middleton and Murray	Carbonate sediments and their origin
Bathurst, R.G.C.	Carbonate sediments and their diagenesis
Carozzi, A.V.	Carbonate rock depositional models: A Microfacies Approach
Wilson, J.L.	Carbonate rocks in Geologic History
Carver, R.F.	Procedures in Sedimentary Petrology
Leeder, M.R.	Sedimentology: Process and Product
Prothero and Schwab	Sedimentary Geology

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 type 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 type 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 type questions (15 marks) to be set from first 10 sub-units (09 marks) and from the last 10 sub-units (06 marks)

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

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

Course No.: PSAGTC112

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. 2022, Dec. 2023 & Dec. 2024)

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

UNIT – 1: Principles of stratigraphy

- 1.1 Principles of stratigraphy. Geological time scale. Elementary idea about Earth's Climatic History.
- 1.2 Codes of stratigraphic nomenclature. Lithostratigraphy, biostratigraphy and chronostratigraphy, Methods of stratigraphic correlation.
- 1.3 Facies concept in Stratigraphy – Walther's law. Geological record and its imperfections. Types of unconformities and their significance.
- 1.4 Magnetostratigraphy and its application, application and problems of C14, fission track, Relative and absolute age dating.

UNIT – 2: Precambrian Stratigraphy of India

- 2.1 Evolution of Indian shield in space and time. Major Precambrian belts of Peninsular India and their tectonic setting.
- 2.2 Stratigraphy of Archean rocks of Karnataka, Madhya Pradesh, Singhbhum & Rajasthan and their geochronological relationship.
- 2.3 Stratigraphy of Proterozoic of peninsular India, viz., Cuddapah, Vindhyan, Godavari Supergroups and their equivalents
- 2.4 Stratigraphy of Precambrian rocks of extra peninsular India in lesser (Chandpur, Mandhali, Nagthar, Jaunsar, Blaini, Infra-Krol, Krol and Shali) and higher Himalaya (Vaikrita, Haimanta, Salkhala, Dogra Slate, Jutogh, Chail, Shimla Slate and Darjeeling Formations)

UNIT – 3: Palaeozoic Stratigraphy of India

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

UNIT – 4: Mesozoic Stratigraphy of India

- 4.1 Distribution, Classification, depositional characteristics, fauna, and flora of Triassic, Jurassic and Cretaceous systems in major basins of India. Distribution, Stratigraphy, Field characters and age of Deccan Trap.

Ice

Ice

Vans

Handwritten signature

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC112

Title: Stratigraphy

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

- 4.2 Distribution, Classification, fauna and flora and correlation of the Mesozoic strata of Himalaya.
- 4.3 Distribution, classification, depositional characteristics, fauna and flora of Bagh Group, Lameta Formation and Intertrappean sediments.
- 4.4 Cretaceous –Tertiary boundary and its identification in India. Significance of marine transgressions in Mesozoic and the development of coastal facies in India.

UNIT –5: Cenozoic and Quaternary Stratigraphy of India

- 5.1 Distribution, Classification, depositional characteristics, fauna, and flora of the Paleogene. Himalayan ophiolites and mélanges and their significance.
- 5.2 Distribution Classification, depositional characteristics, fauna and flora of the Neogene deposits (Siwalik Group and their equivalent).
- 5.3 Distribution, Classification, depositional characteristics, fauna, and flora of the Karewa Group.
- 5.4 Quaternary sediments in India. Neogene/Quaternary boundary and its fixation in India.

Books Recommended

Weller, J.M.	Stratigraphic Principles and Practice.
Dubbar and Rodger	Principles of stratigraphy.
Hedberg	International Stratigraphic Guide.
GSI Publ. 20	Code of Stratigraphic Nomenclature.
Krishnen, M.S	Geology of India and Burma.
Pasco, E.H	Manual of Geology of India & Burma, Vol. I-III
Wadia, D.N	Geology of India.
Ravindra Kumar	Fundamentals of Historical Geology & Stratigraphy of India.
Naqvi	Precambrian Geology of India.
Pichamuthu	Archean Geology.
Rama Krishna & Vadhyathan	Stratigraphy Vol I – II (2008)
S K Shah	Historical Geology (2018)

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 type 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

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC112

Title: Stratigraphy

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

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 type 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 type 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)

See

See

Vani *Handwritten*

Course No.: PSAGTC113

Credits: 04

Maximum Marks: 100

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

Title: Structural Geology & Tectonics

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

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 including advanced ideas of internal structure of earth. Introduction of the latest concept of geomagnetism and its application. The knowledge on tectonic evolution of Himalaya and Indian craton

UNIT I - Fundamentals of Structural Geology

- 1.1 Mechanisms of Rock deformation
- 1.2 Stress and Strain
- 1.3 Techniques of Strain measurement
- 1.4 Mohr diagram, and Wellman diagram

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

- 2.1 **Folds:** Classification, Mechanism
- 2.2 **Faults:** Mechanism
- 2.3 Types of Faults: Normal Fault, Reverse fault, Strike-slip fault
- 2.4 Shear zones Geometry – types and products

UNIT III Orogeny & Tectonics

- 3.1 Time relationship between deformation and recrystallization
- 3.2 **Rock Fabric:** Foliation and Lineation- terminology, development and significance
- 3.3 Kinematics and Palaeostress
- 3.4 Anatomy of Orogenic belts

UNIT III Interior of Earth and Plate Movements

- 4.1 Seismic investigations of Earth's interior, wave's velocity, velocity curves, density distribution, elastic properties, pressure and temperature within the earth
- 4.2 Composition of the earth's crust and upper mantle and crust-mantle relationship. Gravity anomalies
- 4.3 Concept of continental drift, Evidences of sea floor spreading, magnetic anomaly patterns age of ocean sediments, oceanic ridges and trenches, benioff zone.
- 4.4 Geomagnetism- magnetizations, types, magnetic field reversals, polar wandering curve, applications in geology, Nature of plate margins, constructive and destructive geometry of plate motion, mosaic of plate, direction of motion, causes of plate motion, convection plumes and other classical hypothesis, Evolution of Cratonic domains.

UNIT-V Himalayan Tectonics

- 5.1 **Himalayan Tectonics:** sedimentation, closing of continents, rotation of continental blocks, phases of deformation, shifting of depositional basins, vertical tectonics.

Handwritten signatures:
Jai
Van
Sande

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC113

Title: Structural Geology & Tectonics

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

- 5.2 Tectonics of Indian sub-continent, Drift and subduction of the Indian Plate, Andaman subduction zone and Makran subduction.
- 5.3 Indus-Tsangpo suture zone, Main Central Thrust, Main Boundary Fault, Siwalik structure, Himalayan Frontal Fault.
- 5.4 Neotectonic evidences in parts of Himalaya. Evolution of important cratonic domains of India.

Books Recommended

Badgley, P.C.	Structure and Tectonics
Ramsay, J.G.	Folding and fracturing of Rocks
Hobbs, B., Means W. & William, P.	An Outline of Structural Geology
Gosh, S.K.	Structural Geology: Fundamentals & Modern Developments
Dennis, J.G.	Structural Geology: An Introduction
Park, R. G.	Foundations of Structural Geology
Davis, G H	Structural Geology of Rocks & Regions
Jain, A K	Structural Geology, 2014
Passchier & Trouw	Microtectonics
Twiss & Moore	Structural Geology
Ramsay, J.G. and Martin, I.	Techniques in Structural Geology, vol. I, II
Condie, K C	Plate Tectonics and Crustal Evolution
Cox, A	Plate Tectonics and Geomagnetic Reversals
Balanssov	Basic problems in Geotectonics
Wadia, D N	Geology of India
Gansser, A	Geology of the Himalaya
Valdiya, K S	Aspects of Geotectonics
Wyllia	Dynamics of Earth
Fossen	Structural Geology
Mitra and Marshak	Structural Geology and Tectonics
Rowland	Structural Analysis and Synthesis
Valdiya, K S	The Making of India

Guidelines for setting of question papers:

Minor test -I

(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 type 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

Ju

Ju

Van

Handwritten signature

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 type questions (10 marks) from second 5 sub-units (2.2-3.2)

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC113

Title: Structural Geology & Tectonics

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

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 type 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)

De

Pandey

Se

Vas

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. 2022, Dec. 2023 & Dec. 2024)

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 Fundamentals of mineral, crystals and silicate structures.
- 1.2 Interaction of light with matter/minerals (isotropic and anisotropic). Optical phenomena - colour, refraction, reflection, total internal reflection and refractive index. Light vibration and interaction - phase, interference, interference colours, retardation and resolution of light waves.
- 1.3 Optical instruments and accessories. Polarization of light – methods and applications. Mineral extinction - causes, categories, measurement and application
- 1.4 Refractive indices and vibration directions.

