



Estd. 1962  
"A++" Accredited by  
NAAC (2021)  
With CGPA 3.52

**SHIVAJI UNIVERSITY, KOLHAPUR - 416004,  
MAHARASHTRA**

PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in

**शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र**

दूरध्वनी-ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१-२६०९०९४

०२३१-२६०९४८७



**SU/BOS/Science/09**

**Date: 02/01/2024**

**To,**

The Principal,  
All Concerned Affiliated Colleges/Institutions  
Shivaji University, Kolhapur

The Head/Co-ordinator/Director  
All Concerned Department (Science)  
Shivaji University, Kolhapur.

**Subject:** Regarding syllabi of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 (1.0) degree programme under the Faculty of Science and Technology.

**Sir/Madam,**

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 (1.0) degree programme under the Faculty of Science and Technology.

M.Sc.-II (Sem. III & IV) as per NEP-2020 (1.0)			
1.	Mathematics	9.	Gen Microbiology
2.	Mathematics (Distance Mode)	10.	Pharmaceutical Microbiology (HM)
3.	Mathematics (Online Mode)	11.	Alcohol Technology
4.	MSc.(Mathematics With Computer Application)	12.	Sugar Technology
5.	Statistics	13.	Geology
6.	Applied Statistics and Informatics	14.	AGPM
7.	Electronics	15.	Geoinformatics
8.	Microbiology (HM)	16.	Physics

This syllabus, nature of question and equivalence shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in), NEP-2020 (Online Syllabus).

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

**Dy Registrar  
Dr. S. M. Kubal**

**Copy to:**

1	The Dean, Faculty of Science & Technology	4	P.G Admission / Eligibility Section
2	The Chairman, Respective Board of Studies	5	Computer Centre/ Eligibility Section
3	B.Sc. Exam/ Appointment Section	6	Affiliation Section (U.G.) (P.G.)

# **SHIVAJI UNIVERSITY, KOLHAPUR**



**Established: 1962**

**A<sup>++</sup> Accredited by NAAC (2021) with CGPA 3.52**

**Structure and Syllabus in Accordance with**

**National Education Policy - 2020**

**with Multiple Entry and Multiple Exit**

**Master of Science (Geology)**

**under**

**Faculty of Science and Technology**

**(To Be Implemented From Academic Year 2024-25)**

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### **1.PREAMBLE:-**

The revised syllabus includes the foundation, core and applied components of the course/paper. The student should get into the prime objectives and expected level of study with required outcome in terms of basic and advance knowledge at examination level.

### **2.DURATION:**

- The course shall be a full time course.
- The duration of course shall be of Two years / 4 Semesters.

### **3. ELIGIBILITY FOR ADMISSION:-** B. Sc. in Geology.

#### ***For Level 8 (Part I):***

Completed B.Sc. (Level 7) with Geology as principal / major subject.

#### ***For Level 9 (Part II):***

- (i) Completed Post Graduate Diploma (Level 8) in Geology or
- (ii) Completed Bachelor's Degree (Honours / Research) (Level 8) in Geology

### **4. MEDIUM OF INSTRUCTION:**

The medium of instruction shall be English.

### **5. Programme Structure:**

**Structure in Accordance with National Education Policy - 2020**  
**With Multiple Entry and Multiple Exit Options**  
**M.Sc. (Geology) Part – I (Level-8.0)**

<b>SEMESTER-I (Duration- Six Month)</b>											
<b>Course Type</b>	<b>Sr. No.</b>	<b>CourseCode</b>	<b>Theory and Practical</b>			<b>University Assessment (UA)</b>			<b>Internal Assessment (IA)</b>		
			<b>Lectures (Per week)</b>	<b>Hours (Per week)</b>	<b>Credit</b>	<b>Maximum Marks</b>	<b>Minimum Marks</b>	<b>Exam. Hours</b>	<b>Maximum Marks</b>	<b>Minimum Marks</b>	<b>Exam. Hours</b>
Major Mandatory	1	MMT101	4	4	4	80	32	3	20	8	30 min
	2	MMT102	4	4	4	80	32	3	20	8	30 min
	3	MMPR 103	4	8	4	100	40	6	-	-	-
Major Elective	4	MET104/105	4	4	4	80	32	3	20	8	30 min
	5	MEPR106/107	2	4	2	50	20	3	-	-	-
Research Methodology	6	RM108	4	4	4	80	32	3	20	8	30 min
<b>TOTAL (A)</b>			--	28	<b>22</b>	<b>470</b>	--	--	<b>80</b>	--	--
<b>SEMESTER-II (Duration- Six Month)</b>											
Major Mandatory	1	MMT201	4	4	4	80	32	3	20	8	30 min
	2	MMT202	4	4	4	80	32	3	20	8	30 min
	3	MMPR 203	4	8	4	100	40	6	-	-	-
Major Elective	4	MET204/205	4	4	4	80	32	3	20	8	30 min
	5	MEPR206/ 207	2	4	2	50	20	3	-	-	-
OJT/FP	6	OJT/FP208	4*	4*	4	60	24	3	40	16	*
<b>TOTAL (B)</b>			--	--	<b>22</b>	<b>450</b>	--	--	100	--	--
<b>TOTAL (A+B)</b>			--	--	<b>44</b>	<b>920</b>	--	--	<b>180</b>	--	--

• Student contact hour per week: 28 Hours (min.)	• Total Marks for M. Sc. - I : <b>1100</b>
• Theory lectures 60 minutes Each and Practical lectures 120 minutes each.	• Total credits for M. Sc. - I (Semester I &II): <b>44</b>

<ul style="list-style-type: none"> <li>•MMT- Mandatory Theory Course</li> <li>•MMPR- Mandatory Practical Course</li> <li>•MET- Elective Theory Course</li> <li>•MEPR- Elective Practical Course</li> <li>•RM- Research Methodology</li> <li>•OJT/FP- On Job Training/ Field Project (**during vacation)</li> </ul>	<ul style="list-style-type: none"> <li>• Theory and Practical examination will be conducted at the end of respective semester after the theory examination.</li> <li>• Practical courses may be divided into sub-sections.</li> <li>• UA: University Assessment</li> <li>• IA: Internal Assessment</li> <li>• <i>Separate passing is mandatory for Theory, Internal and Practical Examination</i></li> </ul>
<ul style="list-style-type: none"> <li>• <b>Requirement for Entry at Level 8: Completed all requirements of the Bachelor's Degree (Level 7) with Geology as principal / major subject.</b></li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Exit Option at Level 8: Students can exit after Level 8 with Post Graduate Diploma in Geology if he/she completes the course equivalent to minimum of 44 credits.</b></li> </ul>	

**Structure in Accordance with National Education Policy - 2020**  
**With Multiple Entry and Multiple Exit Options**  
**M.Sc. (Geology) Part – II (Level-9.0)**

