Maharaja's College Ernakulam

A GOVERNMENT AUTONOMOUS COLLEGE

Re-Accredited by NAAC with 'A Grade'
Affiliated to Mahatma Gandhi University
Centre of Excellence under Govt. of Kerala
Identified by UGC as College with Potential for Excellence

DEPARTMENT OF GEOLOGY

Estd. 1875

Post Graduate Curriculum and Syllabus
(Credit Semester System)

M.Sc. GEOLOGY

For 2022 Admission Onwards

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POSTGRADUATE & RESEARCH DEPARTMENT OF GEOLOGY

Postgraduate Curriculum and Syllabus

M.Sc. - Geology

For 2022 Admission Onwards

Maharaja's College, Ernakulam

A Government Autonomous College

Affiliated to Mahatma Gandhi University, Kottayam

Masters Degree Programme in Geology

(w.e.f. 2022 Admission Onwards)

Board of Studies in Geology

Sl. No.	Name of Member	Designation
1.	**Dilip Kumar P.G**	Associate professor and HOD Department of geology, Government College Kottayam
2.	**Dr. Sunil P.S**	Associate professor and head, Marine Geology, CUSAT, Ernakulam
3.	**Dr. Baiju K.R**	Associate Professor& Director School of Environmental science, Mahatma Gandhi University
4.	**Dr. Anto Francis K**	Assistant Professor, Government Engineering College, Thrissur
5.	**Sri. Selvasundaram**	Geologist, Geological Survey of India (GSI), Ernakulam
6.	**Dr.Priya P. Menon**	Coordinator Geology, HOD, Department of Statistics, Maharaja's College Ernakulam
7.	**Dr.Greeshma Gireesh A.G**	Guest Lecturer, Department of Geology Maharaja's College Ernakulam
8.	**Mrs. Roja mary Joseph**	Guest Lecturer, Department of Geology Maharaja's College Ernakulam

REGULATIONS OF THE

MAHARAJA'S COLLEGE

(Government Autonomous)

POST GRADUATE PROGRAMMES

UNDER CREDIT SEMESTER SYSTEM, 2019

(MC-PGP-CSS2019)

REGULATIONS OF THE POST GRADUATE PROGRAMMES

UNDER CREDIT SEMESTER SYSTEM, 2019 (MC-PGP-CSS2019)

1. SHORT TITLE

1.1. These Regulations shall be called Maharaja's College (Government Autonomous) Regulations (2019) governing Post Graduate Programmes under Credit Semester System (MC-PGP-CSS2019)

1.2. These Regulations shall come in to force from the AcademicYear2019- 2020.

2. SCOPE

2.1. The regulation provided herein shall apply to all post-graduate programmes from the academic year 2019-2020 admission.

2.2. The provisions herein supersede all the existing regulations for the regular post-graduate programmes conducted in Maharaja's College unless otherwise specified.

3. DEFINITIONS

3.1. **'Academic Committee'** means the Committee constituted by the Principal under this regulation to monitor the running of the Post- Graduate programmes under the Credit Semester System (MC-PGP- CSS2019).

3.2. **'Academic Week'** is a unit of five working days in which distribution of work is organized from day one to day five, with five contact hours of one hour duration on each day. A sequence of minimum of 18 such academic weeks constitutes a semester.

3.3. **'Audit Course'** is a course for which no credits are awarded.

3.4. **'CE'** means Continuous Evaluation (Internal Evaluation)

3.5. **'College Co-Ordinator'** means a teacher from the college nominated by the College Council to look into the matters relating to MC-PGP-CSS 2019 for programmes conducted in the College.

3.6. **'Comprehensive viva-voice'** means the oral examinations conducted by the appointed examiners and shall cover all courses of study undergone by a student for the programme.

3.7. **'Common Course'** is a core course which is included in more than one programme with the same course code.

3.8. **'Core course'** means a course which cannot be substituted by any other course.

3.9. **'Course'** means a segment of subject matter to be covered in a semester. Each Course is to be designed variously under lectures / tutorials / laboratory or fieldwork /seminar / project / practical training / assignments / viva-voce etc., to meet effective teaching and learning needs.

3.10. **'Course Code'** means a unique alpha numeric code assigned to each course of a programme.

3.11. **'Course Credit'** one credit of the course is defined as a minimum of one hour lecture/minimum of 2 hours lab/fieldwork per week for 18weeks in a Semester. The course will be considered as completed only by conducting the final examination.

3.12. **'Course Teacher'** means the teacher of the institution in charge of the course offered in the programme.

3.13. **'Credit (Cr)'**of a course is a numerical value which depicts theme a sure of the weekly unit of work assigned for that course in a semester.

3.14. **'Credit point (CP)'** of a course is the value obtained by multiplying the grade point (GP) by the Credit (Cr) of the course **CP = GP x Cr**.

3.15. **'Cumulative Grade point average (CGPA)'**is the value obtained by dividing the sum of credit points of all the courses taken by the student for the entire programme by the total number of credits and shall be rounded off to two decimal places. CGPA determines the overall performance of a student at the end of a programme.

(CGPA = Total CP obtained / Total credits of the programme)

3.16. **'Department'** means any teaching Department in the college.

3.17. **'Department Council'** means the body of all teachers of a Department in a College.

3.18. **'Dissertation'** means a long document on a particular subject in connection with the project/research/field work etc.

3.19. **'Duration of Programme'** means the period of time required for the conduct of the programme. The duration of post-graduate programme shall be 4 semesters spread over two academic years.

3.20. **'Elective course'** means a course, which can be substituted, by an equivalent course from the same subject.

3.21. **'Elective Group'** means a group consisting of elective courses for the programme.

3.22. '**ESE**' means End Semester Evaluation (External Evaluation).

3.23. '**Evaluation**' is the process by which the knowledge acquired by the student is quantified as per the criteria detailed in these regulations.

3.24. **'External Examiner'** is the teacher appointed from other colleges for the valuation of courses of study undergone by the students in a College. The external examiner shall be appointed by the University.

3.25. **'Faculty Advisor'** is a teacher nominated by the Department Council to coordinate the continuous evaluation and other academic activities under taken in the Department of the College.

3.26. '**Grace Grade Points**' means grade points awarded to course(s), in recognition of the students' meritorious achievements in NSS/ Sports/ Arts and cultural activities etc.

3.27. '**Grade point**' (GP)-Each letter grade is assigned a 'Grade point' (GP) which is an integer indicating the numerical equivalent of the broad level of performance of a student in a course.

3.28. '**Grade Point Average (GPA)**' is an index of the performance of a student in a course. It is obtained by dividing the sum of the weighted grade points obtained in the course by the sum of the weights of the Course **(GPA = ΣWGP / ΣMW).**

3.29. **'Improvement course'** is a course registered by a student for improving his performance in that particular course.

3.30. **'Internal Examiner'** is a teacher nominated by the department concerned to conduct Internal evaluation.

3.31. '**Letter Grade**' **or** '**Grade**' for a course is a letter symbol (A+, A, B+, B, C+, C, D) which indicates the broad level of performance of a student for a course.

3.32. MC-PGP-CSS2019 means Maharaja's College (Government Autonomous) Regulations Governing Post Graduate programmes under Credit Semester System,2019**.**

3.33. '**Parent Department**' means the Department which offers a particular post graduate programme.

3.34. '**Plagiarism**' is the unreferenced use of other authors' material in dissertations and assignments and is a serious academic offence.

3.35. **'Programme'** means the entire course of study and examinations.

3.36. **‘Project’** is a core course in a programme. It means a regular project work with stated credits on which the student under goes a project under the supervision of a teacher in the parent department/any appropriate research center in order to submit a dissertation on the project work as specified. It allows students to work more autonomously to construct their own learning and culminates in realistic, student-generated products or findings.

3.37. **‘Repeat course’** is a course that is repeated by a student for having failed in that course in an earlier registration.

3.38. **'Semester'** means a term consisting of a minimum of 90 working days, inclusive of examinations, distributed over a minimum of 18 weeks of 5 working days each.

3.39. **'Seminar’** means a lecture given by the student on a selected topic and is expected to train the student in self-study, collection of relevant matter from various resources, editing, document writing and presentation.