UNIT II – The optics of uniaxial and biaxial minerals

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

UNIT III– The internal structure and classification of minerals

- 3.1 Internal structure (atomic arrangement) of minerals and crystals. X-rays – historical perspective, nature, generation and spectra.
- 3.2 X-ray crystallography: diffraction – scattering and interference; Bragg's Law - derivation and practical application. X-ray diffractometry- single crystal method and powder method.
- 3.3 Classification of minerals: Silicates, Oxides, Sulphates, Halides, Carbonates, Native Metals. Silicate structures and its modification an insight from Bowen's Reaction Series
- 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.

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC114

Title: Mineralogy

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

- 4.4 Amphibole Group: Nomenclature, structure and paragenesis of amphibole minerals, exsolution textures in amphiboles, and Al-in-amphibole barometry.

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 and paragenesis.

Books Recommended

Whalstrom, E. E.	Optical Crystallography
Nesse, W.D.	Introduction to Optical Mineralogy
Dana, E.S	A Textbook of Mineralogy
Mitra, S.	Fundamentals of Optics Spectroscopic & X-ray Mineralogy
Ehlers, E.G.	Optical Mineralogy
Kerr, P.F.	Optical Mineralogy
Naidu, P.R.J	Optical Mineralogy
Philips, W.R.	Mineral Optics
Sholley, P.	Manual of Optical Mineralogy
Winchel, A.N	Elements of Optical Mineralogy
Mckie, D. & Mckie, C.	Crystalline Solids
Wolfson M.M.	X-Ray Crystallography
Deer, Howie & Zussman	An introduction to the rock forming minerals
Cerreves	Introduction to mineralogy
Berry and Masons	Mineralogy
Kestov	Mineralogy
Batchkhtin	Mineralogy
Vema, P K	Optical Mineralogy Ane Book Pvt Ltd. Delhi
Sharma, R and Sharma A	Crystallography and Mineralogy: Concepts and Methods GSI

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 type 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

Ju

Ju

Van

Sanjay

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC114

Title: Mineralogy

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

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 type 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 type 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)

De

Gandhi

See

Van

Course No. PSAGTE115

Credits: 02

Maximum Marks: 50

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

Title: IGNEOUS PETROLOGY

No. of teaching hours: 30

Duration of Examination: 2 ½ hours

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

Unit-I:

- 1.1 Mantle as heat engine.
- 1.2 Magma and its generation in the mantle and crust; their nature and evolution.
- 1.3 Magmatic processes: Partial melting, Magma, ascent & assimilation.
- 1.4 Magmatic processes (contd.): Fractional crystallization± assimilation (FCA) and liquid immiscibility.

Unit-II:

- 2.1 Phase rule and its application to binary and ternary systems.
- 2.2 Study of phase equilibria in Nepheline-Silica, Diopside-Anorthite, Forsterite-Silica, systems in the light of modern experimental works
- 2.3 Study of phase equilibria in Albite-Anorthite, Forsterite-Fayalite, Orthoclase-Albite systems in the light of modern experimental works.
- 2.4 Study of phase equilibria in Orthoclase-Albite-Silica, Diopside-Albite-Anorthite, Diopside-Forsterite-Silica systems in the light of modern experimental works.

Unit-III:

- 3.1 Petrography and interpretation of igneous textures in terms of rate of nucleation and crystal growth.
- 3.2 IUGS classification schemes of ultramafic and mafic igneous rocks.
- 3.3 IUGS classification schemes of felsic igneous rocks.
- 3.4 Total-alkali-silica (TAS) classification of volcanic igneous rocks.

Unit-IV:

- 4.1 Petrogenesis and tectonic setting of major igneous rock types and suites: Ultramafic rocks, komatiite, ophiolites, flood basalt and anorthosite.
- 4.2 Petrogenesis and tectonic setting of lamprophyres and kimberlite.
- 4.3 Petrogenesis and tectonic setting of Tonalite-Trondhjemite-Granodiorite (TTG), granitoids and its derivatives leucogranite and pegmatites.
- 4.4 Petrogenesis and tectonic setting of alkaline rocks and carbonatite with special reference to type locality of the world and Indian examples.

Books Recommended

- | | |
|---|--|
| Phillpotts, A.R. (1994) | Principles of Igneous and Metamorphic Petrology, Prentice Hall of India. |
| Winter, J. D. (2014) | Igneous and Metamorphic Petrology, Pearson Education Limited, Edinburg. |
| Best, M. G. (2003) | Igneous and Metamorphic Petrology, 2nd Ed. Blackwell. |
| Bose, M.K. (1997) | Igneous Petrology, World Press, Kolkata. |
| Cox, K. G., Bell, J. D. and Pankhurst, R. J. (1979) | The Interpretation of Igneous Rocks, Unwin Hyman. |
| McBirney, A. R. (1993) | Igneous petrology. Jones & Bartlet Publication. |

Dev

Jar.

Van

Pradeep

MDP in GEOLOGY SEMESTER-I

Course No.: PSAGTC115

Title: IGNEOUS PETROLOGY

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

- LeMaitre R. W. (2002) Igneous Rocks: A Classification and Glossary of Terms, Cambridge University Press.
Wilson, M. (1993) Igneous Petrogenesis, Chapman and Hall, London.
Kumar, S, and Singh, R. N. (2014) Modelling of Magmatic and Allied Processes. Springer, Switzerland.
Modules of igneous and metamorphic petrology (E-pathshala website of UGC-Delhi)

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 type 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 type 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

Course No.: PSAGLC116

Title: Practical -I
(Related to courses PSAGTC-111, 112 & local weekend field report)

Credits: 04

Maximum Marks: 100

Duration of Examination: 4 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

Course No. PSAGTC111 (Sedimentology) - 15 marks

Exercises on Textural parameters, Megascopic study of rock specimens, Petrological study of clastic and non-clastic rocks

Course No. PSAGTC112 (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. Identification and division of lithocolumn into Group, Formation, Members, Beds etc.

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

Viva – Voce (5 marks)

Note: Internal Assessment shall consist of daily practical assessment (26 marks),

terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks
For External Examination:

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

Lee

Lee

17

Bangla

Ven

Course No.: PSAGLC117

Title: Practical –II

(Related to courses PSAGTC- 113,114 &115)

Credits: 04

Maximum Marks: 100

Duration of Examination: 4 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in Dec. 2022, Dec. 2023 & Dec. 2024)

Course No PSAGTC113 (Structural Geology & Tectonics) – 15 marks

Geometric methods used to interpret geological structures, completion and interpretation of geological maps, strain analysis. Study of geological maps and drawing of cross sections and profile of geological map.

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

Identification of important rock forming minerals in hand specimen. Determination of various optical properties and identification of rock forming minerals under microscope. Determination of pleochroic scheme for biotite and tourmaline and determination of extinction angle and optic sign of uniaxial and biaxial minerals. Staining techniques for identification of silicate and carbonate minerals.

Course No PSAGTC115 (Igneous Petrology) – 15 marks

Megascopic and microscopic studies of major igneous rock types. CIPW norm calculation. Introduction to software: Sinclass, Petrograph, and GCD kit.