SEMESTER-III (Duration- Six Month)											
Course Type	Sr. No.	CourseCode	Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
Major Mandatory	1	MMT301	4	4	4	80	32	3	20	8	30 min
	2	MMT302	4	4	4	80	32	3	20	8	30 min
	3	MMPR 303	4	8	4	100	40	6	-	-	-
Major Elective	4	MET304/305	4	4	4	80	32	3	20	8	30 min
	5	MEPR306/307	2	4	2	50	20	3	-	-	-
Research Project	6	RP308	4	4	4	80	32	3	20	8	*
TOTAL (A)			--	28	22	470	--	--	80	--	--

SEMESTER-IV (Duration- Six Month)											
Major Mandatory	1	MMT401	4	4	4	80	32	3	20	8	30 min
	2	MMT402	4	4	4	80	32	3	20	8	30 min
	3	MMPR 403	4	8	4	100	40	6	-	-	-
Major Elective	4	MET404/405	4	4	4	80	32	3	20	8	30 min
	4	MEPR406/ 407	2	4	2	50	20	3	-	-	-
Research Project	5	RP408	4	4	4	80	24	3	20	8	*
<b>TOTAL (B)</b>			--	--	<b>22</b>	<b>470</b>	--	--	80	--	--
<b>TOTAL (A+B)</b>			--	--	<b>44</b>	<b>940</b>	--	--	<b>160</b>	--	--

<ul style="list-style-type: none"> <li>• Student contact hour per week: 28 Hours (min.)</li> </ul>	<ul style="list-style-type: none"> <li>• Total Marks for M. Sc. - II : <b>1100</b></li> </ul>
<ul style="list-style-type: none"> <li>• Theory lectures 60 minutes Each and Practical lectures 120 minutes each.</li> </ul>	<ul style="list-style-type: none"> <li>• Total credits for M. Sc. - II (Semester III &amp;IV): <b>44</b></li> </ul>
<ul style="list-style-type: none"> <li>•MMT- Mandatory Theory Course</li> <li>•MMPR- Mandatory Practical Course</li> <li>•MET- Elective Theory Course</li> <li>•MEPR- Elective Practical Course</li> <li>•RP- Research Project</li> </ul>	<ul style="list-style-type: none"> <li>• Theory and Practical examination will be conducted at the end of respective semester after the theory examination.</li> <li>• Practical courses may be divided into sub-sections.</li> <li>• UA: University Assessment</li> <li>• IA: Internal Assessment</li> <li>• <i>Separate passing is mandatory for Theory, Internal and Practical Examination</i></li> </ul>
<ul style="list-style-type: none"> <li>• <b>Requirement for Entry at Level 9:</b> <ol style="list-style-type: none"> <li>1) Completed all requirements of the relevant Post Graduate Diploma (Level 8) in Geology.</li> <li>2) Bachelor's Degree (Honours / Research) (Level 8) in Geology.</li> </ol> </li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Exit Option at Level 9: Students can exit after Level 9 with Master's Degree in Geology if he/she completes the course equivalent to minimum of 88 credits.</b></li> </ul>	

## 6. Programme Outcomes (POs)

After completing the post graduation in the faculty of Science, the student is expected to have:

- Explain scientific laws and principles and applies the scientific knowledge to overcome complex problems in the life.
- Elaborate nature, environment and society critically and rationally.
- Give explanation terms, facts, concepts, processes, techniques, and principles of subjects.
- Communicate the scientific knowledge in lingua-franka of the world i.e. English and gain access to the current scientific affairs.
- Enlighten the people around by uncovering the scientific principles behind the magic and superstitions.
- Show sensitivity to the matters of environment sustainability and use science for the progress of humanity without damaging the ecosystem.
- Self employable abilities through consultancies.

## 7.Course Codes:

<b>M.Sc. Semester-I</b>		
<b>1</b>	Mineralogy, Optics and Crystallography(4 credit)	<b>MSU0325MML921G1</b>
<b>2</b>	Igneous Petrology(4 credit)	<b>MSU0325MML921G2</b>
<b>3</b>	Practical Lab-I (4 credit)	<b>MSU0325MMP921G1</b>
<b>4</b>	Practical Lab-II (2 credit)	<b>MSU0325MMP921G2</b>
<b>5</b>	Research Methodology (4 credit)	<b>MSU0325RML921G</b>
<b>6</b>	Stratigraphy and Palaeontology(4 credit)	<b>MSU0325MEL921G1</b>
	Remote Sensing and Geomorphology(4 credit)	<b>MSU0325MEL921G2</b>

<b>M.Sc. Semester-II</b>		
<b>1</b>	Metamorphic Petrology(4 credit)	<b>MSU0325MML921H1</b>
<b>2</b>	Sedimentary Petrology(4 credit)	<b>MSU0325MML921H2</b>
<b>3</b>	Practical Lab-III (4 credit)	<b>MSU0325MMP921H1</b>
<b>4</b>	Practical Lab-IV (2 credit)	<b>MSU0325MMP921H2</b>
<b>5</b>	Field Project/OJT (4 credit)	<b>MSU0325FPP921H/ MSU0325OJP921H</b>
<b>6</b>	Geophysics and Exploration Methods(4 credit)	<b>MSU0325MEL921H1</b>
	Mining Geology(4 credit)	<b>MSU0325MEL921H2</b>



<b>M.Sc. Semester-III</b>		
<b>1</b>	Hydrogeology(4 credit)	<b>MSU0325MML921I1</b>
<b>2</b>	Geochemistry(4 credit)	<b>MSU0325MML921I2</b>
<b>3</b>	Practical Lab-V (4 credit)	<b>MSU0325MMP921I1</b>
<b>4</b>	Practical Lab-VI (2 credit)	<b>MSU0325MMP921I2</b>
<b>5</b>	Research Project - I (4 credit)	<b>MSU0325RPP921I</b>
<b>6</b>	Environmental Geology (4 credit)	<b>MSU0325MEL921I1</b>
	Natural Resource Management (4 credit)	<b>MSU0325MEL921I2</b>

<b>M.Sc. Semester-IV</b>		
<b>1</b>	Economic Geology(4 credit)	<b>MSU0325MML921J1</b>
<b>2</b>	Structural Geology and Geotectonics(4 credit)	<b>MSU0325MML921J2</b>
<b>3</b>	Practical Lab-VII (4 credit)	<b>MSU0325MMP921J1</b>
<b>4</b>	Practical Lab-VIII (2 credit)	<b>MSU0325MMP921J2</b>
<b>5</b>	Research Project – II (Dissertation) (4 credit)	<b>MSU0325RPP921J</b>
<b>6</b>	Engineering Geology and Geotechniques(4 credit)	<b>MSU0325MEL921J1</b>
	Geoinformatics(4 credit)	<b>MSU0325MEL921J2</b>