3.40. ‘Semester Grade Point Average' (SGPA) is the value obtained by dividing the sum of credit points (CP) obtained by a student in the various courses taken in a semester by the total number of credits for the course in that semester. The SGPA shall be rounded off to two decimal places. SGPA determines the over all performance of a student at the end of a semester **(SGPA = Total CP obtained in the semester / Total Credits for the semester).**

3.41. **'Tutorial'** means a class to provide an opportunity to interact with students at their individual level to identify the strength and weakness of individual students.

3.42. **'University'** means Mahatma Gandhi University, Kottayam, Kerala.

3.43. **'Weight'** is a numeric measure assigned to the assessment units of various components of a course of study.

3.44. **‘Weighted Grade Point’(WGP)** is the grade point multiplied by weight.

(WGP = GP xW).

3.45. ‘Weighted Grade Point Average (WGPA)' is an index of the performance of a student in a course. It is obtained by dividing the sum of the weighted grade points by the sum of the weights. WGPA shall be obtained for CE(Continuous Evaluation) and ESE(End Semester Evaluation) separately and then the combined WGPA shall be obtained for each course.

3.46. **'Internship'** means gain a professional work experience

4. ACADEMIC COMMITTEE

4.1. There shall be an Academic Committee constituted by the Principal to manage and monitor the working of MC-PGP-CSS 2019.

4.2. The Committee consists of

(a) Principal

(b) Vice-Principal

(c) Secretary, Academic Council

(d) The Controller of Examinations

(e) Two Teachers nominated from among the College Council

4.3. There shall be a subcommittee nominated by the Principal to look after the day-to-day affairs of the Regulations for Post Graduate Programmes under MC-PGP-CSS2019.

5. PROGRAMME STRUCTURE

5.1. Students shall be admitted to post graduate programme under the various faculties. The programme shall include three types of courses, Core Courses, Elective Courses and Common core courses. There shall be a project with dissertation and comprehensive viva-voce as core courses for all programmes. The programme shall also include assignments / seminars / practical's etc.

5.2. No regular student shall register for more than 25 credits and less than 16 credits per semester unless otherwise specified. The total minimum credits, required for completing a PG programme is 80.

5.3. Elective course sand Groups

5.3.1. There shall be at least two and not more than four elective groups(Group A, Group B, Group C, etc.) comprising of three courses each for a programme and these elective courses shall be included either in fourth semester or be distributed among third and fourth semesters. This clause is not applicable for programmes defined by the Expert Committees of Music and Performing Arts.

5.3.2. The number of elective courses assigned for study in a particular semester shall be the same across all elective groups for the programme concerned.

5.3.3. The colleges shall select any one of the elective groups for each programme as per the interest of the students, availability of faculty and academic infrastructure in the institution.

5.3.4. The selection of courses from different elective groups is not permitted.

5.3.5. The elective groups selected by the College shall be intimated to the Controller of Examinations with in two weeks of commencement of the semester in which the elective courses are offered. The elective group selected by the college for the students who are admitted in a particular academic year shall not be changed.

5.4. Project work

5.4.1. Project work shall be completed in accordance with the guidelines given in the curriculum.

5.4.2. Project work shall be carried out under the supervision of a teacher of the department concerned.

5.4.3. Acandidatemay, however, incertain cases be permitted to work on the project in an Industrial/Research Organization on there commendation of the supervising teacher.

5.4.4. There shall be an internal assessment and external assessment for the project work.

5.4.5. The Project work shall be evaluated based on the presentation of the project work done by the student, the dissertation submitted and the viva-voce on the project.

5.4.6. The external evaluation of project work shall be conducted by two external examiners from different colleges and an internal examiner from the college concerned.

5.4.7. The final Grade of the project (External) shall be calculated by taking the average of the Weighted Grade Points given by the two external examiners and the internal examiner.

5.5. **Assignments:** Every college going student shall submit at least one assignment as an internal component for each course.

5.6. **Seminar Lecture:** Every regular student shall deliver one seminar lecture as an internal component for every course with a weightage of two. The seminar lecture is expected to train the student in self-study, collection of relevant matter from the various resources, editing, document writing, and presentation.

5.7. **Test Papers (Internal):** Every regular student shall undergo at least two class tests

as an internal component for each course with a weightage of one each. The best two shall be taken for awarding the grade for class tests.

5.8. No courses shall have more than 5credits unless otherwise specified.

5.9. **Comprehensive Viva-Voce** -Comprehensive Viva-Voce shall be conducted at the end of fourth semester of the programme and its evaluation shall be conducted by the examiners of the project evaluation.

5.9.1. **Comprehensive Viva-Voce** shall cover questions from all courses in the programme.

5.9.2. There shall be an internal assessment and an external assessment for the comprehensive Viva-Voce.

6. ATTENDANCE

6.1. The minimum requirement of aggregate attendance during a semester for appearing at the end-semester examination shall be 75%. Condonation of shortage of attendance to a maximum of 15 days in a semester subject to a maximum of two times during the whole period of the programme may be granted by the Principal.

6.2. If a student represents his/her institution, University, State or Nation in Sports, NCC, or Cultural or any other officially sponsored activities such as college union / university union etc., he/she shall be eligible to claim the attendance for the actual number of days participated subject to a maximum 15 days in a Semester based on the specific recommendations of the Head of the Department or teacher concerned.

6.3. Those who could not register for the examination of a particular semester due to shortage of attendance may repeat the semester along with junior batches, without considering sanctioned strength, subject to the existingUniversityRulesandClause7.2.

6.4. A Regular student who has undergone a programme of study under earlier regulation / Scheme and could not complete the Programme due to shortage of attendance may repeat the semester along with the regular batch subject to the condition that he has to undergo all the examinations of the previous semesters as per the MC-PGP-CSS2019 regulations and conditions specified in 6.3.

6.5. A student who had sufficient attendance and could not register for fourth semester examination can appear for the end semester examination in the subsequent years with the attendance and progress report from the Principal.

7. REGISTRATION /DURATION

7.1. A student shall be permitted to register for the programme at the time of admission.

7.2. A student who has registered for the programme shall complete the programme within a period of four years from the date of commencement of the programme.

8. ADMISSION

8.1. The admission to all regular PG programmes shall be through PG- CAP (Centralized Allotment Process) of the Maharaja's College unless otherwise specified.

8.2. The eligibility criteria for admission to PG Programmes shall be published by the Maharaja's College along with the notification for admission.

9. ADMISSION REQUIREMENTS

1.1 Candidates for admission to the first semester of the PG programme through CSS shall be required to have passed an appropriate Degree Examination recognized by Mahatma Gandhi University as specified or any other examination of any recognized University or authority accepted by the Academic council of Mahatma Gandhi University as eligible there to.

1.2 Students admitted under this programme are governed by the Regulations in force.

10. PROMOTION:

10.1. A student who registers for a particular semester examination shall be promoted to the next semester.

10.2. A student having 75% attendance and who fails to register for examination of a particular semester will be allowed to register notionally and is promoted to the next semester, provided application for notional registration shall be submitted within 15 days from the commencement of the next semester.

10.3. The medium of Instruction shall be English except programmes under faculty of Language and Literature.

11. EXAMINATIONS

11.1. There shall be End Semester Examinations at the end of each semester.

11.2. Practical examinations shall be conducted by the College at the end of each semester or at the end of even semesters as prescribed in the syllabus of the particular

programme. The number of examiners for the practical examinations shall be prescribed by the Board of Studies of the programmes subjected to the approval of the Academic Council of the College.

11.3. End-Semester Examinations: The examinations shall normally be conducted at the end of each semester for regular students.

11.4. There shall be one end-semester examination of 3 hours duration for each lecture based and practical courses.

11.5. A question paper may contain short answer type/annotation, short essay type questions/problems and long essay type questions. Different types of questions shall have different weightage.

12. EVALUATION ANDGRADING

12.1. **Evaluation**: The evaluation scheme for each course shall contain two parts; (a) End Semester Evaluation(ESE) (External Evaluation) and (b) Continuous Evaluation(CE)(Internal Evaluation).25%weightageshallbe given to internal evaluation and the remaining 75% to external evaluation and the ratio and weightage between internal and external is 1:3. Both End Semester Evaluation(ESE) and Continuous Evaluation(CE) shall be carried out using direct grading system.