Viva – Voce (5 marks) **

Note: Internal Assessment shall consist of daily practical assessment (26 marks),

terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks

For External Examination:

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

Deu

Par

18

Par

Var

SEMESTER - II DETAILED SYLLABUS

Course No.: PSAGTC211

Title: Basin Analysis and Sequence Stratigraphy

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 2023, May 2024 & May 2025)

Objectives: To understand the depositional mechanism of different sedimentary basins in relation to tectonics. Sequence stratigraphy and its application

UNIT-I

- 1.1 Continental and Marine sedimentary basins
- 1.2 Mechanisms of basin formation: tectonic v/s nontectonic processes
- 1.3 Tectonic classification of sedimentary basins – 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 Case histories of tectonic basins of India (Siwalik and Kutch)

UNIT-II

- 2.1 Methods of basin analysis (Tectonic, stratigraphic and sedimentological)
- 2.2 Tools of basin analysis– Facies analysis, sediment dispersal and palaeo-flow analysis
- 2.3 Geophysical tools (seismic, gravity, aeromag)
- 2.4 Geochemical tools (organic and mineral geochemistry)

UNIT-III

- 3.1 Classification of sedimentary environments
- 3.2 Continental sedimentary environments (Fluvial, Lacustrine)
- 3.3 Shallow marine sedimentary environments (Estuary, Delta, Tidal flat, Lagoon)
- 3.4 Deep marine sedimentary environment (Submarine fan, Abyssal plain)

UNIT-IV

- 4.1 Principles of sedimentation
- 4.2 Concept of sequence stratigraphy
- 4.3 Sea level changes, systems tracts, para-sequences and hemicycles
- 4.4 Application of geochronology and thermo-chronology in sequence stratigraphy

UNIT-V

- 5.1 Introduction to Quaternary sedimentology
- 5.2 Allogenic controls on basin evolution
- 5.3 Applications of basin analysis for energy resources and palaeoclimate
- 5.4 Symbiosis among field and laboratory sedimentological technique

Books Recommended

Miall, Andrew D.

Principles of Sedimentary Basin Analysis

Lindholm, R. C.

A Practical Approach to Sedimentology

MDP in GEOLOGY SEMESTER-II

Course No.: PSAGTC211

Title: Basin Analysis and Sequence Stratigraphy

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

Reading, H.G.	Sedimentary Environments
Reineck, H. E. & Singh, I. B.	Depositional Sedimentary Environments
Allen, J.R.L.	Physical processes of Sedimentation
Collinson, J. D. & Thompson, D. B.	Sedimentary Structures
Petijohn, F.J. & Potter	Sand and Sandstone
Petijohn, F.J.	Sedimentary rocks
Friedman, M. Gorale & Sanders	Principles of Sedimentology
Selley, R.C.	Applied Sedimentology
Bjorlykke, K.	Sedimentology and Petroleum Geology
Blatt, Middleton and Murray	Origin of Sedimentary rocks
Swift, Oertel, Tillman and Thorne	Shelf Sand and Sandstone Bodies:
Zutshi and Panwar	Geology of Petroliferous Basins of India
Bhandari et al.	Petroliferous Basins of India
Miall, A D	The Geology of Sequence Stratigraphy
Catuneanu O	Principles of Sequence Stratigraphy

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 type 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 type 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 type questions (15 marks) to be set from first 10 sub-units (09 marks) and from the last 10 sub-units (06 marks)

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

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

Course No.: PSAGTC212

Credits: 04

Maximum Marks: 100

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

Title: Palaeontology

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

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, vertebrate, trace and plant fossils and their significance

UNIT-I

- 1.1 Origin and Diversity of life with major adaptive events. Evolutionary process and the fossil record: concept of species, Micro- and Macro-evolution, heterochrony, punctuated equilibrium, Hennigian systematics, molecular clocks and estimation of divergence time
- 1.2 Modes of preservation of fossils and concept of taphonomy, collection and preparation of fossils
- 1.3 Classification and Nomenclature, distribution and dispersal of organisms. Type specimens, fixing and nature of type specimens, methods of fossil identification and description, law of priority, homonymy and synonymy
- 1.4 Mass extinctions – patterns, selectivity, timing, periodicity and causes.

UNIT-II

- 2.1 Trace Fossils: classification –Morphology, Taphonomic, Ethological and Phylogeny; Preservation of Trace fossils.
- 2.2 Borings as trace fossils and marine bio- erosion traces of predation, fossil tracks and impressions of vertebrates. Environmental significance of trace fossils
- 2.3 Definition, origin and key steps in evolution of plants, dispersal and migration. Modern techniques used in palaeobotanical studies
- 2.4 Gondwana floras of India and their significance, Application of palaeobotany in palaeoclimatic studies

UNIT-III

- 3.1 Trilobites and Brachiopoda –Morphology, classification, evolution and geological distribution
- 3.2 Bryozoa and Graptolites – Morphology, classification, evolution and geological distribution
- 3.3 Lamellibranchs, Gastropods, Cephalopods – Morphology, classification, evolution and geological distribution
- 3.4 Echinoderms and Cnidarians – Morphology, classification, evolution and geological distribution.

UNIT-IV

- 4.1 General characters of vertebrates, origin of vertebrates. Classificatory characters of vertebrates and division at the level of class

Dev

Mr.

Van

Sandhu

MDP in GEOLOGY SEMESTER-II

Course No.: PSAGTC212

Title: Palaeontology

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

- 4.2 Important landmarks in the evolution of vertebrates: evolution of bone and cartilage, jaw and teeth, transition from water to land, development of amniote egg,
- 4.3 Classification of reptiles; origin of dinosaurs and their classification in brief. Origin of birds, anatomy of *Archaeopteryx*, birds as dinosaurs
- 4.4 Endothermy versus ectothermy in dinosaurs. Extinction of dinosaurs

UNIT -V

- 5.1 Gondwana and Deccan vertebrates of India and their palaeobiogeographic significance.
- 5.2 Brief classification of mammals; habitat shift in whales - fossil record from the Indian subcontinent. Interrelationships of major groups of primates; evolution of man and lithic cultures associated with various stages of human evolution
- 5.3 Classic trends in the evolution of horse and proboscideans, their distribution, evolutionary implications of climatic change, systematic and phylogeny
- 5.4 Siwalik vertebrate faunal changes and their relation to tectonic and eustatic events. Pleistocene extinction of mammoths and other fauna.

Books Recommended

- | | |
|---|---|
| Morley Davis & Stubblefield, S.J. | In Introduction to Palaeontology |
| Shrock, R.R. & Twenhofel, W.H. | Principles of Invertebrate Palaeontology |
| Black, R.M. | The Elements of Palaeontology |
| Fairbridge & Jablonski | The Encyclopedia of Palaeontology |
| Babin, C. | Elements of Palaeontology |
| Clarkson, E.N.T. | Invertebrate Palaeontology and Evolution |
| Raup, D.M. & Stanley, S.M. | Principles of Palaeontology |
| Lull, R.S. | Organic Evolution |
| Benton, M.J. & Harper | Basic Palaeontology |
| Dodd, J.R. & Stenton, R.J. | Palaeoecology-Concept and Applications |
| Frey, R.W. | The study of trace fossils |
| Bromley, R.G. | Trace Fossils |
| Seilachers | Trace Fossils |
| Amal Dasgupta | Introduction to Palaeontology |
| Romer & T.S. Parsons. 1977 | The Vertebrate Body. 5 th edition. Saunders, Philadelphia, PA. |
| Colbert. 1980. | Evolution of the Vertebrates – A history of the backboned animals through time. John Wiley & Sons. Pp510. |
| R.L. Carroll. 1997. | Pattern and Processes of Vertebrate Evolution. Cambridge University Press. Pp 448. |
| M.J. Benton. 2000. | Vertebrate Palaeontology. 2 nd edition. Blackwell Science Ltd. Pp452. |
| Milton Hildebrand and G.E. Goslow. 2001 | Analysis of Vertebrate Structure. 5 th edition. John Wiley & Sons, Inc. Pp635. |

Scu

Vaz

Handwritten signature

MDP in GEOLOGY SEMESTER-II

Course No.: PSAGTC212

Title: Palaeontology

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

M.J. Benton. 2005.	Vertebrate Palaeontology. 3 rd edition. Blackwell Science Ltd. Pp455.
David E. Fastovsky & David B. Weishampel. 1996.	The Evolution and Extinction of the Dinosaurs. Cambridge University Press. Pp460. (Chapter 13 Pp 293-322).
R.L. Carroll. 1988.	Vertebrate Palaeontology and Evolution. Spektrum Akademischer Verlag Pp698.
R.S. Lull. 1976.	Organic Evolution. Macmillan Publishing Co. Inc.
P. Doyle. 1996.	Understanding of Fossils. John Wiley and Sons Ltd.
D.E.G. Briggs & P.R. Crowther. 2001.	Palaeobiology II. Blackwell Science Ltd.