**COURSE STRUCTURE :**  
**M. Sc. GEOLOGY PART-I ( LEVEL-8)**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
<b>SEMESTER I</b>			
<b>1</b>	<b>MMT101</b>	<b>Mineralogy, Optics and Crystallography</b>	<b>4</b>
<b>2</b>	<b>MMT102</b>	<b>Igneous Petrology</b>	<b>4</b>
<b>3</b>	<b>MMPR103</b>	<b>Practical-I - based on MMT101 and MMT102</b>	<b>4</b>
<b>4</b>	<b>MET104/105</b>	<b>Any one of the following elective papers</b>	<b>4</b>
		<b>MET104      Stratigraphy and Palaeontology</b>	
		<b>MET105      Remote Sensing and Geomorphology</b>	
<b>5</b>	<b>MEPR106/107</b>	<b>Practical-II - based on MET104/105</b>	<b>2</b>
<b>6</b>	<b>RM108</b>	<b>Research Methodology</b>	<b>4</b>
<b>SEMESTER II</b>			
<b>1</b>	<b>MMT201</b>	<b>Metamorphic Petrology</b>	<b>4</b>
<b>2</b>	<b>MMT202</b>	<b>Sedimentary Petrology</b>	<b>4</b>

3	MMPR203	Practical-III - based on MMT201 and MMT202		4
4	MET204/205	Any one of the following elective papers		4
		MET204	Geophysics and Exploration Methods	
		MET205	Mining Geology	
5	MEPR206/207	Practical-IV - based on MET204/205		2
6	FP/OJT208	Field Project/On Job Training ( During Summer Vacation )		4
Total Credits				44

**COURSE STRUCTURE :**  
**M. Sc. GEOLOGY PART -II ( LEVEL-9)**

Sr. No.	Course Code	Course Title		Credits
SEMESTER III				
1	MMT301	Hydrogeology		4
2	MMT302	Geochemistry		4
3	MMPR303	Practical-V - based on MMT301 and MMT302		4
4	MET304/305	Any one of the following elective papers		4
		MET304	Environmental Geology	
		MET305	Natural Resource Management	
5	RP308	Research Project		4
6	MEPR306/307	Practical-VI - based on MET304/305		2
SEMESTER IV				
1	MMT401	Economic Eeology		4
2	MMT402	Structural Geology and Geotectonics		4
3	MMPR403	Practical-VII - based on MMT401 and MMT402		4
4	MET404/405	Any one of the following elective papers		4
		MET404	Engineering Geology and Geotechniques	
		MET405	Geoinformatics	
5	MEPR406/407	Practical-VIII - based on MET404/405		2
6	RP408	Research Project		4
Total Credits				88

## **8. Syllabus:**

### **M. Sc. Part – II: Geology Semester III**

**Title of Course: MMT-301: Hydrogeology**

**Course Code: MSU0325MML921H**

**Total Credits: 04**

#### **Unit I**

Groundwater – Origin, types, importance, occurrence and distribution of water in the Earth's crust. Hydrological cycle – Precipitation, runoff, infiltration and evapotranspiration; Groundwater reservoir and Groundwater movement; Influent and effluent seepage, springs, Types of aquifers and their properties.

Hydrologic properties of rocks: porosity, permeability, specific yield, specific retention, hydraulic conductivity, transmissivity, storage coefficient, Darcy's law, Occurrence of groundwater in different rock types.

#### **Unit II**

Water well technology, types of wells; Drilling methods; Construction, development and maintenance of wells. Water table contour maps, Hydrographs; Well hydraulics, confined, unconfined, steady, unsteady and radial flow, Water level fluctuations, causative factors and their measurements; Methods of pumping test and analysis of test data, Evaluation of aquifer parameters from pumping test analysis.

#### **Unit III**

Surface and subsurface geophysical and geological methods of groundwater exploration. Hydrogeomorphic mapping using remote sensing techniques. Radio-isotope Tracers in hydrogeological studies. Collection of hydrogeological data and preparation of hydrogeological maps.

Groundwater quality: Physical, Chemical and Bacteriological parameters and their estimation, Diagrammatic representation of chemical data, Water contaminants and pollutants: Pollution factors, sources and nature of pollution, Pollution mechanism, its detection and prevention.

#### **Unit IV**

Water management in rural and urban areas: Problems of overexploitation of groundwater, artificial and natural factors controlling water recharge, Rain water harvesting, artificial recharge of groundwater, Groundwater legislation, Groundwater intrusion in coastal aquifers and remedial measures, watershed management and related environmental aspects.

Problems of arsenic and fluoride contamination of groundwater in various regions of India;

Hydro-stratigraphic units of India; Paleo-hydrological studies; Groundwater Modelling.

## Reference Books

1. Groundwater hydrogeology – D. K. Todd , John Wiley and Sons Inc, New York.
2. Hydrogeology – S. N. Davis and R. J. M. Dewiest. Hydrogeology. John Wiley.
3. Ground water – Freeze, R.A. and Cherry, J.A. Prentice Hall Publication.
4. Water- Subramaniam, V. Kingston Publication London.
5. Groundwater studies – R. H. Brown and others
6. Groundwater Hydrology – Herman Bouver
7. Groundwater Resources Evaluation – W. C. Walton
8. Hydrogeology – C. F. Fetter
9. Hand book of applied hydrology – Ven Te Chew
10. Groundwater and wells – Hohnson publication
11. Physical and chemical hydrogeology – Patrick A. D. Dominics
12. Applied hydrogeology – Chow M. Mays, Mac Graw Hil Publicaiton
13. Hydrogeology and wet housed conservation – Gulman – wiley publication
14. Groundwater survey and investigation – Gautham Mahajan ApH puls.
15. Hydrogeology – Raghunath HM
16. Hydrogeology – Karanth K R, Tata Mac Graw Hill Co. Ltd., New Delhi.
17. Groundwater Assessment Development and Management – Karanth KR, Tata Mac-Graw Hill
18. Groundwater – S. Ramakrishnan
19. Palehydrology and Environmental change : Bemite, V R Babar and K. J. Gregong, Wiley, Chichester
20. Global Environment Changes, the context of paleohydrology, J. Brauson., A. G. Brown, K. S. Gregory, Wiley Chichester.
21. Groundwater in Hydrosphere (Groundwater Hydrology)- Nagabhushanian, H.S. CBS Publisher, New Delhi.
22. Applied hydrogeology – Fetter C. V
23. Regional Groundwater Quality – Alley W. M. VNR, New York

## M. Sc. Part – II: Geology Semester III

**Title of Course: MMT-302: Geochemistry**

**Course Code: MSU0325MML921I2**

**Total Credits: 04**

### Unit I

Origin and abundance of elements in the Earth, solar system and its constituents. Atomic structure and properties of elements in the periodic table, Special properties of transition and rare – earth elements.

## **Unit II**

Goldschmidt's Principles of Geochemistry. Geochemical classification of elements in the Earth. Principles of Geochemical Cycle. Isomorphism and Polymorphism, Principles of Geothermobarometry.

## **Unit III**

Radiogenic Isotopes; Radioactive decay scheme of V-Pb, Sm-Nd, Rb-Sr, K-Ar And growth of daughter isotopes; Radioactive dating of single minerals and whole rocks; Stable Isotopes- nature, abundance and fractionation, fluid interaction and biological processes.

Laws of thermodynamics, Concept of free energy; Activity, fugacity and equilibrium constant; Thermodynamics of ideal, non – ideal and dilute solutions.