12.2. Direct Grading: The direct grading for CE (Internal)and ESE (External Evaluation)shallbebasedon6lettergrades(A+,A,B,C, D and E)with numerical values of 5,4,3,2,1and 0 respectively**.**

12.3. **Grade Point Average (GPA):** Internal and External components are separately graded and the combined grade point with weightage 1 for internal and 3 for external shall be applied to calculate the Grade Point Average(GPA)of each course. Letter grade shall be assigned to eachcoursebasedonthecategorizationprovidedin12.15.

12.4. **Internal** evaluation for Regular programme: The internal evaluation shall be based on predetermined transparent system involving periodic written tests, assignments, seminars, lab skills, records, viva-voce etc.

12.5. **Components of Internal**(CE) **and External Evaluation(ESE):**Grades shall be given to the evaluation of theory / practical / project / comprehensive viva-voce and all internal evaluations are based on the Direct Grading System.

Proper guidelines shall be prepared by the BoS for evaluating the assignment, seminar, practical, project and comprehensive viva- voce within the framework of

the regulation.

12.6. There shall be no separate **minimum grade point for** internal evaluation.

12.7. **The model** of the components and its weightages for Continuous Evaluation(CE) and End Semester Evaluation(ESE) are shown in below:

a) For Theory (CE) (Internal)

	Components	**Weightage**
i.	Assignment	1
ii.	Seminar	2
iii.	Best Two Test papers	2(1 each)
Total		**5**

(Grades of best two test papers shall be considered. For test papers all questions shall be set in such a way that the answers can be awarded A+, A, B, C, D and E grade)

b) For theory (ESE) External Evaluation is based on the pattern of questions specified in 12.15.5.

c) For Practical (CE) Internal

Components	**Weightage**
Written/Lab test	2
Lab involvement and Record	1
Viva	2
Total	**5**

(The components and the weightage of the components of the practical (Internal) can be modified by the concerned BoS without changing the total weightage 5).

Components	Weightage
Relevance of the topic and analysis	2
Project content and presentation	2
Project viva	1
Total	**5**

d) For Practical (ESE) External

Components	Weightage
Written / Lab test	7
Lab involvement and Record	3
Viva	5
Total	**15**

(The components and the weightage of the components of the practical (External) can be modified by the concerned BoS without changing the total weightage 15).

e) For Project (CE) Internal

Components	Weightage
Relevance of the topic and analysis	2
Project content and presentation	2
Project viva	1
Total	**5**

(The components and the weightage of the components of the project (Internal) can be modified by the concerned BoS without changing the total weightage 5**)**

A two stage Internal evaluation to be followed for the fruitful completion of the project.

f) For Project (ECE) External

Components	Weightage
Relevance of the topic and analysis	3
Project content and presentation	7
Project viva	5
Total	**15**

(The components and the weightage of the components of the Project (External) can be modified by the concerned BoS without changing the total weightage 15**).**

g) Comprehensive viva-voce

Components	Internal (CE) Weight	External (ESE) Weight
Basic knowledge and Presentation skills	1	3
Topic of interest	1	3
Knowledge of core courses	3	9
Total	**5**	**15**

These basic components can be subdivided if necessary. Total as well as component weightage shall not be changed.

12.8. All grade point averages shall be rounded to two digits.

12.9. To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of external examination.

12.10. **There shall not be any chance for improvement for internal grade**.

12.11. The course teacher and the faculty advisor shall maintain the academic record of each student registered for the course which shall be forwarded to the University through the Principal and a copy should be kept in the college for verification for at least two years after the student completes the programme.

12.12. External Evaluation. The external examination in theory courses is to be conducted by the University at the end of the semester. The answers may be written in English or Malayalam except those for the Faculty of Languages. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation. The external evaluation shall be done immediately after the examination preferably through Centralized Valuation.

12.13. Photocopies of the answer scripts of the external examination shall be made available to the students on request as per the rules prevailing in the College/University.

12.14. The question paper should be strictly on the basis of model question paper set and directions prescribed by the BoS.

12.15.1. Due weightage shall be given to each module based on content/teaching hours allotted to each module.

12.15.2. The question setter shall ensure that questions covering all skills are set.

12.15.3. A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.

12.15.4. The question shall be prepared in such a way that the answers can be awarded A+, A, B, C, D, E grades.

12.15.5. Weight: Different types of questions shall be given different weights to quantify their range as follows:

SL.NO	Pattern of Questions	Weight	Number of questions to be answered
1	Short Answer type questions	1	8 out of 10
2	Short essay/ problem solving type questions	2	6 out of 8
3	Long Essay type questions	5	2 out of 4

12.15. **Pattern of question for practical**. The pattern of questions for external evaluation of practical shall be prescribed by the Board of Studies.

12.16. **Direct Grading System.** Direct Grading System based on a 6— point scale is used to evaluate the Internal and External examinations taken by the students for various courses of study.

Grade	Grade Points	Range
A+	5	4.50to5.00
A	4	4.00to4.49
B	3	3.00to3.99
C	2	2.00to2.99
D	1	0.01to1.99
E	0	0.00

12.17. **Performance Grading.** Students are graded based on their performance (GPA/SGPA/CGPA) at the examination on a 7-point scale as detailed below.

Range	Grade	Indicator
4.50 to 5.00	A+	Outstanding
4.00 to 4.49	A	Excellent
3.50 to 3.99	B+	Very good
3.00 to 3.49	B	Good(Average)
2.50 to 2.99	C+	Fair
2.00 to 2.49	C	Marginal(pass)
up to 1.99	D	Deficient(Fail)

12.18. No separate minimum is required for internal evaluation for a pass, but a minimum C grade is required for a pass in an external evaluation. However, a minimum C grade is required for pass in a course.

12.19. A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch.

12.20. Improvement of Course- The candidates who wish to improve the grade / grade point of the external examination of a course/courses he/ she has passed can do the same by appearing in the external examination of the semester concerned along with the immediate junior batch. **This facility is restricted to first and second semesters of the programme.**

12.21. **One Time Betterment Programme** - A candidate will be permitted to improve the CGPA of the programme within a continuous period of four semesters immediately following the completion of the programme allowing only once for a particular semester.

The CGPA for the betterment appearance will be computed based on the SGPA secured in the original or betterment appearance of each semester whichever is higher. If a candidate opts for the betterment of CGPA of a programme, he/she has to appear for the external examination of the entire semester(s) excluding practicals / project/ comprehensive viva-voce. One time betterment programme is restricted to students who have passed in all courses of the programme at the regular (First appearance).

12.22. **Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)** Calculations. The SGPA is the ratio of sum of the credit points of all courses taken by a student in the semester to the total credit for that semester. After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below.

Semester Grade Point Average -SGPA (S_j) = $\Sigma(C_i \times G_i) / \Sigma(C_i$
(SGPA=Total credit Points awarded in a semester/Total credits of the semester)

where 'Sj' is the j semester, 'Gi ' is the grade point scored by the Student in the 'i' course 'q' is the credit of the i^{th} course.

12.23. **Cumulative Grade Point Average (CGPA)** of a Programme is calculated using the formula:-

Cumulative Grade Point Average (CGPA) = $\Sigma((C_i \times S_i) / \Sigma(C_i$
(CGPA=Totalcreditpointsawardedinallsemesters/Totalcreditsof theprogramme)

where 'CI' is the credits for the 'i' semester 'Si' is the SGPA for the i^{th} semester. The SGPA and CGPA shall be rounded off to 2 decimal points. For the successful completion of semester, a student shall pass all courses and score a minimum SGPA of 2.0. However, a student is permitted to move to the next semester irrespective of her/his SGPA.

13. GRADE CARD

13.1 The University under its seal shall issue to the students, a consolidated grade card on completion of the programme, which shall contain the following information.

- Name of College
- Title of the PG Programme.
- Name of the Semesters
- Name and Register Number of the student
- Code, Title, Credits and Max GPA (Internal, External & Total) of each course (theory& Practical), project, viva etc. in each semester.
- Internal, external and total grade, Grade Point (G), Letter Grade and Credit Point (P) in each course opted in the semester.
- The total credits and total credit points in each semester.
- Semester Grade Point Average (SGPA) and corresponding Grade in each semester
- Cumulative Grade Point Average (CGPA), Grade for the entire programme.
- Separate Grade card will be issued at the request of candidates and based on University Guidelines issued from time to time.
- Details of description ofevaluation process- Grade and Grade Point as well as indicators, calculation methodology ofSGPA and CGPA as well as conversion scale shall be shown on the reverse side of the grade card.