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 type 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 type 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 type 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)

De

De

Va

Sandhu

Course No.: PSAGTC213

Credits: 02

Maximum Marks: 50

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

Title: Geomorphology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

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 of Geomorphology.
- 1.2 Lithological and structural control on landforms.
- 1.3 Qualitative and quantitative analysis of basins and drainage density.
- 1.4 Landform evolution by fluvial process

UNIT-II

- 2.1 Landform evolution by aeolian activity in hot arid regions
- 2.2 Landform evolution by marine processes
- 2.3 Glacier, types, and landform generation by glacial and fluvio-glacial processes
- 2.4 Morphometric parameters of mass movement deposits.

UNIT-III

- 3.1 Factors of weathering-mechanical disintegration, chemical decomposition.
- 3.2. Determination of weathering indices and ratios
- 3.3 Soils - soil formation and climate
- 3.4 Process of pedogenesis

UNIT-IV

- 4.1 Introduction to planetary geomorphology.
- 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

F.A. Pitty	Introduction to Geomorphology
Donj-Easterbrook	Principles of Geomorphology
C. Ollier	Tectonics and Landforms
C. Ollier	Weathering
Thornbury	Geomorphology
A. Bloom	Fluvial Geomorphology
C.A.M. King	Introduction to Marine Geology and Geomorphology
K.S. Valdiya	Aspects of Tectonics
Ronald Greeley	Introduction to Planetary Geomorphology
R Greeley	Planetary Landscapes

MDP in GEOLOGY SEMESTER-II

Course No.: PSAGTC213

Title: Geomorphology

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

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 type 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 type 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 type 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)

Dr

Dr

Var

Dr

Course No.: PSAGTC214

Credits: 02

Maximum Marks: 50

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

Title: Geospatial Techniques

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

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 Geospatial Technology-concept and overview

- 1.1 An Overview of geospatial technology
- 1.2 Developments of remote sensing, advantages and limitations of remote sensing techniques.
- 1.3 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 Introduction to aerial photography – Basic information and specifications of aerial photographs
- 2.2 Aerial camera, lens, types of aerial photographs and information records on the aerial photographs. Planning and execution of photographic flights
- 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.

MDP in GEOLOGY SEMESTER-II

Course No.: PSAGTC214

Title: Geospatial Techniques

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

- 4.2 Introduction and application of GIS, components of geographical information system (GIS), database structures in raster and vector and its comparison.
- 4.3 Global Positioning System (GPS) and its segments, observation principle, parameters affecting the accuracy of result, main components of a GPS receiver and GPS application.
- 4.4 Digital cartography - elements of digital cartography Relation between digital cartography, RS & GIS

Books Recommended

P.J. Curran	Principles of remote sensing
S.A. Drury	A guide to remote sensing interpretation images of earth
R.P. Gupta	Remote sensing in geology
T.Lillesand & R.W. Kiefer	Remote sensing and image interpretation
V.C. Miller	Photogeology
S.N. Pandey	Principles & application of photo-geology
A.N. Patel & S. Sundera	Principles of remote sensing
D.P. Rao	Remote sensing for earth resources
A. Reddy	Remote sensing and Geographical Information System
F.F. Sabins	Remote sensing-principles and interpretation
E.S. Seigel & A. Gillespie	Remote sensing in geology
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 type 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 type 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)

Dee

Dee

Var

Handwritten signature

Course No.: PSAGTC215

Credits: 02

Maximum Marks: 50

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

Title: Metamorphic Petrology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

Unit-I

- 1.1 Mineralogical phase rule of open and closed systems.
- 1.2 Nature and types of metamorphic reactions.
- 1.3 Concept and classification of metamorphic facies; Facies series.
- 1.4 Graphical representation of minerals in ACF, AKF and AFM diagrams; Time relation between phases of deformation and metamorphic crystallization.

Unit-II

- 2.1 Description of facies of low pressure with special reference to characteristics minerals, mineral assemblages, metamorphic reactions and pressure-temperature conditions of metamorphism
- 2.2 Description of metamorphic facies of medium to high pressure with special reference to characteristics minerals, mineral assemblages, metamorphic reactions and pressure-temperature conditions of metamorphism.
- 2.3 Description of very high pressure with special reference to characteristics minerals, mineral assemblages, metamorphic reactions and P-T conditions of metamorphism.
- 2.4 Introduction to ultra-high temperature (UHT) and ultra-high pressure (UHP) metamorphism.

Unit-III

- 3.1 Isograds and Reaction Isograds.
- 3.2 Metamorphic differentiation;
- 3.3 Anatexis and origin of migmatites;
- 3.4 Paired metamorphic belts.

Unit-IV

- 4.1 Gibb's free energy; Entropy; Enthalpy.
- 4.2 Clausius-Clapeyron equation.
- 4.3 Geothermobarometry.
- 4.4 Pressure-Temperature-Time (P-T-t) paths and tectonic implications.

Books Recommended

Turner, F.J. (1980)

Yardley, B.W.D. (1989)

Philopotts, A.R. (1994)

Kretz, R. (1994)

Bucher, K. and Frey, M. (2002)

Powell, R. (1978)

Metamorphic Petrology, McGraw Hill, New York.

An introduction to Metamorphic Petrology, Longman Scientific and Technical, New York.

Principles of Igneous and Metamorphic Petrology, Prentice Hall.

Metamorphic Crystallization, John Wiley.

Petrogenesis of Metamorphic Rocks (7th Rev. Ed.), Springer-Verlag.

Equilibrium thermodynamics in Petrology: An Introduction, Harper and Row Publ., London.

See

See

Vs

Handwritten signature

MDP in GEOLOGY SEMESTER-II

Course No.: PSAGTC215

Title: Metamorphic Petrology

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

- Wood, B.J. and Fraser, D.G. (1976) Elementary Thermodynamics for Geologists, Oxford University Press,
Spry, A. (1976) Metamorphic Textures, Pergamon Press.
Winter, J.D. (2001) An introduction to Igneous and Metamorphic Petrology, Prentice Hall.
Sharma, Ram S. (2017): Metamorphic Petrology, Geological Society of India, Bangalore

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 type 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 units1 & 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 type 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)

Dr.

Prof.

Dr.

Var

Course No.: PSAGTC216

Credits: 02

Maximum Marks: 50

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

Title: Geochemistry

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

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

Unit-I:

- 1.1 Composition of Earth and its constituents (crust, mantle and core); Lithosphere and asthenosphere.
- 1.2 Meteorites: Mineralogy and Classification.
- 1.3 Crystal chemistry: ionic and co-ordination number; Rules of ionic substitution, coupled substitution.
- 1.4 Geochemical classification of elements.

Unit-II:

- 2.1 Distribution coefficient: Capture admission and camouflage.
- 2.2 Definition of major (Raoult's Laws) and trace (Henry's Laws) elements.
- 2.3 Behaviour of major and trace during magmatic crystallization.
- 2.4 Geochemical properties and behavior of rare earth elements (REE) during magmatic crystallization.

Unit-III:

- 3.1 Atmosphere: structure and composition
- 3.2 Near-surface geochemical environment: Eh-pH diagram and its application
- 3.3 Principle of chemical mass balance and rock-cycle
- 3.4 Chemical weathering of minerals and rocks

Unit-IV:

- 4.1 Radiogenic isotopes: Decay and growth of daughter isotopes
- 4.2 Radiogenic isotopes in geochronology and petrogenesis: Rb-Sr, Sm-Nd, U-Pb isotopic system.
- 4.3 Stable isotopes: nature, abundance and fractionation.
- 4.4 Application of stable isotopes in geological processes.

Suggested Readings

Allegre, C.J. and Michard, G. (1974)

Evans, R.C. (1964)

Faure, G. (1998)

Faure, G. (1986)

Krauskopf, K.B. (1967)

Mason, B. and Moore, C.B. (1991)

Introduction to Geochemistry, Reidel, Holland.

Introduction to Crystal Chemistry, Cambridge Univ. Press.

Principles and applications of geochemistry, 2nd Edn., Prentice Hall, New Jersey, 593p.

Principles of Isotope Geology, 2nd Ed. John Wiley.

Introduction to Geochemistry, McGraw Hill.

Introduction to Geochemistry, Wiley Eastern.

[Handwritten signatures and initials: "Jw", "Vas", and a large signature]

MDP in GEOLOGY SEMESTER-II

Course No.: PSAGTC216

Title: Geochemistry

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

Rollinson, H.R. (1993)

Using geochemical data: Evaluation, Presentation, Interpretation, Longman, U.K.

White, W H (2013)

Geochemistry. Willey - Blackwell

R. Gill (1995)

Chemical Fundamental of Geology, Springer Ind Ed.