## **Unit IV**

Principles of ionic substitution in minerals; Element partitioning in mineral/rock formation and Concept of simple distribution coefficients and exchange reaction distribution coefficients; Element partitioning (partitioning ?) in mineral assemblages and its use in the pressure – temperature estimation.

Chemistry of natural waters; mineral stability in Eh-pH diagram; Rock weathering and soil formation; Elemental mobility in surface environment; Concept of geochemical – biogeochemical cycle and Global climate.

## **Reference Books**

1. Allegre, C.J. and Michard, G. Introduction to Geochemistry, Reidel Holland.
2. Mason, B. Introduction to Geochemistry, Wiley Eastern.
3. Anderson, G.M. and Crerar, D.A. Thermodynamics in Geochemistry-the equilibrium model, Oxford Univ. Press, NY.
4. Introduction to Geochemistry – Mason B and Moore C. B.
5. Introduction to Geochemistry – Krauskopf K. B and Bird D. K.
6. Geochemistry – Goldschmidt V. M Clarendon Press.
7. Encyclopedia of Geochemistry – Marshal C. P and Fairbridge R. W.
8. Stable Isotope Geochemistry – Hoefs J.
9. Principles of Isotope Geology – Faure G.
10. Handbook of Exploration Geochemistry – Govett G. J. S.
11. Geochemistry of Natural Waters – Drever J. I.
12. Marine Chemistry – Home R. A.

## **M. Sc. Part – II: Geology**

### **Semester III**

**Title of Course: MET-304: Environmental Geology**

**Course Code: MSU0325MEL921I1**

**Total Credits: 04**

#### **Unit I**

Introduction, fundamental concept and scope of Environmental Geology, Concepts of lithosphere, hydrosphere and atmosphere and their Physico–chemical characteristics. Time scales of changes in the ecosystem and climate.

Ecology –Meaning and Scope, Concept of Ecosystem, Energy flow in ecosystem, Earth systems and cycles: Carbon Cycle, Nitrogen Cycle, Oxygen Cycle, Phosphorus cycle.

#### **Unit II**

Natural hazards – Types, causes, effects and controlling of natural disasters- Volcanism, Earthquakes and tsunamis, Avalanches, Floods, Landside, Coastal hazards, Desertification : Planning for disaster mitigation, Remedial measures and Case studies,

Air Pollution: Sources and Classification of air pollutants, Effects of air pollution on environment, antipollution measures, Acid rain, Ozone depletion, Green House Effects & Global Warming, Remedial measures. Water pollution: BIS and WHO Standards for water quality, Sources and Classification of surface water and groundwater pollutants - Domestic waste, Agricultural waste, Fertilizers and pesticides, Remedial measures.

#### **Unit III**

Soil Pollution: Geological conditions vulnerable to soil pollution- Rock type, Soil cover, Depth of weathering, Porosity and Permeability. Sources and Classification of pollutants effects on soil, alkaline / saline soil, acidic soils, formation of wasteland and its reclamation.

Environmental aspects of mining and refineries- Open cast and underground mining, refineries. Hazardous Waste Disposal - Solid and liquid waste. Geological factors in selection of sites for solid, liquid, hazardous waste disposal, remedial measures.

#### **Unit IV**

Environmental Impact Assessment (EIA)– Risk Assessment and Analysis, Remedial Measures, Environment Management Plan (EMP).

Role of Geology in Environmental management. Hazard Zonation Maps and Preparedness Plans with respect to Mining, Earthquakes and Tsunamis, Volcanism, Landslides, Floods and Desertification.

## Reference Books

1. Principles of Environmental Science- Watt K. E. F., McGraw Hill Book Company
2. Environmental Geology- K.S. Valdiya, Tata McGraw Publication
3. Environmental Geology –Keller, E. A. Bell and Howell, USA
4. Fundamentals of Ecology- E. P. Odum
5. Natural Hazards – Bryant, E., Cambridge University Press
6. Geological Hazards – Bell, F. G., Routledge, London
7. Disaster Management- Prakash I., Rashtriya Prahari Prakashan.
8. Disaster Management- Sharma, V. K. I. I. P.A. New Delhi
9. Chemical and Biological Methods for Water Pollution Studies- R. K. Trivedi and P.K. Goel, Enviro Publication
10. Environmental Biology- K. C. Agarwal, Agro-Bios Jodhapur.
11. Environmental Impact Assessment – Larry W. Canter, McGraw Hill Industrial Edition.
12. The Dynamic Earth System – Patwardhan, A. M., Prentice Hall

## M. Sc. Part – II: Geology Semester III

**Title of Course: MET-305: Natural Resource Management**

**Course Code: MSU0325MEL921I2**

**Total Credits: 04**

### Unit I

Meaning and Classification of Natural Resources- Renewable and non-renewable resources. Identification of natural resources – Economic minerals, Natural Fuels, Water, Land, Soil, and Forests. Human use and its impact on the resources. Management tools and techniques. Planning for Sustainable Development. National Policy for Natural Resources.

Classification of economic minerals based on their use, Ore minerals- Production, treatment and use of Precious metals, Ferrous metals, Rare earth / minor element resources. Non-metallic minerals Classification, Production, treatment and uses in - Ceramic, refractory, pigments, paints, fertilizer etc. industry. Mineral resources management and conservation.

### Unit II

Marine Mineral Resources- Factors controlling occurrence and distribution of Polymetallic / Manganese nodules, Phosphorites, Hydrocarbons, Beach Placers, Evaporites, Rare metals, Ornamental stones- Corals, Pearls, and Shells. Management of Marine Resources- Principles and parameters.

Land Resources- Land as a natural resource, Land use and Land cover classification system. Physiography, climate, structure and composition of –Forest, Croplands, Grazing, Desert and

Wastelands. Land use evaluation and planning. Techniques of terrain evaluation. Management of Land Resources – Croplands, Wasteland, Grazing land, Forests and Deserts.

### **Unit III**

Soil resources – Soil profile, Soil Types – Components and Genesis. Physico- chemical parameters of soil in relation to Agriculture and Engineering Practices. Soil erosion- preventive measures. Soil Conservation Practices.

Water resources – Water as a Renewable Resource – River resources and Flood control, Groundwater resources- Occurrence and Distribution. Management of water resources- Identification of problems of overdraft, over- irrigation- Salination of soil and water, Seawater intrusion in coastal aquifers, Surface water and Groundwater Pollution.

Remedial Measures- Water budgeting-Demand and Supply evaluation. Sustainable Watershed Development. Surface water conservation methods. Groundwater Recharge- Natural and Artificial methods, Water Quality parameters and standards for domestic, agriculture and industrial use.

Water use and Law, National and Maharashtra State Water Policy.

### **Unit IV**

Natural Energy Resources –Role of energy resources in the development of a Nation. Non- Renewable energy resources-Coal, Petroleum, Natural Gas and Atomic Minerals- Production, treatment and use. Indian occurrences. Planned development and Integrated use.

Conventional and Non-conventional Energy Resources. Wind Energy as a Resource, Wind availability, Geomorphological considerations in the site selection for windmills. Solar Energy as a Resource, Geological, Climatological aspects in Harnessing Solar Energy.