14. AWARD OF DEGREE

The successful completion of all the courses with 'C' grade within the stipulated period shall be the minimum requirement for the award of the degree.

15. MONITORING COMMITTEE

There shall be a Monitoring Committee constituted by the Vice- chancellor to monitor the internal evaluations conducted by institutions.

16. RANK CERTIFICATE

The College shall publish the list of top 10 candidates for each programme after the publication of the programme results. Rank certificate shall be issued to candidates who secure positions from 1st to 3rd in the list. Position certificate shall be issued to candidates on their request.

Candidates shall be ranked in the order of merit based on the CGPA secured by them. Grace grade points awarded to the students shall not be counted for fixing the rank/position. Rank certificate and position certificate shall be signed by the Controller of Examinations.

17. GRIEVANCE REDRESSAL COMMITTEE

17.1 **Department level:** The College shall form a Grievance Redressal Committee in each Department comprising of the course teacher and one senior teacher as members and the Head of the Department as Chairperson. The Committee shall address all grievances relating to the internal assessment grades of the students.

17.2 **College level:** There shall be a college level Grievance Redressal Committee comprising of faculty advisor, college coordinator, one senior teacher and one staff council member and the Principal as Chairperson.

18. REPEAL

The Regulations now in force in so far as they are applicable to programmes offered by the College and to the extent they are inconsistent with these regulations are hereby repealed. In the case of any inconsistency between the existing regulations and these regulations relating to the Credit Semester System in their application to any course offered in a College, the latter shall prevail.

19. Credits allotted for Programmes and Courses

19.1 Total credit for each programme shall be 80.

19.2 Semester-wise total credit can vary from 16 to 25

19.3 The minimum credit of a course is 2 and maximum credit is 5.

20. Common Course: If a course is included as a common course in more than one programme, its credit shall be same for all programmes.

21. Course codes: The course codes assigned for all courses (core courses, elective courses, common courses etc.) shall be unique.

22. Models of distribution of courses, course codes, type of the course, credits, teaching hours for a programme are given in the following tables.

Example: Programmes with practical -Total Credits 80- Scheme of the Syllabus

Semester	Course-code	Course name	Type of the course	Teaching Hours Per Week	Credit	Total Credits
I	Course.code1	Name1	core	5	4	20
	Course.code2	Name2	core	5	4	
	Course.code3	Name3	core	6	4	
	Course.code4	Name4	core	5	4	
	PracticalCourse.code5	Name5	core	4	4	
II	Course.code6	Name6	core	6	4	21
	Course.code7	Name7	core	5	4	
	Course.code8	Name8	core	5	4	
	Course.code9	Name9	core	5	4	
	Practical-Course.code10	Name10	core	4	4	
	Field Mapping Training.Course.code.11	Name 11	core	2*	2	
III	Course.code12	Name12	core	6	4	19
	Course.code13	Name13	core	6	4	
	Course.code14	Name14	core	4	4	
	Course.code15	Name15	core	5	3	
	Practical Course.code16	Name16	core	4	4	
IV	Course.code17	Name17	Elective	6(7)*	4	20
	Course.code18	Name18	Elective	5(7)*	3	
	Course.code19	Name19	Elective	5(7)*	4	
	Practical-Course.code20	Name20	Elective	4	3	
	Course.code21	Name21	Elective	6(7)*	4	
	Course.code22	Name22	Elective	5(7)*	3	
	Course.code23	Name23	Elective	5(7)*	4	
	Practical-Course.code24	Name24	Elective	4	3	
	Project-Course.code25	Name25	core	5**	4	
	Comprehensive viva-voce-Course.code26	Name26	core		2	
	Total					**80**

Evaluation first stage – Both internal and external (to be done by the teacher)

Grade	Grade Points	Range
A+	5	4.50 to 5.00
A	4	4.00 to 4.49
B	3	3.00 to 3.99
C	2	2.00 to 2.99
D	1	0.01 to 1.99
E	0	0.00

The final Grade range for courses, SGPA and CGPA

Range	Grade	Indicator
4.50 to 5.00	A+	Outstanding
4.00 to 4.49	A	Excellent
3.50 to 3.99	B+	Very good
3.00 to 3.49	B	Good
2.50 to 2.99	C+	Fair
2.00 to 2.49	C	Marginal
Upto 1.99	D	Deficient(Fail)

Theory External (ESE)

Maximum weight for external evaluation is 30. Therefore, maximum Weighted Grade Point (WGP) is 150.

Type of Question	Qn. No's	Grade Awarded	Grade point	Weights	Weighted Grade Point
Short Answer	1	A+	5	1	5
	2	-	-	-	-
	3	A	4	1	4
	4	C	2	1	2
	5	A	4	1	4
	6	A	4	1	4
	7	B	3	1	3
	8	A	4	1	4
	9	B	3	1	3
	10	-	-	-	
Short Essay	11	B	3	2	6
	12	A+	5	2	10
	13	A	4	2	8
	14	A+	5	2	10
	15	-	-	-	-
	16	-	-	-	-
	17	A	4	2	8
	18	B	3	2	6
Long Essay	20	A+	5	5	25
	21	-	-	-	-
	22	-	-	-	-
	23	B	3	5	15
			TOTAL	**30**	**117**
Calculation : **Overall Grade of the theory paper = Sum of Weighted Grade Points /Total weight** **117/30 = 3.90 = Grade B**					

Theory – Internal (CE)

Maximum Weight for internal evaluation is 5. *ie*., maximum WGP is 25

Components	Weight (W)	Grade Awarded	Grade Point (GP)	WGP=W *GP	Overall Grade of the course
Assignment	1	A	4	4	**WGP/Total weight = 24/5 =4.8**
Seminar	2	A+	5	10	
Test paper 1	1	A+	5	5	
Test paper 2	1	A+	5	5	
Total	**5**			**24**	**A+**

Practical-External-ESE

Maximum weight for external evaluation is 15. Therefore Maximum Weighted Grade Point (WGP) is 75.

Components	Weight (W)	Grade Awarded	Grade Point(GP)	WGP=W *GP	Overall Grade of the course
Written/Lab test	7	A	4	28	**WGP/Total weight = 58 / 15 = 3.86**
Lab involvement & record	3	A+	5	15	
viva	5	B	3	15	
Total	**15**			**58**	**B**

Practical-Internal-CE

Maximum weight for internal evaluation is 5. Therefore Maximum Weighted Grade point (WGP) is 25.

Components	Weight (W)	Grade Awarded	Grade Point(GP)	WGP=W *GP	Overall Grade of the course
Written/ Lab test	2	A	4	8	**WGP/Total weight =17/5=3.40**
Lab involvement & record	1	A+	5	5	
viva	2	C	2	4	
Total	**5**			**17**	**B**

Project-External-ESE

Maximum weight for external evaluation is 15. Therefore Maximum Weighted Grade Point (WGP) is 75.

Components	Weight (W)	Grade Awarded	Grade Point(GP)	WGP=W *GP	Overall Grade of the course
Relevance of the topic & Analysis	2	C	2	4	**WGP/Total weight = 59/15= 3.93**
Project content & presentation	8	A+	5	40	
Project viva-voce	5	B	3	15	
Total	**15**			**59**	**B**

Project-Internal-CE

Maximum weight for internal evaluation is 5. Therefore Maximum Weighted Grade Point (WGP) is 25.

Components	Weight (W)	Grade Awarded	Grade Point(GP)	WGP=W *GP	Overall Grade of the course
Relevance of the topic & Analysis	2	B	3	6	**WGP/Total weight = 21/5 = 4.2**
Project content & presentation	2	A+	5	10	
Project viva-voce	1	A+	5	5	
Total	**5**			**21**	**A**

Comprehensive viva-voce-External-ESE.

Maximum weight for external evaluation is 1.5. Therefore Maximum Weighted Grade Point (WGP) is 75.

Comprehensive viva voce-Internal-CE

Maximum weight for internal evaluation is 5. Therefore Maximum Weighted Grade Point (WGP) is 25.