Albarde, F. (2003)

Geochemistry: An introduction, Cambridge Univ. Press

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 type 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 type 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)

De

De

Var

Sandhu

Course No.: PSAGLC217

Title: Practical -I

(Related to courses PSAGTC-211, 212)

Credits: 04

Maximum Marks: 100

Duration of Examination: 4 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

Course No. PSAGTC211 (Basin Analysis & Sequence Stratigraphy) -23 marks

Preparation and interpretation of lithologs and isopach maps, Palaeocurrent analysis, Analysis of seismic profiles, Delineation of sequence boundaries, systems tracts and parasequences in sedimentary sequences

Course No. PSAGTC112 (Paleontology) – 22 marks

Application of zoological code of nomenclature for taxonomic studies. Study of mega and microfossils of various plants, invertebrate and vertebrate groups. Univariate and bivariate analysis of fossils using regression analysis and major axis equations. Study of methods of preservation of fossils.

Viva – Voce (5 marks)

Note: Internal Assessment shall consist of daily practical assessment (26 marks),

terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks

For External Examination:

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

Dee

Ice

Barak

Van

Course No.: PSAGLC218

Title: Practical –II
(Related to courses PSAGTC- 214, 215 & 216)

Credits: 04

Maximum Marks: 100

Duration of Examination: 4 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in May 2023, May 2024 & May 2025)

Course No. PSAGTC214 (Geospatial Techniques) - 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 PSAGTC215 (Metamorphic Petrology) – 15marks

Megascopic and microscopic studies of important metamorphic rocks with reference to texture/structure, time relation between phases of deformation and metamorphic crystallization, mineral association, parent rock, metamorphic facies to which rock can be assigned; Representation of assemblage in ACF, AKF and AFM.

Course No PSAGTC216 (Geochemistry) – 15 marks

Preparation of Solution A and Solution B; determination of various major oxides by titration methods; determination of alkali elements by Flame photometer; determination of elements by UV/VIS spectrophotometer.

Viva – Voce (5 marks)**

Note: Internal Assessment shall consist of daily practical assessment (26 marks),

terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks

For External Examination:

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

See

See

33

Vs

Handwritten signature

SEMESTER - III DETAILED SYLLABUS

Course No.: PSAGTC311

Credits: 04

Maximum Marks: 100

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

Title: Micropaleontology and Oceanography

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

Objectives:

1. To provide working knowledge of various microfossil groups and their geological significance.
2. To study the modern concepts, dynamics and resources of the marine realm

UNIT-I

- 1.1 Microfossils- Introduction, record, important groups, sampling. Techniques for separation and picking and mounting of microfossils.
- 1.2 Ostracoda: morphology, ornamentation, orientation of the carapace, classification and significance
- 1.3 Foraminifera: test morphology, composition and classification and significance
- 1.4 Siliceous microfossils: Radiolaria and Diatoms: classification, distribution, ecology, geological history and significance.

UNIT-II

- 2.1 Calcareous nannofossils: Coccolithophores: coccoliths and nanoliths, their geological history, ecology, and significance
- 2.2 Conodont: composition, elements, groups, apparatus and assemblages, biological affinities, geological history and significance. Pteropods and tentaculitids and their significance.
- 2.3 Acritarchs and Chitinozoans: morphology, classification, biological affinities, ecology, geological history and significance.
- 2.4 Dinoflagellates: morphology, classification, biological affinities, geological history, ecology and significance.

UNIT-III

- 3.1 Calcareous algae (Rhodophyta and Chlorophyta): morphology and internal structure, broad classification and their significance; Charophytes: morphology, classification, ecology and significance
- 3.2 Palynomorphs: Spores and Pollens morphology (shape, aperture, composition and structure, sculpture, size) and their application. Silicoflagellates and phytoliths and their significance.
- 3.3 Biozones, biozonation, stratigraphic correlation and problems in biostratigraphic interpretations.
- 3.4 Palaeoenvironment and palaeogeographic interpretations using multi microfossils.

MDP in GEOLOGY SEMESTER-III

Course No.: PSAGTC311

Title: Micropaleontology and Oceanography

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

UNIT-IV

- 4.1 Oceanography- origin and evolution of oceans; paleoceanography – Palaeozoic, Mesozoic and Tertiary. Sea level fluctuations and their causes
- 4.2 Topographic features of the ocean floor. Hypsography of the continents and ocean floor. Classification of marine sediments, sediment budget, transport, accumulation. Coral reefs. Geochronology of oceanic sediments
- 4.3 Wave dynamics: deep water, shallow water, wind waves; wave reflection, refraction and diffraction. Tides: equilibrium and dynamic theory, tidal currents in coastal areas, observation and prediction. Seiches and Tsunamis.
- 4.4 Heat budget and Atmospheric Circulation. Storms, jet streams, El Nino and land effects on winds. Ocean circulation: forces driving currents. Surface currents and their effects on climate. Thermohaline circulation and global heat connection. Wind induced vertical circulation.

UNIT-V

- 5.1 Origin and evolution, structure and physiography, bathymetry and sediments of the Indian Ocean. Petroleum occurrences and exploration activity in Indian Ocean. Exclusive Economic Zone (EEZ) and its marine minerals resources.
- 5.2 Seawater chemistry and dissolved gases. Density structure of ocean and stratification. Phytoplankton dynamics in the marine food web and factors limiting productivity.
- 5.3 Marine resources: Physical (Petroleum and Natural Gas, sand and gravel, magnesium and magnesium compounds, salts, manganese and phosphate nodules, metallic sulfides and muds); Biological (fish, crustaceans, molluscs, whaling, fur-bearing mammals, botanical, aquaculture).
- 5.4 Marine pollution – pollutants, habitat destruction and global changes (ozone layer depletion, global warming, acid rain)

Books Recommended

Gerard Bignot 1985	Elements of Micro Palaeontology. Graham Trotman Limited
David G. Jenkins (Ed) 1993	Applied Micropalaeontology. Kluwer Academic Publishers
Daniel J. Jones 1956	Introduction to Microfossils. Harper and Brothers, Harper Geoscience Series.
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
Garrison, T. 1996	Oceanography- An invitation to Marine Science. Wadsworth Publishing Company

MDP in GEOLOGY SEMESTER-III

Course No.: PSAGTC311

Title: Micropaleontology and Oceanography

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

- Qasim, S.Z. & Roonwal, G.S. (eds). 1996 India's Exclusive Economic Zone. Omega Scientific Publishers.
- Gross, M.G. 1972 Oceanography - A view of the Earth. Prentice-Hall.
- S. Davis, R.A. Jr. 1972 Principles of Oceanography. Addison-Wesley Publishing Company.
- Roonwal, G.S. 1986 The Indian Ocean: Exploitable mineral & petroleum Resources. Narosa Publishing house
- Haq, B.U. & Milliman, J.D. 1984 Marine Geology and oceanography of Arabian Sea and coastal Pakistan. Elite Publishers Limited.
- Francis P. Shepard Geological Oceanography.
- Bhatt, J.J. 1978 Oceanography - Exploring "the planet Ocean. D. van Nostrand Company.
- Duxbury, A.B. & Duxbury, A.C. 1993 Fundamentals of Oceanography. Wm. C. Brown Publishers.
- Turekian, K.K. Oceans.
- A.P. Trujillo & H.V. Thurman 2012 Essentials of Oceanography. PHI Learning Private Limited

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 be set from first 5 sub-units (1.1 - 2.1)

Question 2: Two short answer type 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 type 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 type 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)

De

De

Van

Dand

Course No.: PSAGTC312

Credits: 04

Maximum Marks: - 100

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

Title: Fuel Geology

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

Objectives: This course contrives to introduce the history of the fuel geology with a futuristic vision, also bearing in mind the importance of present energy challenges of which coal, oil and gas form an important and inseparable part. Stress will be on inculcating the classical ideas and imparting the latest knowledge – 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 Fundamental of coal geology

- 1.1 Origin of coal, formation of coal: macroscopic and microscopic description of coal
- 1.2 Types of coal, rank of coal, structures in coal seams
- 1.3 Coal quality: proximate and ultimate analysis of coal
- 1.4 Petrography of coal: lithotypes, macerals and microlithotypes.