Forests resources– Forest cover, Integrated use of forest resources, Degradation of forest resources and remedial measures. Coastal resources and problems.

### **Reference Books**

1. Natural Resource Ecology, Economics and Policy - Holechek, J. L., Cole, R. A., Fisher, J. T., and Valdez, R., 2nd Edition, Prentice Hall Education.
2. Modelling in Natural Resource Management Development, Interpretation and Application- Shenk, T. M. and Franklin A. M., Island Press.
3. Making Collaboration Work- Lessons from Innovation in Natural Resource Management- Wondolleck, J. M. and Yaffee, S. L., Island Press
4. Aerial Photography and Image Interpretation for Resource Management-Paine, D. P., John Wiley and Sons, New York, 571p.
5. Principles of Geographical Information System for land Resources Assessment - Burroughs, P. A., Oxford University Press.
6. Understanding GIS: The Arc Info method Training Course for GIS for resource management and development planning- Environment Systems Research Institute.
7. Examination and Valuation of Mineral Property- Banter and Parks



8. India's Mineral Wealth-Brown and Day.
9. Groundwater Assessment, Development, and Management- Karanth K. R.
10. Geology of Petroleum- Levenson
11. Petroleum Geology- Russel

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## M. Sc. Part – II: Geology Semester III

**Title of Course: RP308: Research Project**

**Course Code: MSU0325RML921I**

**Total Credits: 04**

1. Each student is required to undertake a research project under the Guidance of a Faculty Member at the beginning of Semester III.
2. The dissertation work may involve
  - a) field investigations or
  - b) survey of useful earth materials in industries and
  - c) laboratory studies.

This is to be followed by computational work, data processing and analysis or a combination of these.

3. Towards completion of the work each student should present his work using Power Point to the audience consisting of his/her Guide, Head of the Department, Staff and Students of Geology Department and interested persons from other departments. The draft of the thesis should then be then finalized and typed. The dissertation guide should review the draft thesis at least twice in due consultation with the concerned student before finalizing it.
4. Each student should prepare and submit two copies of the thesis to the Head of the Department one week prior to the Practical Examination. One copy of the thesis will be returned to the student and the other will be retained by the guide.
5. The dissertation work carries 100 marks which will be evaluated as per following guidelines:
  - 50% marks- Evaluation by the Guide and Head of the Geology Department on the basis of performance of the student – punctuality, enthusiasm, and aptitude- during fieldwork / survey of industries / laboratory work / theoretical investigations / data processing as applicable.
  - 50% marks for Power Point Presentation and Preparation of the thesis– to be evaluated by the Internal and External Examiners.

## **Reference Books**

1. Manual of Field Geology By Crompton.
2. Statistics and data analysis in geology by Davis.
3. An introduction to statistical model in geology by W.C.Krumbein and F.A. Graybill.
4. Statistical analysis in geological sciences by Miller and Khan.
5. Field Geology: Lahee.

## **M. Sc. Part – II: Geology Semester III**

### **Practical Lab-V**

**MMPR-103 : Based on MMT-301 and Based on MMT-302**

**Course Code: MSU0325MMP921I1**

**Total Credits: 04**

#### **Hydrogeology**

- Identification and demarcation of Watershed boundaries,
- Interpretation of well inventory data, Determination of groundwater flow direction,
- Preparation of water table contour map.
- Estimation permeability.
- Analysis of hydrographs and estimation of infiltration capacity.
- Pumping test – Time, Drawdown and time recovery tests. Evaluation of aquifer parameters, step drawdown test.
- Study of depth and yields of bore wells.
- Study of Electric resistivity sounding data for delineation of fresh and saline aquifers.
- Study of geophysical well logs.
- Exercises on groundwater exploration using remote sensing techniques.
- Exercises related on ground water modeling with given data.

#### **Geochemistry**

- Preparation and Interpretation of geochemical maps.
- Analysis of Rock / Sediment / Soil samples.
- Periodic Table

## **Practical Lab-VI**

**MEPR-306/307 : Based on Environmental Geology (MET-304)/ Natural Resource Management (MET-305)**

**Course Code: MSU0325MMP921I2**

**Total Credits: 02**

### **MEPR-306 : Based on Environmental Geology (MET-304)**

- Methods of collection of surface and groundwater samples.
- Analysis of water samples– pH, EC, ( Electrical Conductivity), total hardness, Ca, SO<sub>4</sub>.
- Classification of water samples for finding its suitability as drinking, irrigation, industrial suitability with reference to BIS and WHO standards.
- Presentation of chemical analysis data and plotting chemical classification diagrams.
- Preparation of hazard zonation maps for different kinds of hazards.

## **Practical Lab-VI**

**MEPR-306/307 : Based on Environmental Geology (MET-304)/ Natural Resource Management (MET-305)**

**Course Code: MSU0325MMP921I2**

**Total Credits: 02**

### **MEPR-307 : Based on Natural Resource Management (MET-305)**

- Study of Mineral Map of India.
- Preparation of land use pattern maps from field studies,
- Water budgeting,
- Study of Toposheets and Remote Sensing data,
- Analyses of multidisciplinary data such as water availability, land use, agricultural practice, soil character and composition for optimum and sustainable development.

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## **M. Sc. Part – II: Geology**

### **Semester IV**

**Title of Course: MMT-401: Economic Geology**

**Course Code: MSU0325MML921J1**

**Total Credits: 04**

#### **Unit I**

Mode of occurrence of mineral deposits, their morphology and relationship with host rock. Organic matter in ores and their significance.

Significance of mineral resources in national economy. Uses of various minerals in industries. Strategic, critical and essential minerals. National mineral policy.

#### **Unit II**

Paragenesis and zoning. Tectonic controls on mineralisation. Stratigraphic controls on mineralisation. Metallogenic epochs and metallogenic provinces.

#### **Unit III**

Study of the following ore deposits of India with reference to their geological and tectonic setting, genesis and distribution: Cu, Pb, Zn, Mn, Fe, Cr, Al, Sn, W and Au.

Study of following non-metallic deposits of India: Magnesite, talc, barite, kyanite, sillimanite, asbestos, phosphorite, mica, precious and semiprecious stones.

Atomic minerals- occurrences in India and their applications.

#### **Unit IV**

Coal- origin of peat, lignite, bitumen and anthracite; classification, rank and grading of coal, coal petrography, coal measures of India;

Petroleum and natural gas- origin, migration and entrapment of petroleum, properties of source and reservoir rocks, structural; stratigraphic and combination traps, petroliferous basins of India.

#### **Reference Books**

1. Economic Mineral Deposits: Jensen and Betman
2. Ore Deposits: Betman
3. Ore Deposits: Evans
4. Minerals of India: R. K. Sinha.
5. Ore Deposits: Gokhale and Rao.

6. Metallisation associated with Acid magmatism: Evans.
7. Ore Deposit Geology: Edvends and Atkinson.
8. Geology of Ore Deposits: Gilbert.
9. Ore Petrography: Cameran
10. Ore Petrography: Ramdhor.
11. Ores in Sediments: Amstutz and Bernard.
12. Mineral Economics: R. K. Sinha.
13. Mineral Economics: Chaterjee.