Components	Internal (CE) Weight	External (ESE) Weight
Basic knowledge and Presentation skills	1	3
Topic of interest	1	3
Knowledge of core courses	3	9
Total	**5**	**15**

These basic components can be subdivided if necessary.

1. **Evaluation - second stage -**

   Consolidation of the Grade(GPA) of a Course PC-I.

   The End Semester Evaluation(ESE) (External evaluation) grade awarded for the course PC-I is A and its Continuous Evaluation(CE)(Internal Evaluation)grade is A. The consolidated grade for the course PC-I is as follows:

Evaluation	**Weight**	**Grade awarded**	**Grade Points awarded**	**Weighted Grade Point**
External	3	A	4.20	12.6
Internal	1	A	4.40	4.40
Total	**4**			**17**
Grade of a course.	GPA of the course =Total weighted Grade Points/Total weight **17/4 =4.25 = Grade A**			

2. **Evaluation -Third Stage**

   Semester Grade Point Average (SGPA).

Course code	**Title of the course**	**Credits (C)**	**Grade Awarded**	**Grade Points(G)**	**Credit Points (CP=C X G)**
01	**PC-1**	**5**	**A**	**4.25**	**21.25**
02	**-----**	**5**	**A**	**4.00**	**20.00**
03	**-----**	**5**	**B+**	**3.80**	**19.00**
04	**-----**	**2**	**A**	**4.40**	**8.80**
05	**-----**	**3**	**A**	**4.00**	**12.00**
TOTAL		**20**			**81.05**
SGPA	**Total credit points / Total credits = 81.05/20 = 4.05= Grade- A**				

3. **Evaluation - fourth Stage -**

Cumulative Grade Point Average (CGPA)

If a candidate is awarded three A+ grades in semester 1 (SGPA of semester 1), semester 2 (SGPA of semester 2) and semester 4 (SGPA of semester 4) and a B grade in semester 3 (SGPA of semester 3). Then the CGPA is calculated as follows:

Semester	**Credit of the Semesters**	**Grade Awarded**	**Grade point (SGPA)**	**Credit points**
I	20	A+	4.50	90
II	20	A+	4.60	92
III	20	B	3.00	60
IV	20	A+	4.50	90
TOTAL	**80**			**332**
CGPA= Total credit points awarded / Total credit of all semesters = 332 / 80 = 4.15 (Which is in between 4.00 and 4.49 in 7-point scale)Therefore the overall Grade awarded in the programme is A				

Masters of Science in Geology

Programme Structure& Syllabi for MSc. Geology

(With effective from the academic year 2022 admission onwards)

Overview

Geology is an interdisciplinary subject which explores the interior structure of the earth. It incorporates inputs from almost all science disciplines. Geologists are mainly involved in the exploration and extraction of natural resources such as minerals, rocks, fossil fuel and water. As it is a fast growing area geologists will have to play a vital role in our future. Those who complete post graduation in Geology can show their skills in this area. They can also engage in geological research which has immense potential in the current scenario.

Duration

The duration of PG program shall be 4 semesters. The duration of each semester shall be 90 working days. A student may be permitted to complete the program, in a period of 4 continuous semesters from the date of commencement of the first semester of the programs.

Program Structure

The programme shall include two types of courses, Program Core (PC) courses and Program Elective (PE) Courses. There shall be a Program Project (PP) with dissertation to be undertaken by all students. The Programme will also include assignments, seminars / practical, viva etc., if they are specified in the Curriculum. In the third and the fourth semesters the students can choose electives that will suit the needs of students, from the electives specified in the syllabus. There shall also be a Program Project or dissertation to be undertaken by all students. Every program conducted under Credit Semester System.

Geological Field Mapping

Geological field mapping is included in the second semester and its participation is a mandatory requirement. The training is to be scheduled in a single batch, for duration of maximum 15 days. It may be guided by a member of faculty in any place of geological interest in India. Alternatively, the student may be attached to an organization engaged in geological field work (say, Geological Survey of India) for imparting training.

Viva Voce

Comprehensive Viva-voce shall be conducted at the end semester of the program and it shall cover questions from all courses in the program.

Project work (Dissertation)

Each student should undertake an individual dissertation fieldwork during fourth semester under guidance and supervision of a staff member. A staff, member may supervise the work of more than one student in related fields of study in adjacent field areas, but should be separate on topics. He/she should choose a topic within the purview of the course curriculum. The work can be done in collaboration with scientific research institute/ establishment/ academic institutions on cooperating co- guide/s from that organization.Eighteen working days equivalent to ninety hours may year marked to collect filed data and for experiment, survey, analysis and interpretations during fourth semester. If additional time required it should be availed outside instructional hours including vacation and holidays. Each student should submit a thesis (certified as authentic and bonafide by both supervising teacher and head of the department) prior to attending viva voce. The work done should be presented before examiners and part of viva voce. Submission of thesis prior viva voce and presentation during it are mandatory requirements, without which course will be incomplete.

Seminar Lecture

Every PG student shall deliver one seminar lecture as an internal component for every course. The seminar lecture is expected to train the student in self-study, collection of relevant matter from the books and internet resources, editing, document writing, typing and presentation.

Test Papers

Student shall undergo at least two class tests as an internal component for every course. The weighted average shall be taken for awarding the class tests.

Assignments

Students shall submit one assignment as an internal component for every course.

Examinations

There shall be end-semester examination at the end of each semester. Project evaluation and Viva -Voce shall be conducted at the end of the program only. Project evaluation and Viva-Voce shall be conducted by external examiner and one internal examiner. There shall be one end-semester examination of 3 hours duration in each lecture based course and practical course. The examinations for which computers are essential should be conducted in the computer lab supervised by an external examiner.

SYLLABUS – M.Sc. Geology

Semester	Course Code	Course Name	Credit	Hours
I	PG1GEOC01	GEOMORPHOLOGY AND GEOMATICS	4	5
	PG1GEOC02	APPLIED MINERALOGY	4	5
	PG1GEOC03	STRUCTURAL GEOLOGY AND TECTONICS	4	6
	PG1GEOC04	STRATIGRAPHY AND QUATERNARY GEOLOGY	4	5
	PG1GEOP01 Practical 1	GEOMORPHOLOGY, GEOMATICS, MINERALOGY AND STRUCTURAL GEOLOGY	4	4
	Total		**20**	**25**
II	PG2GEOC05	IGNEOUS AND METAMORPHIC PETROLOGY	4	6
	PG2GEOC06	SEDIMENTOLOGY AND GEOSTATISTICS	4	5
	PG2GEOC07	GEOCHEMISTRY AND ISOTOPE GEOLOGY	4	5
	PG2GEOC08	CLIMATOLOGY AND MARINE GEOLOGY	3	5
	PG2GEOP02 Practical 2	PETROLOGY	4	4
	PG2GEOF01	FIELD MAPPING TRAINING	2*	2
	Total		**21**	**25**
III	PG3GEOC09	EXPLORATION GEOLOGY AND GEOPHYSICS	4	6
	PG3GEOC10	ADVANCED ECONOMIC GEOLOGY	4	6
	PG3GEOC11	MINING AND ENGINEERING GEOLOGY	4	4
	PG3GEOC12	HYDROGEOLOGY	3	5
	PG3GEOP03	EXPLORATION GEOLOGY, ECONOMIC GEOLOGY ANDHYDROGEOLOGY	4	4
	Total		**19**	**25**
IV	PG4GEOEA01	FUEL GEOLOGY AND MICROPALAEONTOLOGY	4	6(7)*
	PG4GEOEA02	ADVANCED PALAEONTOLOGY	3	5(7)*
	PG4GEOEA03	ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT	4	5(7)*
	PG4GEOEAP01	ELECTIVE PRACTICAL	3	4
	PG34GEOEB01	GEMMOLOGY	4	6(7)**
	PG4GEOEB02	PLANETARY GEOLOGY	3	5(7)**
	PG4GEOEB03	ANALYTICAL GEOCHEMISTRY	4	5(7)**
	PG4GEOEBP02	ELECTIVE PRACTICAL	3	4
	PG4GEOD01	PROJECT/ DISSERTATION	3	5**
	PG4GEOV01	VIVA-VOCE	2	Nil***
	Total		**20**	**25**

TOTAL CREDITS: 80

Fourth Semester Elective Courses

Elective Group	Course Code	Course Title
Group 1 - Elective 1	PG4GEOEA01	Fuel Geology and Micropalaeontology
	PG4GEOEA02	Advanced Palaeontology
	PG4GEOEA03	Environmental Geology and Disaster Management
	PG4GEOEAP01	Elective Practical
Group 2 - Elective 2	PG34GEOEB01	Gemmology
	PG34GEOEB02	Planetary Geology
	PG4GEOEB03	Analytical Geochemistry
	PG4GEOEBP02	Elective Practical

* 2 hours per week allotted for Field mapping training (GL010206) in the II semester will be engaged as theory classes and the field mapping training program will be carried out (maximum up to 15 days) towards the end of the II semester.