UNIT-II Coal classifications and processes

- 2.1 Combustion and carbonization of coal
- 2.2 Stages and methods of coal exploration, coal preparation for different industrial use.
- 2.3 Seyler's Classification of coal, grading of coking and non-coking coals of India.
- 2.4 Geological and geographical distribution of coal in India; Lignite resources of India

UNIT-III Coal deposits and commercial aspects

- 3.1 Detailed geology of Jharia and Raniganj coalfield
- 3.2 Coal exploration and estimation of coal reserves; Indian coal reserves and production of coal in India
- 3.3 Coal as an alternative energy resource: coal bed methane (CBM); underground coal gasification
- 3.4 Coal and the Environment: water pollution; dust suppression; subsidence; health hazards. Coal marketing

UNIT-IV Petroleum Geology –Basics

- 4.1 Petroleum: Origin and occurrence.
- 4.2 Petroleum: composition, classification, physical and chemical properties
- 4.3 Organic matter (production, accumulation and transformation) and Kerogen (composition and classification), timing of oil and gas generation and geochemistry of source rocks
- 4.4 Classification of reservoir rocks- fragmental reservoir rocks and chemical reservoir rocks. Cap rocks and their characteristics.

UNIT- V Petroleum Exploration and Exploitation

- 5.1 Petroleum traps: structural, stratigraphic, diapiric (salt domes etc.), combination, mechanism and timing of trap and reservoir development.

MDP in GEOLOGY SEMESTER-III

Course No.: PSAGTC312

Title: Fuel Geology

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

- 5.2 Primary migration (physicochemical, geological and geochemical aspects), secondary migration and accumulation of oil and gas, well logging and drilling
- 5.3 Classification of petroliferous basins of India.
- 5.4 Radioactive minerals as fuels

Books Recommended for Coal Geology

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

Books Recommended for Petroleum Geology

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

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 type 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 type 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

MDP in GEOLOGY SEMESTER-III

Course No.: PSAGTC312

Title: Fuel Geology

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

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 type 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)

De

Sec.

Van

Handwritten signature

Course No.: PSAGTC313

Credits: 02

Maximum Marks: 50

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

Title: Ore Geology

No. of teaching hours: 30

Duration of Examination: 2½ hours

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

Objectives - To impart the knowledge and understanding about ores, 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 – 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 – 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 – types, characteristics and mode of occurrences.

UNIT-IV

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

De

She

Vm

Handwritten signature

MDP in GEOLOGY SEMESTER-III

Course No.: PSAGTC313

Title: Ore Geology

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

Books Recommended

Barnes, H L	Geochemistry of Hydrothermal Ore Deposits
Edwards & Atkinson	Ore Deposit Geology
Evans A M	Ore Geology and Industrial Minerals
Evans A M	An Introduction to Ore Geology
Klemm & Schneider	Time and Strata Bound Deposits
Mishra K C	Understanding Mineral Deposits
Mukerjee A	Ore Genesis: A Holistic Approach
Robb, L J	Introduction to Ore Forming Processes
Park & Macdiarmid	Ore Deposits
Pohl, W	Economic Geology: Principal and Practice
Smirnov	Geology of Ore Deposits
Pirajno Franko	Hydrothermal Mineral Deposits
Sharma, R and Srivastava, P K	Hydrothermal Fluids of Magmatic origin in S Kumar and R N Singh : Modelling of Magmatic and allied processes, Springer
Srivastava, P K	On e-pathshala on website of UGC, New Delhi

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 type 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 type 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)

Dec

Dec.

Var

Handwritten signature

Course No.: PSAGTC314

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 Dec. 2023, Dec. 2024 & Dec. 2025)

Unit-1

- 1.1 Remote Sensing in geology – 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 – types and its significance in geologic interpretation

Unit -2

- 2.1 Lithological interpretation: Igneous rocks, Sedimentary rocks and Metamorphic Rocks; lithological mapping
- 2.2 Structural interpretation: folds, faults unconformities and lineaments; structural mapping
- 2.3 Interpretation of fluvial landforms
- 2.4 Interpretation of glacial and volcanic landforms

Unit – 3

- 3.1 Digital Elevation Model, terrain evaluation and geomorphological mapping
- 3.2 Interpretation of structural and denudational landforms – cuesta, hogback, butte, mesa, etc
- 3.3 Interpretation of landforms related to igneous, sedimentary and metamorphic rocks
- 3.4 Morphometric analysis and its applications in morphotectonics

Unit – 4

- 4.1 Remote Sensing in water exploration; Role of Remote Sensing in watershed conservation, planning and management
- 4.2 Remote Sensing in Mineral exploration
- 4.3 Remote Sensing in Oil Exploration
- 4.4 Remote sensing in Environmental studies.

Books Recommended

Drury, S.A., 1987

Gupta, R.P., 1990

Jensen, J.R. 2000

Lillesand, T.M., and Kieffer, R.M., 1987 Remote Sensing and Image Interpretation, John Wiley.

Paine, D.P., 1981:

Pandey, S.N., 1987:

Miller, V.C., 1961:

Ray, R.G., 1969:

Image Interpretation in Geology. Allen and Unwin

Remote Sensing Geology. Springer Verlag.

Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall

Aerial Photography and Image Interpretation for Resource Management. John Wiley.

Principles and Applications of Photogeology. Wiley Eastern.

Photogeology. McGraw Hill.

Aerial Photographs in geologic Interpretations. USGS Prof, Paper 373.

MDP in GEOLOGY SEMESTER-III

Course No.: PSAGTC314

Title: Application of Remote Sensing in Geology

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

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 type 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 type 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)

He

he

Van

Handwritten signature

Course No. PSAGTC315

Credits: 04

Maximum Marks: 100

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

Title: Engineering & Environmental Geology

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

Course objective: This introductory course in engineering geology provides the understanding of how earth materials and geologic processes influence various civil engineering works. It also describes various important classifications, methods of investigation in various civil engineering projects with an emphasis on making construction decisions. On the other hand, the study of environment geology helps to impart knowledge about pollution and their remedial measures in order to mitigate the environmental problems.

UNIT-I Material and Investigations

- 1.1 Introduction and Importance of engineering geology; engineering properties of rocks: specific gravity, porosity, sorption, absorption value, compressive strength, poisson's ratio
- 1.2 Physical and engineering properties of soil: structure, texture, colour, density, porosity, permeability and void ratio.
- 1.3 Rocks as engineering materials: selection criteria of rocks for varied engineering purposes
- 1.4 Geological investigations for civil engineering projects: surface investigations, sub-surface investigations.

UNIT-II Classifications

- 2.1 Rock mass classifications: Rock Quality Designation (RQD); Geo-mechanics classification
- 2.2 Q-System classification for rock masses
- 2.3 Slope Mass Rating (SMR)
- 2.4 Landslides: classification and causes of landslides. Earthquakes: classification and distribution of earthquakes, seismic zones of India

UNIT-III Infrastructural Engineering

- 3.1 Methods of tunneling: NATM, Fore poling method, Needle beam method, heading and bench method, full face method,
- 3.2 Dams and tunnels: classification and lining in tunnels, classification of dam; influence of various geological factors on dam and tunnels
- 3.3 Bridges: types, stability, design of bridges. Roads: constructions of roads in hilly regions, marshy regions and permafrost regions, role of geological factors in road construction
- 3.4 Shore line engineering: types of shorelines, erosional features of shorelines, shoreline protection, coastal laws

UNIT-IV Earth system and biosphere

- 4.1 Inter-relationship of Earth, Man and Environment, anthropogenic changes in ecosystem, conserving endangered species.
- 4.2 Ecological spectrum - biotic communities; food chains, community stability.

See. *Van* *Sand*

MDP in GEOLOGY SEMESTER-III

Course No. PSAGTC315

Title: Engineering & Environmental Geology

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

- 4.3 Components of the geosphere and environment - lithosphere, biosphere, hydrosphere and atmosphere (nitrogen cycle, carbon cycle and phosphorous cycle).
- 4.4 Global warming - increase of CO₂ and N₂O due to industrialization, urbanization, burning of fossil fuels and deforestation, ozone depletion and its impact.

UNIT-V Energy resources and pollution

- 5.1 Energy resources- consumption and production trends, environmental effects of various energy resources
- 5.2 Mineral resources- processing and smelting of minerals, environmental impact of exploitation, conservation of mineral resources.
- 5.3 Waste disposal - toxic, metallic and radioactive waste, planning and management of hazardous waste, carbon sequestration.
- 5.4 Medical Geology – trace elements and health; controls on elemental intake.