## **M. Sc. Part – II: Geology**

### **Semester IV**

**Title of Course: MMT-402: Structural Geology and Geotectonics**

**Course Code: MSU0325MML921J2**

**Total Credits: 04**

#### **Unit I**

Concept of stress and strain, stress strain relationship of elastic, plastic and viscous materials. Theory of rock failure, Behavior of rocks and minerals with respect to stress and strain.

Structural Analysis: Principles, phases, Scale, homogeneity and symmetry of structural analysis. Structural analysis on microscopic, mesoscopic and megascopic scales. Structural analysis of areas of one, two and three phases of structural deformation. Interference structures of different scales and their origin.

#### **Unit II**

Joints: Classification and Genesis. Origin and significance of different types of minor structures within shear zones. Rock cleavages, foliation and lineation.

Folds :Mechanisms of folding, Classification of folds, Folding in shear zones.

Faults: Classifications and Genesis. Thrust belts and Nappes. Shear zones: Sense of movement and its determination in shear zones,

Unconformity : Development and Types. Significance in stratigraphy.

#### **Unit III**

Internal structure of the earth. Significance of asthenosphere and outer core in geodynamics. Physical characters of continents and ocean basins – Shields, Cratons, Platforms, Continental shelf, continental slope and abyssal plains; Island arcs, Trenches, Rift valleys and Mid-Oceanic Ridges.

Outlines of hypotheses of contraction, expansion, convection, polar wandering. Continental drift, Palaeomagnetism and Seafloor spreading; Isostasy, orogenesis and epirogenesis. Precambrian and Palaeozoic orogenies.

#### **Unit IV**

Plate tectonics, Plate Tectonic model of the origin of folded mountain belts. Hot spot activity. Seismicity and plate movement.

Tectonic features of India: Structural trends during Archaean and Proterozoic Era. Proterozoic sedimentary platform basins- their trend and tectonics. Tectonic model of the evolution of Himalayas- Geodynamics of the Indian plate.

#### **Reference Books**

1. Structural Geology: Billings M. P.
2. Structural Geology- Fundamental and Modern Developments: Ghosh, S. K.
3. The Techniques of Modern Structural Geology-1. Strain Analysis: Ramsey, J. G. and Hubber, M. I.
4. The Techniques of Modern Structural Geology- 2. Folds and Fractures : Ramsey, J. G. and Hubber, M. I.
5. Folding and Fracturing of Rocks: Ramsey, J. G.
6. Structural Geology: Davis, G. A.
7. The Evolving Continents: V. F. Windley
8. Plate Tectonics and Crustal Evolution: K. C. Condie
9. Aspects of Tectonics: K. S. Valdiya

### **M. Sc. Part – II: Geology Semester IV**

**Title of Course: MET-404: Engineering Geology and Geotechniques**

**Course Code: MSU0325MEL921J1**

**Total Credits: 04**

#### **Unit I**

Scope of Engineering Geology in Civil Engineering and mining industry. Building Stones: Engineering properties of rocks and their dependence upon geological characters, rock discontinuities, inbuilt stresses in rocks, measurement of these stresses by Flat Jack Method. Requirement of good building stone, Engineering properties of soils.

Preliminary Geological Investigation: Geological and geophysical studies for various projects, Engineering consideration of structural features, Importance of hydrogeology in civil engineering structures.

## **Unit II**

Exploratory drilling: Observations, Preservation of cores, Core logging, Core recovery, R.Q.D., Graphical representation of core log, Limitation of exploratory drilling method, numerical problems on core drilling.

Earthquake and Seismicity, Seismic zones of India, Engineering problems, precautionary measures and mitigations of hazards related to seismicity. Aseismic design of Engineering Projects.

## **Unit III**

Classification of dams, Geotechnical investigations for dams and reservoirs, Criteria for selection of a good dam site, Dam foundation problems, Reservoir problems, Reservoir Induced Seismicity.

Tunnelling: Definition, Civil Engineering terms, difficulties during tunnelling, Influence of geological conditions on tunnelling, Lining after tunnelling, Geological consideration while choosing tunnel alignment, Tunnel in folded strata, sedimentary rocks.

## **Unit IV**

Geology of Bridge sites: Types of bridges, Geological investigation for selection of sites for bridge. Geotechnical studies for Beach engineering, hydroelectric power generation, Highways etc.

Engineering Geology of Deccan Traps: Types of basalts and associated volcanic rocks, Engineering characteristics of these rock types, Engineering significance of variation in size, number and infillings of gas cavities, Compact and amygdaloidal basalt as construction material, Effects on jointing, hydrothermal alteration and weathering on engineering behaviour of various varieties of Deccan traps. Tail channel erosion problem in Deccan Trap region, suitability of basalts from tunnelling point of view, Problems due to columnar basalt, dykes, red bole, tachylitic basalt, Volcanic breccia and fractures, Laterites-Origin, occurrence and engineering aspects. Ground water bearing capacity of the rocks of Deccan Trap region, Percolation tanks, Geological conditions suitable and unsuitable for construction of percolation tanks.

## **Books Recommended**

1. Engineering and General Geology – By Prabin Singh, S. K. Katariya and sons, Delhi.
2. A Text Book of Geology – By P. K. Mukerjee, The World Press Pvt.Ltd., Calcutta.
3. Geology Hand book in Civil Engineering- By R. F. Legget – McGrawHill, New York.
4. Principles of Engineering Geology and Geotechnics- By D. P. Krynine & W. R. Judd, CBS Publishers & Distributors, New Delhi.
5. Engineering Properties of Rocks – By L. W. Farmer, Chapman & Hall, London.
6. Experiments in Engineering Geology – By K. V. G. K. Gokhale & D. M. Rao, TMN, New-Delhi.
7. A Text Book of Engineering Geology – By R. B. Gupte, Pune Vidyarthi Griha Prakashan, Pune.

8. Engineering Geology for Civil Engineering – By Dr. D. V. Reddy, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
9. Engineering Geology - By B. S. Sathya Narayanswami, Dhanpat Rai & Co. (P) Ltd, Delhi.
10. Engineering Geology Laboratory Manual.
11. Geology of India and Burma- M. S. Krishnan, Higginbothams Pvt. Ltd.
12. Koyana Earthquake Journal (1968) Indian Geophysics Uni.
13. Introduction to Rock Mechanics by Verma B. P., Khanna Publisher, Delhi.

## **M. Sc. Part – II: Geology Semester IV**

**Title of Course: MET-405: Geoinformatics**

**Course Code: MSU0325MEL921J2**

**Total Credits: 04**

### **Unit I**

Geographical Information Systems (GIS): Principle, Definitions & Terminology, Roots of GIS, Need of GIS, Component of GIS. Spatial analysis- spatial elements, entities and attributes, patterns.

Map as geographic data base- Map scale, Classes of Map, Geographic Coordinate system, map projections- conformal and mathematical projections and properties, map reading.