** 5 hours per week allotted for Dissertation (GL010401) in the IV semester will be engaged as theory classes and the Dissertation program will be carried out continuously for 90 hours (18 days including fieldwork) towards the end of the IV semester.

*** Viva voce does not require any contact hours per week.

PROGRAM SPECIFIC OUTCOME (PSO)

PSO 1: Understand the basic concepts of geomorphology, Mineralogy, structural geology and principles of stratigraphy and apply this knowledge to analyzethe evolution of the Earth and life on it. Understand how Earth can be sensed remotely, resources mapped and analysed, with the aid of geoinformatics tools, and how disasters can be mitigated and managed

PSO 2: Understand how rocks are formed, the underlying geochemical and petrological principles and apply this knowledge to analyze sedimentary, igneous and metamorphic rocks for unraveling earthhistory.

PSO 3: Understand the minerals, and the economic significance of mineral deposits, apply the concepts of exploration geology to analyze the formation and significance of ore deposits. Understand the concept of Engineering Geology and apply this knowledge to analyze geological formations and structures for effective human use. Understand how water behaves within the Earth, and apply this knowledge to analyze groundwater resources.

PSO 4: Analyze and apply the knowledge gained through studies into a thesis that incorporates scientific planning and execution of work, methodology, analyses, and presentation of results, all within the ambit of research ethics, possibly leading to the creation of new knowledge in geosciences.

FIRST SEMESTER

Sl. No.	Course Code	Course Name
1	PG1GEOC01	GEOMORPHOLOGY AND GEOMATICS
2	PG1GEOC02	APPLIED MINERALOGY
3	PG1GEOC03	STRUCTURAL GEOLOGY AND TECTONICS
4	PG1GEOC04	STRATIGRAPHY AND QUATERNARY GEOLOGY
5	PG1GEOP01 Practical 1	GEOMORPHOLOGY, GEOMATICS, MINERALOGY AND STRUCTURAL GEOLOGY

COURSE CODE : **PG1GEOC01**

COURSE TITLE : **GEOMORPHOLOGY AND GEOMATICS**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the basics concepts of Geomorphology and geomorphic process and topographic maps	U	1
2	Understand the concepts of fluvial geomorphology, topography and Hydraulic geometry, geomorphology of kerala	U	1
3	Understand the application of geomorphology in mineral prospecting, civil engineering, hydrogeology and environmental studies,	U, Ap, E	1
4	Understand the basics concepts of remote sensing and how remotely sensed images can beenhanced.	U, Ap, E	1
5	Understand the fundamentals of Geographic information system(GIS) and applications of arerial photographs and satellite	U,Ap,E	1

PSO – Programme Specific Outcome, CO-Course Outcome;

Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1 Basic concept of geomorphology-ancient and modern ideas	12	1
	1.2 Geomorphological cycle-Davis and penck, king and gilbert model		1
	1.3 Analysis of the geomorphic process		1
	1.4 Geomorphic agents and process		1
	1.5 Endogenic—sudden forces and movement		1
	1.6 Diastrophic force and movements		1
	1.7 Epeirogenetic and orogenetic movements		1
	1.8 Exogenic process		1
II	2.1 Fluvial Geomorphology	12	2
	2.2 Channel morphology		2

	2.3	Channel geometry- channel length,width,bends, slopes ,thalwege and wetter parametter		2
	2.4	Fluid dynamics-channel discharge, capacity, velocity, sediment load capacity		1, 2
	2.5	Hydraulic Geometry-channel type and pattern		2
	2.6	Channel bed topography		2
III	3.1	Topographic maps	22	2
	3.2	Morphometric elements and parameters		2
	3.3	Morphometric analysis of drainagebasins- linear, aerial and relief aspects		2
	3.4	Applications of geomorphology in mineral prospecting, civil engineering, hydrogeology and environmental studies		3
	3.5	Geomorphology of Kerala- geomorphic divisions		1,2
	3.6	Evolution of Kerala coast during the Quaternary period		1,2
IV	4.1	Basic concepts of remote sensing	24	4
	4.2	Types and platforms of remote sensing		4
	4.3	Energy sources and radiation principles		4
	4.4	Electromagnetic radiation- EMR spectrum		4
	4.5	Energy interaction with atmosphere and earth surface.		4
	4.6	Satellite remote sensing- basic principles		4
	4.7	Aerial photography- basic principles		4
	4.8	Geometrical characteristics of aerial photographs		4
	4.9	Types of aerial photographs- vertical/oblique/high oblique		4
	4.10	Aerial mosaics		4
	4.11	Flight plan of aerialphotography		4
	4.12	Photogrammetry – analogue and digital photogrammetry		4
	4.13	Terminologies associated with photogrammetry- Scale, Relief displacement, Vertical exaggeration and Stereoscopic Imageparallax – a brief description		4
	4.14	Stereoscopic vision – Stereoscopes – types - pocket and mirror stereoscopes		4
	4.15	Tilt, drift and crab in aerial photographs		4
V	5.1	Fundamentals of GIS- basic concepts	32	5
	5.2	Components of GIS- hardware and software		
	5.3	Projections, geographic and Cartesian co-ordinates; georeferencing		5
	5.4	GIS data structures- Raster and Vector, DEM; WebGIS- definition and concepts		5
	5.5	GIS softwares- open source- QGIS, GRASS, commercial softwares- ArcGIS, ERDAS		5
	5.6	Application of aerial photographs and satellite imageries in petroleum, mineral and groundwater exploration, geotechnical engineering projects, geological mapping, wet land and waste land mapping		5
	5.7	Application of GIS in geology, disaster management and water resources management		5

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

First Semester

Programme – M.Sc. Geology

PG1GEOC01 – GEOMORPHOLOGY AND GEOMATICS

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Graded streams
2. Digital Elevation Model
3. Aerial photograph
4. Laminar flow
5. Catastrophism
6. River Linking
7. Exogenetic Processes
8. Deflation
9. Satellite
10. Hypsometry

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Fluvial Erosion
12. Photogrammetry
13. Basic principle of satellite remote sensing
14. Stream hydaulics
15. Raster and Vector Data
16. Geomorphology of Kerala
17. Slope stability
18. ERDAS

(6x2=12 Weights)

Part C
Long Essay Questions
*(Answer any **two** questions. Each question carries Weight **5**)*

19. Write an essay about different type of platforms of remote sensing.

20. Describe the model of landscape evolution by Davis and Penck.

21. Describe about GIS and its applications.

22. Write an essay about the morphometric analysis of drainage basins.

(2x5=10 Weights)

COURSE CODE : **PG1GEOC02**

COURSE TITLE **: APPLIED MINERALOGY**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to accomplish the following:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the basic concept of rock forming minerals	U , E	1
2	Understand the structure, chemical composition and optical properties and paragenesis of common rock forming minerals	U,E	1
3	Understand the mineral chemistry and the advanced instrumental analytical techniques used for minerals.	U, E, Ap	1

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1Crystalline state	8	1
	1.2 symmetrical lattice, Bravais lattice		1
	1.3 point groups and their symmetry		1
II	2.1 Principles of mineral optics	24	2
	2.2 Birefringence		2
	2.3 Optical accessories and their uses		2
	2.4 Conoscopic study and interference figures		2
	2.5 Dispersion in minerals		2
	2.6 Procedure for determining 2V (Mallards method)		2
	2.7 optic sign		2
	2.8 scheme of pleochroism		2
III	3.1 Silicate structure – co-ordination number and silicon tetrahedra	24	2,3
	3.2. Nesosilicates: Olivine- Fo-Fa series, structure, properties, paragenesis and P-T stability		2,3
	3.3 Garnet-structure, chemistry, properties and paragenesis		2,3
	3.4 Al_2SiO_5 polymorphs		2,3
	3.5 Sorosilicates: Melilite- composition and structure		2,3