Books Recommended for Engineering Geology

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

Books Recommended for Environmental Geology

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

MDP in GEOLOGY SEMESTER-III

Course No. PSAGTC315

Title: Engineering & Environmental Geology

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

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 type 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 type 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 type 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)

Deu

Dr.

Van

Bansal

Course No.: PSAGLC317

Title: Practical -I

(Related to courses PSAGTC-311, 312)

Credits: 04

Maximum Marks: 100

Duration of Examination: 4 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

Course No. PSAGTC311 (Micropalaeontology and Oceanography) - 15 marks

Processing of samples, picking and mounting of fauna, study of diagnostic morphological characters of selected microfossils and construction of biostratigraphic correlation and relative charts, ocean floor profiles, bathymetry of oceanic sub-environments, circulation patterns etc.

Course No. PSAGTC312 (Fuel Geology) – 15 marks

Physical characteristics of coal, Macroscopic characterization of banded coals, Calculation of coal reserves, Microscopic examination of coal

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

Viva – Voce (5 marks)

Note: Internal Assessment shall consist of daily practical assessment (26 marks),

terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks
For External Examination:

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

See

47
He

Van

Dandh

Course No.: PSAGLC318

Title: Practical –II
(Related to courses PSAGTC- 313, 314 & 315)

Credits: 04

Maximum Marks: 100

Duration of Examination: 4 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in Dec. 2023, Dec. 2024 & Dec. 2025)

Course No PSAGTC313 (Ore Geology) – 15 marks

Identification of ore specimens using their physical properties; Study and identification of optical properties of ores under the microscope

Course No. PSAGTC214 (Application of RS & GIS) - 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 Hydro-geomorphology map.

Course No PSAGTC215 (Engineering & Environmental Geology) – 15marks

Plotting/Kinematic analysis of Joint data, Determination of RQD, RMR and Basic RMR

Viva – Voce (5 marks) **

Note: Internal Assessment shall consist of daily practical assessment (26 marks),

terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks

For External Examination:

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

Dec 48
Viva
Signature

SEMESTER - IV DETAILED SYLLABUS

Course No. PSAGTC411

Credits: 04

Maximum Marks: 100

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

Title: **HYDROGEOLOGY**

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

Unit-I: **Origin, occurrence and distribution of water**

- 1.1 Introduction to Hydrogeology: Hydrology, Hydrogeology and sources of information. Fundamental concepts – Water, its origin and nature – theory and classification. Subsurface movement and vertical distribution of groundwater and the governing physical laws; surface ground water relationships. Renewable and non-renewable groundwater resources.
- 1.2 Hydrological properties of rock-formations (aquifers): porosity, permeability, and 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. Springs - , classification, distribution and economic importance, spring sanctuary development and its importance.

UNIT-II: **Water well and well hydraulics**

- 2.1 Different drilling methods used in the construction of water wells; Shallow, deep penetrating and non-penetrating types, various groundwater structures.
- 2.2 Different well development methods, well construction, completion, sustenance, and abandonment.
- 2.3 Effluent and influent seepage, laminar and turbulent flow, force and laws of groundwater movement, Darcy's law - assumptions, derivation, applications and limitations, Reynolds's number, Rugosity and Manning factor. Unconfined, confined, steady, unsteady and radial flow to the well. Thiem's and Thies equations.
- 2.4 Pump test methods, 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. Step-draw down test (SDT), determination of aquifer parameter, formation and well characteristics and their material relationship.

UNIT-III **Groundwater Exploration**

- 3.1 Global tectonics in distribution of groundwater repositories, surface indicators of groundwater.
- 3.2 Fracture trace analysis, Hydrogeological- lithological classification with respect to hydrologic properties. Hydraulic continuity in relation to groundwater structures.
- 3.3 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.

See

See
49

See

See

MDP in GEOLOGY SEMESTER-IV

Course No. PSAGTC411

Title: **HYDROGEOLOGY**

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

- 3.4 Mode of occurrence of groundwater in unconsolidated and semi-consolidated formations, Hydrogeology of arid and wet land zones of Indian Sub-continent

UNIT-IV: Conservation, augmentation and management of Water Resources

- 4.1 Groundwater recharging methods.
- 4.2 Runoff estimates and future surface discharge simulation for watershed management.
- 4.3 Watershed conservation, planning and management.
- 4.4 Groundwater balance and methods of optimization.

UNIT-V: Water Quality

- 5.1 Physical and chemical properties of water quality criteria for domestic, irrigation and industrial use, and graphical presentation of water quality data.
- 5.2 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.
- 5.3 Seawater Intrusion in coastal aquifers and remedial measures. Upcoming Ghyben-Herzberg relation.
- 5.4 Influence of aquifer material on groundwater quality. Water quality estimation and methods of treatment for various uses.

Books Recommended

Todd, D.K	: Groundwater Hydrology
Hariwarayan	: Exploration techniques for groundwater.
Lynch, R.J	: Formation of Evaluation
Davis & Wiest	: Hydrology
Chow	: Handbook of Applied Hydrology
Johwon	: Groundwater and Wells
Watton	: Groundwater Resource Evaluation
Linsleyehal	: Applied Geology
Linsley and Frangini	: Water Resource Engineering
H. Bouwar	: Groundwater Hydrology
Patrick. A Dommenica	: Concepts and Models in Groundwater Hydrology
Freeze, R.A and Cherry, J.A. 1979	: Groundwater
Fetter, C.W. 1990	: Applied Hydrogeology
Alley, W.M. 1993	: Regional Groundwater Quality
Subramaniam, V. 2000	: Water
Singhal, B.B.S. 1986	: Engineering Geosciences.
Black W. and others (Ed.) 1989	: Hydrogeology Geol.Soc. of America Pub.
Davis	: Geohydrology

Dr. Jee. 50

Var

Dandla

MDP in GEOLOGY SEMESTER-IV

Course No. PSAGTC411

Title: **HYDROGEOLOGY**

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

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 type 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 type 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 type 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)

Dec

Jan.

51

Van

Sindhu

Course No.: PSAGTC412

Credits: 04

Maximum Marks: 100

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

Title: Exploration and Mining Geology

No. of teaching hours: 60

Duration of Examination: 3 hours

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

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 Geological aspects of pitting, trenching and common drilling techniques.
- 1.2 Sampling and assaying: Theory, patterns and methods. Core logging and core sampling.
- 1.3 Resources and Reserves: Identified and Unidentified Resources, Measured, Indicated and Inferred Reserves, Para-marginal, Sub-marginal, Hypothetical and Speculative Resources; Classification Schemes, viz. USGS and UNFC Schemes.
- 1.4 Evaluation of exploration data and ore reserve estimation. Introduction to geostatistical estimation of reserves.

UNIT-II

- 2.1 Selection of area for prospecting. Stages of geological prospecting, Geological guides for the prospecting of mineral deposits; mineralogical, lithological and structural guides, gossans and capping.
- 2.2 Geochemical exploration Principle: mobility and geochemical association of elements, primary and secondary geochemical dispersion patterns.
- 2.3 Methods and applications of geochemical exploration. Treatments of geochemical data.
- 2.4 Geobotanical survey: Uptake of mineral matters by plants, geobotanical indicators, geobotanical survey techniques. Biogeochemical anomalies and biogeochemical method of exploration.

UNIT-III

- 3.1 Gravity method - basic principles. Earth's gravitational field and its relation to geophysical exploration. Instruments used in gravity prospecting - pendulum, torsion balance and gravimeters.
- 3.2 Reduction of gravity data, separation of regional and residual gravity anomalies and interpretation of gravity data.
- 3.3 Gravity corrections: Free-air correction, Bouguer correction, Latitude correction, Terrain correction
- 3.4 Magnetic method: Geomagnetic field, Induced magnetism, Remnant magnetism, Susceptibility, Field survey method, Equipment, Data processing, Qualitative and quantitative interpretation of magnetic data.

for

52

for

Ua

Danish

MDP in GEOLOGY SEMESTER-IV

Course No.: PSAGTC412

Title: Exploration and Mining Geology

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

UNIT-IV

- 4.1 Electrical Methods: Electrical properties of rocks, Flow of current through ground surface, Apparent resistivity, Field procedures and electrode arrangements, VES and CST and their qualitative interpretation. Electromagnetic spectrum and induction,
- 4.2 Seismic Methods: Basic principles, Types of seismic waves and their propagation characteristic, Seismic velocities in Earth's materials.
- 4.3 Refraction technique - Time distance relations for horizontal interface, dipping beds and faults. Delay time, shot and detector arrangement and corrections.
- 4.4 Reflection technique - Time distance relations for horizontal and dipping interfaces, shooting procedures and corrections applied to reflection records.