### **Unit II**

Concept of Cartography, history and sequence of development, Cartographic processes, cartographic abstraction, generalization, accuracy and reliability. Georeferencing, Attribute data for Thematic Mapping & Preparation of Thematic maps.

Graphic representation of data Raster & Vector, Relation between data representation & Data Analysis.

### **Unit III**

Input & Output methods, Remote sensing as raster data input.

Editing- importance, editing errors, edge matching and rubber sheeting,

### **Unit IV**

Digital Terrain Models (DTM)- Definition & Terminology, Approaches to DTM, Acquisition of Data, data processing & Visualization, Applications of DTM

Applications of GIS- geological, geographical, Land use/Land cover, Watershed development, Environmental, Urban planning.



### **Books Recommended**

1. Remote Sensing and Geographical Information System – Anji Reddy
2. Concepts and Techniques of Geographical Information System – C. P. Lo and Albert K. W. Yeung
3. Star J. And Estes, J.E. Geographic Information System: An introduction, New Jersey, Printice Hall.
4. Aronoff, S. geographical Information Syatem- a management perspective, WDL Publication Ottawa, Canada.
5. Tyner, J. Introduction to thematic Cartography, Prentice-hall, Englewood Cliff, New Jersey.
6. Mishra, R.P. and A. Ramesh . Fundamental of Cartography, Concepts Publishing Company, New Delhi.
7. Ian Heywood, Sarah Cornwilius and Steve Carver An introduction to
8. Geographical Information System, Addison Wesley Longman Limited, New York.
9. Monkhouse, F.J. and Wilkinson, H.R. Maps and diagrams, Metheun & Co., London.
10. Lawrence, G.R.P.. Cartographic methods, Metheun & Co.,Canada.
11. Andon, R.W. (Ed). Basic Cartography for students and technicians, Vol. 2,
12. International Cartographic association, Elsevier Applied Science Publisher London.

## **M. Sc. Part – II: Geology Semester IV**

**Title of Course: RP408: Research Project(Dissertation)**

**Course Code: MSU0325RML921J**

**Total Credits: 04**

1. Each student is required to undertake a research project/dissertation under the Guidance of a Faculty Member at the beginning of Semester IV.
2. The dissertation work may involve
  - a) field investigations or
  - b) survey of useful earth materials in industries and
  - c) laboratory studies.

This is to be followed by computational work, data processing and analysis or a combination of these.

3. Towards completion of the work each student should present his work using Power Point to the audience consisting of his/her Guide, Head of the Department, Staff and Students of Geology Department and interested persons from other departments. The draft of the thesis should then be then finalized and typed. The dissertation guide should review the draft thesis at least twice in due consultation with the concerned student before finalizing it.

4. Each student should prepare and submit two copies of the thesis to the Head of the Department one week prior to the Practical Examination. One copy of the thesis will be returned to the student and the other will be retained by the guide.

5. The dissertation work carries 100 marks which will be evaluated as per following guidelines:

- 50% marks- Evaluation by the Guide and Head of the Geology Department on the basis of performance of the student – punctuality, enthusiasm, and aptitude- during fieldwork / survey of industries / laboratory work / theoretical investigations / data processing as applicable.

- 50% marks for Power Point Presentation and Preparation of the thesis– to be evaluated by the Internal and External Examiners.

## **Reference Books**

1. Manual of Field Geology By Crompton.
2. Statistics and data analysis in geology by Davis.
3. An introduction to statistical model in geology by W.C.Krumbein and F.A. Graybill.
4. Statistical analysis in geological sciences by Miller and Khan.
5. Field Geology: Lahee.

## **Practical Lab-VII**

**MMPR-403 : Based on MMT-401 and Based on MMT-402**

**Course Code: MSU0325MMP921J1**

**Total Credits: 04**

### **Economic Geology**

- Megascopic study of typical ore minerals,
- Study of ore microscope, Processing of ore sections for optical study,
- Study of ore textures,
- Study of ore minerals under ore microscope- optical parameters, determinative mineralogy,
- Preparation of paragenetic sequence,
- Assay value and Ore reserve calculations.
- Microchemical techniques.
- Methods of surveying in geological mapping.

### **Structural Geology and Geotectonics**

#### *Structural Geology*

- Description of structural geological maps and drawing their sections,
- Exercises in determination of finite strain, Exercises in fold analysis by 't' and graphs,

- Exercises in structural analysis,
- Exercises in shear zones,
- Exercises in syntectonic fabrics for determination of strain history.

#### *Geotectonics*

- Recognition of Plate boundaries and their types in maps
- Study of tectonic maps of different parts of India.

### **Practical Lab-VIII**

**MEPR-406/407 : Based on Engineering Geology and Geotectonics (MET-404)/  
Geoinformatics (MET-405)**

**Course Code: MSU0325MMP921J2**

**Total Credits: 02**

#### **MEPR-406 : Based on Engineering Geology and Geotectonics (MET-404)**

- Study of geological map of Maharashtra state and India.
- Core logging of exploring drill hole.
- Study and construction of subsurface sections based upon data of the series of drill holes.
- Use of Electrical Resistivity Method for determining depth of bedrock.
- Study of engineering properties of rock and soil samples.
- Suitability of different rock types for the civil engineering work.
- Problems related to RQD
- Preparation of Rose diagram
- Soil classification/ rock classification related problems

#### **MEPR-407 : Based on Geoinformatics (MET-405)**

- Identification of Geographic features,
- Map registration, digitization and editing,
- Linking external tables,
- Vector analysis,
- Raster analysis,
- Terrain analysis and watershed delineation.
- Use of sophisticated GIS based software.

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## 9. SCHEME OF TEACHING AND EXAMINATION:

(Applicable to University Department and University affiliated colleges' centers).

- ❖ Each unit in theory course shall comprise 15 lectures, each of 60 minutes' duration and there shall be four lectures per theory course per week.
- ❖ Entire course of M. Sc. Geology will be of 2200 marks. Every Semester will be of 550 marks.
- ❖ Examination of each theory course shall be of 100 marks (80 University Examination + 20 Internal Assessments). University examination of 80 marks (3 hours' duration) will be conducted at the end of each Semester. Internal assessment of 20 marks will be conducted before the semester examination during each semester.
- ❖ Examination of practical course shall be of 150 marks.
- ❖ Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus.

## 10. NATURE OF THEORY & PRACTICAL QUESTION PAPER AND SCHEME OF MARKING:

Theory and Practical examination shall be conducted at the end of each Semester.

Question Paper will be set in the view of the / in accordance with the entire syllabus of the semester and preferably covering each unit of syllabus.

### Theory Examination

- Theory papers will be of 3 hours duration and 80 marks each.
- There will be internal examination of 20 marks for each paper.
- Each theory paper will consist of 7 questions of 16 marks each.
- Question No. 1 is compulsory.
- Has to be answered **any Four** questions from **2 to 7**. All questions amounting to maximum 80 marks as detailed below:

**Q. No. 1:** Objective Question with 4 multiple choice of 1 mark each, total 16 Questions ( Fill in the Blanks type )

**Q.No. 2, 3, 4, 5 & 6 :** Each question is either one long answer type descriptive question of 16 marks or 2 brief answer type questions of 8 marks each.