	3.6 Inosilicates: Single chain- Pyroxenes- T-O-T beam structure and classification		2,3
	3.7 orthopyroxene- Enstatite-Ferrosilite series- properties and paragenesis		2,3
	3.8 Clinopyroxenes – Ca-, Ca-Na- and Na-, chemistry, properties and paragenesis		2,3
	3.9 Double chain- Amphiboles- orthoamphiboles and clinoampbiboles– chemistry, structure, properties and paragenesis		2,3
IV	4.1 Cyclosilicates- Cordierite ,Tourmaline and Beryl-chemistry, structure, properties and paragenesis	24	2,3,4
	4.2 Phyllosilicates: Sheet structure- Brucite and Gibbsite sheet, TO, TOT, TOT+c and TOT+Ostructures		2,3
	4.3 Clay and mica- chemistry, structure, properties and paragenesis		2,3
V	5.1 Structure, properties and paragenesis of following non-silicates: Spinel, Perovskite, Calcite and Dolomite	20	2,3
	5.2 Chemical analysis of minerals -Principles of X- ray diffraction, Bragg's law, Basic feature of X- ray diffractometer, single crystal and powder methods		2,3
	5.3 Preparation of sample for XRD study andinterpretation of data		2,3
	5.4 Basic principles of EPMA analysis		2,3

References

1. Ford, W. H. (1955) A text book of Mineralogy- Asia publishing House – Wiley.

2. Phillips, (1956) An Introduction to Crystallography – Longmans Green

3. Cornelis Klein and Hurlbut (1985) Manual of Mineralogy, John Wiley

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6.Nesse, W. D. (1999) Introduction to Mineralogy, Oxford University Press, New Delhi.

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

First Semester

Programme – M.Sc. Geology

PG1GEOC02 – APPLIED MINERALOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Crystalline state
2. Refractive indices in uniaxial negative minerals.
3. Birefringence
4. Biaxial negative indicatrix.
5. Point groups
6. Chemistry and structure of cordierite and tourmaline.
7. Framework silicate structure
8. Exsolution
9. Bragg's law
10. Absorption and pleochroism (8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Define the four types of tetragonal bravais lattice.
12. EPMA and its advantages.
13. Explain the formation of uniaxial interference figure
14. Explain reconstructive polymorphism of mineral phases with composition Al_2SiO_5
15. Brucite structure.
16. General physical properties and composition of orthopyroxene series.
17. Polysynthetic twinning in feldspars.
18. Physical properties of calcite and dolomite (6x2=12 Weights)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Write an essay on the structure, classification, physical properties of the mica family of minerals. Give a comparison of the optical properties of muscovite and biotite.
20. What is X-ray Diffraction? Describe an X-ray diffractometer and its working. Narrate how samples are prepared for an X-ray diffraction study, distinguish the single crystal and powder methods.
21. Write an essay on the composition, structure, optical properties and paragenesis of the olivine isomorphous series.
22. Explain the features. Working and uses of mica plate and quartz wedge. Explain what is sign of elongation and how it can be determined using a microscope and an optical accessory. (2x5=10 Weights)

COURSE CODE : **PG1GEOC03**

COURSE TITLE **: STRUCTURAL GEOLOGY & TECTONICS**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the concepts of rock deformation, types of Stress and strain, its use in studying the stages of deformation and factors affecting deformation	U,E	1
2	Understand the concept, classification and mechanism of fold. Understand Superposedfold and interference patterns	U,E	1
3	Understand the concept, classification and mechanism of fault, mapping of structural features and tectonites	U,E	1
4	Understand the fundamentals of geometric analysis and petrofabric analysis, steriographic projections	U,E	1
5	Understand the concept of geodynamic settings of plate margins	U,E	1

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1 Deformations- homogenous and heterogenous deformation- elastic and plastic deformation	20	1
	1.2 Concept of stress and strain		1
	1.3 Types of stress – lithostatic, compressive and tensile stress. Normal and shear stress. Strain		1
	1.4 Strain– dialation and distortion		1
	1.5 Stress and strain ellipsoids		1
	1.6 stress strain graphs		1
	1.7 concepts of Flinn Diagram & Mohr's Circle		1
	1.8 Nature of rocks and minerals under stress – brittle and ductile conditions		1
II	2.1 Fold- Cylindrical and non-cylindrical folds	20	2
	2.2 Classification of folds - Ramsay's classification		2

	2.3 Donath and Parkers classification		2
	2.4 Drag folds – minor folds and their use in determining major fold structure		2
	2.5 Mechanics of folding. Poly-phase deformation – canoe and inverted canoe folds		2
	2.6 Superimposed folds and interference patterns		2
III	3.1 Fault systems related to plate tectonic domains	36	3
	3.2 Shear zone – types, geometry and mechanism of formation		3
	3.3 Brittle and ductile shears and associated structures		3
	3.4 Thrust – large scale thrust and their tectonic significance		3
	3.5. Mapping of structural features		3
	3.6 Tectonites - classification, tectonic fabrics		3
	3.7 Foliation – definition and types, Fracture cleavage and transposed foliation		3
	3.8 Origin of axial plane foliation		3
	3.9 Use of axial plane foliation and fracture cleavage in structural interpretation		3
	3.10 Lineation – classification and origin		
IV	4.1 Spatial orientation of planar and linear fabrics	18	4
	4.2 Fundamentals of geometric analysis		4
	4.3 Petrofabric analysis – field and laboratory techniques involved in the construction of fabric diagrams and their interpretation		4
	4.4 Graphical representation of structural data –stereographic and equal-area projections in structural geology – π and β diagrams, histogram and rose diagram		4
	4.5 Strain analysis		4
V	5.1 Geodynamic settings of plate margins	14	5
	5.2Tectonic framework of Indian plate		
	5.3 Evolution of Himalaya, Central Indian Tectonic Zone (CITZ)		
	5.4 Supercontinents- Indian plate journey through Rodinia, Gondwana and Pangaea		
	5.5 Tectonic framework of Southern Granulite Terrain (SGT)		
	5.6 Shear zones in SGT- Moyar, Bhavani, Attur, Palghat-Cauvery and Achenkoil		5

References

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2. Davis, G.H., Structural Geology of Rocks and Regions, John Wiley and Sons, 1984.
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11. Turner, F.J. and Weiss, L.E., Structural Analysis of Metamorphic Tectonites, I Edition,Mc Graw Hill, 1963.
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17. Radhakrishna, T and Piper, J. D. A., (ed.), The Indian Subcontinent and Gondwana: APalaeomagnetic and Rock Magnetic Perspective, JGSI Memoir 44.
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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	1	0/1*
II	2	1	0/1*
III	2	1	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

First Semester

Programme – M.Sc. Geology

PG1GEOC03 – STRUCTURAL GEOLOGY AND TECTONICS

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Differentiate between normal and shear stress.
2. Evaluate brittle and ductile deformation of rocks?
3. Differentiate foliations and lineations.
4. Discuss cylindrical and non-cylindrical folds.
5. Differentiate π and β diagrams.
6. Differentiate canoe and inverted canoe folds.
7. Explain poly-phase deformation and superimposition of folds?
8. Discuss the significance of drag fold?
9. Discuss thrusts and their tectonic significance.
10. Explain Mylonite and its types.

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Give a detailed note on the interpretation of fabric diagrams based on their symmetry.
12. Describe the folds in Donath and Parkers genetic classification of folds.
13. Illustrate extensional tectonics with different fault systems associate with them.
14. Discuss the origin of tectonites and their classification.
15. Write a note on Ramsay's classification of folds with respect to the dip isogons.
16. Explain the Mohr's Diagram for Uniaxial, Biaxial, and Triaxial stresses.
17. Write a detailed note on the configuration of Southern Granulite Terrain.
18. Discuss the mapping of folds, faults and foliations with appropriate symbols.

(6x2=12 Weights)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Discuss the evolution of Himalayas as a result of collision of the indian subcontinent with the Eurasian plate, during its journey since the breakup of Gondwanaland.
20. Give a detailed account of classification of foliations, and discuss the significance of axial plane foliations in the study of Structural Geology.
21. Discuss Stress and Strain ellipsoids, and illustrate the nature of rocks and minerals deformed under brittle and ductile conditions, and various structures associated with
22. Give a detailed account of geometry, mechanism of formation and classification of shear zones.