UNIT-V

- 5.1 Introduction to mining, elements of mining, definitions and explanation of different mining terms.
- 5.2 Introduction to surface mining; deposits amenable to surface mining; Placer mining methods; Classification of surface mining systems.
- 5.3 Introduction to underground metal mining; deposits amenable to underground metal mining. Modes of entry to underground mineral deposits. Mine development: drifting, raising and winzing; Classification of underground metal mining methods. General description, applicability and operations involved in different methods.
- 5.4 Introduction to underground coal mining: Broad classification of underground coal mining methods. Board and Pillar method, Logwall mining methods – general description and its advantages and disadvantages.

Books Recommended

Govett, G.J.S. (1983)

Rock Geochemistry in mineral exploration, Vol.3. Elsevier Scientific Publishing Company.

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.

Hale, M. and Plant, J.A. (1994)

Handbook of Exploration Geochemistry – Drainage Geochemistry, vol 6, Elsevier Scientific Publishing Company.

Levinson, A.A. (1974)

Introduction to Exploration Geochemistry, Applied Publishing Ltd. USA.

Reedman, J. H. (1979)

Techniques in mineral exploration. Applied Science Publishers.

Rose, Arthur W., Herbert, E. Hawkes and

Webb, John S. (1979) Geochemistry in Mineral Exploration. Acad Press.

Evans (1998)

Introduction to Mineral Exploration. *Blackwell Science*

McKinstry, H.E. (1967)

Mining Geology, Prentice Hall,

Clark, G.B. (1967)

Elements of Mining, III ed. John Wiley

Dr

53

V_h

Handwritten signature

MDP in GEOLOGY SEMESTER-IV

Course No.: PSAGTC412

Title: Exploration and Mining Geology

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

Arogyaswami, R.P.N. (1996)

Garland GD (1979)

Nettelton, L.L. (1976)

Dobrin, M.B. (1988)

Ramakrishna, T.S. (2006)

Courses in Mining Geology, IV Ed. Oxford IBH

Introduction to Geophysics. *W.B. Saunders Company*

Gravity and Magnetism in oil prospecting. *McGraw-Hill*

Introduction to Geophysical Prospecting. *McGraw-Hill & C.H. Savit*

Geophysical Practice in Mineral Exploration and Mapping.

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 be set from first 5 sub-units (1.1 - 2.1)

Question 2: Two short answer type 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 type 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 type 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)

Dr. 54 Van

Course No.: PSAGTE413

Credits: 02

Maximum Marks: 50

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

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

Title: Gemology

No. of teaching hours: 30

Duration of Examination: 2½ hours

OBJECTIVE: To introduce the students about the concepts and techniques for identification of gemstones

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 gemology and limitations.
- 2.4 Quantitative determination of Specific gravity of gemstones by hydrostatic weighing, heavy liquids, flotation 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, labradorescenceetc.
- 3.2 Principal, Construction and use of refractometer in gemology
- 3.3 Polariscope and Dichroscope: construction and use in gemology ,
- 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

Rev.

55

Jw

Var

Sandesh

MDP in GEOLOGY SEMESTER-IV

Course No.: PSAGTC413

Title: Gemology

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

4.4 Grading of diamonds and coloured gemstones

Recommended Books:

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

Dec
56
Jan
Van
D. S. S.

Course No.: PSAGTE414

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 2024, May. 2025 & May. 2026)

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

- 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

- 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 – causes and mitigation.

Unit III

- 3.1 Definition of Quaternary, duration of the Quaternary and development of Quaternary studies.
- 3.2 Quaternary stratigraphy- Oxygen isotope stratigraphy, biostratigraphy and magneto-stratigraphy, 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

- 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 –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.

48
Jee
57
Vee
Dante

MDP in GEOLOGY SEMESTER-IV

Course No.: PSAGTC414

Title: Cryosphere & Climate Change Science

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

Books Recommended

- | | |
|--|--|
| Maher and Thompson 2000 | Quaternary climates, environments and magnetism. Cambridge Univ. Press |
| Williams, D. et al. 1998 | Quaternary Environments. Wiley & Sons. |
| Bigg, G., 1999 | Ocean and Climate. Springer- Verlag |
| Bradley, F., 2000. | Paleoclimatology: Reconstructing Climates of the Quaternary. Springer- Verlag. |
| Williams, Durnkerley, Decker, Kershaw and Chhappell, 1998, | Quaternary Environments. Wiley and Sons. |
| Evelyn Brown et al. 2001 | Ocean Circulation. Elsevier. |
| Davind Randall 2015 | Introduction to the Global Circulation of the atmosphere. Princeton Press. |
| 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 type 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 type 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)

Se

58

Van

Se

Se

MDP in GEOLOGY SEMESTER-IV

Course No.: PSAGTC415

Title: Dissertation

Credits: 08

Maximum Marks: 200

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

The dissertation shall comprise both field and laboratory work by a student. The allotment of specialization / Supervisor shall be based on preference and merit (total marks obtained in Semester I & II). The number of students shall be distributed equally among the permanent faculty on the basis of merit and preference of students. The dissertation shall be evaluated by a board of Examiners comprising Head of the Department, Supervisor and an external examiner.

Course No.: PSAGTO416

Title: Geohazards and Disaster Management

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 2024, May. 2025 & May. 2026)

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's 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 – physical vulnerability, socioeconomic vulnerability, Vulnerability and Disaster Risk.

Dr. J. C. Pandey

59 Var

MDP in GEOLOGY SEMESTER-IV

Course No.: PSAGTO416

Title: Geohazards and Disaster Management

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

UNIT-IV

- 4.1 Disaster Management – 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.

Books Recommended

A Rittmann and E A Vincent	Volcanoes and their activity
Vishwas S Kale	Flood studies in India
Gordon A Macdonald	Volcanoes
Ayaz Ahmad	Disaster Management through the New Millennium
S R Singh	Disaster Management
Arvind Kumar	Disaster Management Recent Approaches
G K Ghosh	Disaster Management
Jay Levinson and Hayim Granot	Transportation Disaster Response
Bruce W Clements	Disaster and Public Health Planning and Response
Arun K Talwar and Satish Juneja	Flood Disaster Management
A K Jain	A Practical Guide to Disaster Management
Dr R Nagarajan	Landslide Disaster, Assessment and Monitoring
	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 type 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

[Handwritten signatures and initials]

60 Van

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 type 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).
hours

Time allowed 03

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 type 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)

Dec 2016

61 Van

Signature

Course No.: PSAGLC417

Title: Practical -I

(Related to courses PSAGTC-411, 412)

Credits: 04

Maximum Marks: 100

Duration of Examination: 4 hours

(Internal 50 and External 50)

(Syllabus for the examination to be held in May 2024, May. 2025 & May. 2026)

Course No. PSAGTC411 (Hydrogeology) - 23 marks

Estimation of potential evapotranspiration and water balance through empirical equation; Drainagemapping and morphometric analysis; Determination water equivalent in snow hydrology; Presentation of Hydro-geochemical data. Flow net analysis. Fracture Trace Analysis. Identification of groundwater and spring recharge zones in Himalaya. Ground water-table contouring and estimation of the flow directions – geological considerations. Borehole logs – interpretation and analysis.

Selection of gravel, sieve and slot size for sieve analysis data and interpretation. Designing of tube-well assembly from electric logs; Interpretation of three layer resistivity curve by Tagg's method. Computation of aquifer parameters from SDT and APT data. Identification of aquifer boundaries. Groundwater Budgeting. Computation of intergranular and pore fluid 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. PSAGTC412 (Exploration & Mining Geology) – 22 marks

Geophysical exploration data interpretation; Geochemical anomaly maps and its interpretation, Simple reserve estimation problems.

Viva – Voce (5 marks)

Note: Internal Assessment shall consist of daily practical assessment (26 marks),

Terminal practical test (14 marks) and practical attendance (10 marks) = total 50 marks

For External Examination:

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

Scu

See

62 Va

Santhosh