**Q. No. 7 :** Six short notes of 4 marks each, out of which four to be solved for 16 marks

### Practical Examination

**Practical Lab-V- MP301 -based on MT301 and MT302,  
100 marks**

Que. 1 Experiment/Experiments Based on <b>MT301</b>	20
Que. 2 Experiment/Experiments Based on <b>MT301</b>	20
Que. 3 Experiment/Experiments Based on <b>MT302</b>	20

Que. 4 Experiment/Experiments Based on <b>MT302</b>	20
Que. 5 <i>Viva voce</i>	10
Que. 6 Journal	10

For passing in MP301, student must score minimum 40 marks out of 100 in practical examination.

**Practical Lab-VI- EP301/302 -based on ET-301/302**  
**50 marks**

Que. 1 Experiment/Experiments Based on ET301/302	20
Que. 2 Experiment/Experiments Based on ET301/302	20
Que. 3 <i>Viva voce</i>	05
Que. 4 Journal	05

For passing in EP301/302, student must score minimum 20 marks out of 50 in practical examination.

**Practical Lab-VII- MP401- based on MT401 and MT402,**  
**100 marks**

Que. 1 Experiment/Experiments Based on <b>MT401</b>	20
Que. 2 Experiment/Experiments Based on <b>MT401</b>	20
Que. 3 Experiment/Experiments Based on <b>MT402</b>	20
Que. 4 Experiment/Experiments Based on <b>MT402</b>	20
Que. 5 <i>Viva voce</i>	10
Que. 6 Journal	10

For passing in MP401, student must score minimum 40 marks out of 100 in practical examination.

**Practical Lab-VIII- EP401/402- based on ET401/402**  
**50 marks**

Que. 1 Experiment/Experiments Based on ET401/402	20
Que. 2 Experiment/Experiments Based on ET401/402	20
Que. 3 <i>Viva voce</i>	05
Que. 4 Journal	05

For passing in EP401/402, student must score minimum 20 marks out of 50 in practical examination.

**SCHEME OF EXAMINATION FOR INTERNAL ASSESSMENT:**

Course Type	Total Internal Assessment	Class Test	Seminar Presentation	Assignment	Project Reports	Study Tour Report	Supervisor's Report
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	<b>Marks</b>						
Theory	20	10	--	10	--	--	--
Practical – 4 Credits	Nil	--	--	--	--	Required	--
Practical – 2 Credits	Nil	--	--	--	--	Required	--
Field Project / On Job Training – 4 Credits	40	--	Required (During Practical Examination)	--	Required (During Practical Examination )	--	40
Research Project – 4 Credits	20	--	Required (During Practical Examination)	--	Required (During Practical Examination )	--	20

#### **SCHEME OF EXAMINATION FOR FIELD PROJECT / JOB TRAINING (60 MARKS):**

Que. 1. Seminar Presentation	20 Marks
Que. 2. Evaluation of Project Report/Job Report	30 Marks
Que. 3. Viva Voce	10 Marks

#### **SCHEME OF EXAMINATION FOR RESEARCH PROJECT (80 MARKS)**

Que. 1. Seminar Presentation	20 Marks
Que. 2. Evaluation of Project Report/Job Report	40 Marks
Que. 3. Viva Voce	20 Marks

## 12. Equivalence of courses

### M. Sc. Part I (Semester I and II)

Old Course				Equivalent Course		
Sem No.	Course Code	Title of Old Course	Credit	Course Code	Title of New Course	Credit
I	CC-101	Mineralogy, Optics and Crystallography	04	MSU0325MML921G1	Mineralogy, Optics and Crystallography	04
I	CC-102	Igneous Petrology	04	MSU0325MML921G2	Igneous Petrology	04
I	CC-103	Metamorphic Petrology	04	MSU0325RML921G	Research Methodology	04
I	CC-104	Sedimentary Petrology	04	MSU0325MEL921G1/ MSU0325MEL921G2	Stratigraphy and Palaeontology/Remote Sensing and Geomorphology	04
I	CCPR-105	Core Course Practical	08	MSU0325MMP921G1	Practical Lab-I	04
I	AEC-106	Non-CGPA(Mandatory)	--	MSU0325MMP921G1	Practical Lab-II	02
II	CC-201	Structural Geology and Geotectonics	04	MSU0325MML921H1	Metamorphic Petrology	04
II	CC-202	Stratigraphy and Palaeontology	04	MSU0325MML921H2	Sedimentary Petrology	04
II	CC-203	Economic Geology	04	MSU0325FPP921H/ MSU0325OJP921H	Field Project/OJT	04
II	CC-204	Remote Sensing and Geomorphology	04	MSU0325MEL921H1/ MSU0325MEL921H2	Geophysics and Exploration Methods/Mining Geology	04
II	CCPR-205	Core Course Practical	08	MSU0325MMP921H1	Practical Lab-III	04
II	SEC-206	Non-CGPA(Mandatory)	--	MSU0325MMP921H2	Practical Lab-IV	02

### M. Sc. Part II (Semester III and IV)

Old Course				Equivalent Course		
Sem No.	Course Code	Title of Old Course	Credit	Course Code	Title of New Course	Credit
III	CC-301	Hydrogeology	04	<b>MSU0325MML921I1</b>	Hydrogeology	04
III	CCS-302	Geophysics and Exploration Methods	04	<b>MSU0325MML921I2</b>	Geochemistry	04
III	CCS-303	Geochemistry	04	<b>MSU0325RML921I</b>	Research Project	04
III	DSE-304	Gemology and Industrial Mineralogy/ Mining Geology/ Marine Geology/ Geoinformatics	04	<b>MSU0325MEL921I1/ MSU0325MEL921I2</b>	Environmental Geology/Natural Resource Management	04
III	CCPR-305	Core Course Practical	08	<b>MSU0325MMP921I1</b>	Practical Lab-V	04
III	AEC-306 & EC(SW M MOOC)-307	Non-CGPA(Mandatory)	--	<b>MSU0325MMP921I2</b>	Practical Lab-VI	02
IV	CC-401	Engineering Geology and Geo-techniques	04	<b>MSU0325MML921J1</b>	Economic Geology	04
IV	CCS-402	Natural Resource Management	04	<b>MSU0325MML921J2</b>	Structural Geology and Geotectonics	04
IV	CCS-403	Environmental Geology	04	<b>MSU0325MEL921J1/ MSU0325MEL921J2</b>	Engineering Geology and Geotechniques / Geoinformatics	04
IV	DSE-404	Dissertation and Institutional Training	04	<b>MSU0325FPP921J</b>	Research Project/Dissertation	04
IV	CCPR-405	Core Course Practical	08	<b>MSU0325MMP921J1</b>	Practical Lab-VII	04
IV	SEC-406 & GE-407	Non-CGPA(Mandatory)	--	<b>MSU0325MMP921J2</b>	Practical Lab-VIII	02