(2x5=10 Weights)

COURSE CODE : **PG1GEOC04**

COURSE TITLE **: STRATIGRAPHY AND QUATERNARY GEOLOGY**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand stratigraphic principles and its history	U	1
2	Understand the Precambrian stratigraphy with special reference to the Indian shield and evolution of sedimentary basins of India	U	1
3	Understand Phanerozoic, Cenozoic and Quaternary stratigraphy and relative dating methods,	U	1
4	Understand the different types of stratigraphic analytical techniques	U	1
5	Understand Ice ages and glacial cycles, sealevel changes and global significance	U	1

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1 Stratigraphic principles and evolution	22	1
	1.2 Chronostratigraphy, Biostratigraphy and Lithostratigraphy		1
	1.3 stratigraphic correlation		1
	1.4 Evolution of Geological Time Scale		1
	1.5 Procedures in seismic stratigaphy,magneto-stratigraphy and sequence stratigraphy		1
	1.6 Major geological events in Phanerozoic Eon		1
	1.7 Major extinction events in Phenerozoic		3
	1.8 K- T Boundary extinction and its causes		1
	1.9 Volcanic eruption and meteorite impact hypothesis		1
II	2.1 Precambrian stratigraphy	22	2
	2.2 Precambrian Crust- Nature and evolution of primitive crust and characteristic features of Achaean crust		2
	2.3 Detailed study of Precambrian stratigraphy in India with special references to SGT, Dharwar, Bastar, Singhbhum, Aravalli and Bundelkhand Cratons.		2

	2.4 Mobile belts in India – Pandyan, Eastern Ghats, Satpura and Aravalli mobile belts.		2
	2.5 Evolution and stratigraphy of Proterozoic sedimentary basins of India – Cuddapah, Vindhyan, Kurnool		2
III	3.1 Phanerozoic stratigraphy of India	12	3
	3.2 Palaeozoic Stratigraphy of Kashmir and Kumaon		3
	3.3 Stratigraphy and evolution of Deccan Volcanic Province		3
	3.4 Gondwana Super group		3
	3.5 Cenozoic of Bengal basin		3
	3.6 Boundary problems- Permian-Triassic and Cretaceous-Tertiary with special references to India		3
IV	4.1. Definition of Quaternary Significance and subdivisions	24	4
	4.2 Quaternary dating methods Radiocarbon, Uranium series		4
	4.3 Luminescence–TL&OSL		4
	4.4 Dendrochronology, Varve chronology, Lichenology and layers in Ice cores		4
	4.5 Regression method of estimation		4
	4.6 Relative dating methods–Using surface weathering, Amino acids and obsidian hydration		4
	4.7 Techniques for establishing age equivalence-Oxygen isotope chronostratigraphy, Tephro chronology and using paleosols.		4
V	5.1 Ice Ages during Quaternary	10	5
	5.2 factors controlling glacial cycles		5
	5.3Various stages in Quaternary glaciations		5
	5.4 Eustatic Sea Level changes and their global significance.		5

References

1. Dunbar, C.O. and Rogers, J. Principles of Stratigraphy, Wiley, 1961.
2. Stanley, S.M., Earth and life through time, W.H. Freeman and company, 1986.
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4. Tiwari, S.K., A text book of stratigraphy, micropalaeontology and palaeobotany, Kalyanipublishers, New Delhi, 2004.
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11. Gupta, V.J. Cenozoic Stratigraphy of India, Hindustan Publishing House, 1976.
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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

First Semester

Programme – M.Sc. Geology

PG1GEOC04 – STRATIGRAPHY AND QUATERNARY GEOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Bundelkhand Craton
2. Semri Group
3. Barren Measures
4. Describe Aravalli supergroup.
5. Describe Milankovich Cycle.
6. Explain in brief about Varve Chronology.
7. Explain the significance of unconformities.
8. Paleontological correlation methods.
9. Describe Pedostratigraphy?
10. Define Sukma Group.

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Write short note on Magneto stratigraphy.
12. Explain K-T boundary extinction.
13. Write short note on Pandiyan mobile belt.
14. Briefly explain about the singhbum craton.
15. Briefly describe the lithplogy and age of Deccan traps.
16. Briefly describe OSL dating technique.
17. Write a short note relative dating techniques.
18. Write a short note on Ice Ages. (6x2=12 Weights)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Write an essay on sequence stratigraphy.
20. Write an essay on classification of dharwar group.
21. Write an essay on the cuddappah group.
22. Briefly explain principles of stratigraphy

(2x5=10 Weights)

COURSE CODE : **PG1GEOPO1**

COURSE TITLE **: GEOMORPHOLOGY AND GEOMATICS, MINERALOGY AND STRUCTURAL GEOLOGY (PRACTICAL-1)**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understands the interpretation of satellite imageries, identification of drainage and lineaments, interpretation of aerial photos	U, Ap	1
2	Understand the morphometric analysis using GIS software and toposheets.	U, Ap	1
3	Understands the application of stereographic projections and identification of minerals	U, Ap	1
4	Understand the interpretation of geological map	U, E	1
5	Stereographic solution to problems in structural geology, geometric analysis of planar and linear structures	U, Ap	1

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

modlue	Course Description		Hours	CO No.
1	1.1.	Interpretation of satellite imageries	28	1
	1.2.	Identification and mapping of drainage patterns, lineaments, litho contacts and geological structures		1
	1.3.	Hypsometric analysis		1
	1.4.	Interpretation of aerial photos with special references to topography, drainage, structure and geology		1
	1.5.	Simple calculations based on aerial photos- determination of photo scale, total number of photos required to cover a given area, height of objects and relief displacement from aerial photographs		1
	1.6.	Morphometric analysis using GIS software and toposheets		2
	1.7.	Data inputs to GIS software		2
	1.8.	Georeferencing, digitization and digital cartography		2

I	1.9.	Determination of slope and slope map preparation		2
	1.10.	Identification of lineaments and preparation of lineament maps		2
II	2.1.	Mathematical Crystallography: Axial ratios, Zone symbols, Law of Anharmonic ratio and Napier's rule	18	3
	2.2.	Stereographic projection of Normal class of Isometric, Tetragonal, Hexagonal, Orthorhombic, Monoclinic, Triclinic System and Rhombohedral class		3
	2.3.	Identification of typical mineral hand specimens based on physical properties		3
	2.4.	Determination of the following optical characters of minerals: Order of Interference colour, Sign of Elongation, Optic sign Scheme of Pleochroism, Optic orientation, Optic axial angle and Extinction Angle		3
III	3.1.	Interpretation of complex geological maps - 25 Nos	26	4
	3.2.	Trigonometric and stereographic solution to problems in structural geology (unconformities, fold and fault)		5
	3.3.	Geometric analysis of planar and linear structures, Fabric diagrams, Rose diagrams, Histograms, β diagram and π diagram, strain analysis		5

Question Paper Blue Print

Part	Weight
A	3
B	4
C	3
Total	**10**

MODEL QUESTION PAPER

First Semester

Programme – M.Sc. Geology

PG2GEOP01 – GEOMORPHOLOGY AND GEOMATICS, MINERALOGY AND STRUCTURAL GEOLOGY PRACTICAL

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 10

I. Interpret the given aerial photos (weight 1.5)

II. Determine the aerial height of the tower from the aerial photograph of scale 1:15,000. Length of the shadow on aerial photograph is measured as 26 c.m and sun's deviation angle is 60º. (weight 1.5)

PART -B

I. Identify the given mineral specimen and elaborate the physical properties,origin and Indian occurrence.
(weight 2)

II. Identify the given thin section and write the diagnostic features.
(weight 2)

PART -C

I. Interpret the given geological map. (weight 1.5)

II. Draw stereographic projection of a lineation plunging 30º towards N40º (weight 1.5)

SECOND SEMESTER

Sl. No.	Course Code	Course Name
1	PG2GEOC05	IGNEOUS AND METAMORPHIC PETROLOGY
2	PG2GEOC06	SEDIMENTOLOGY AND GEOSTATISTICS
3	PG2GEOC07	GEOCHEMISTRY AND ISOTOPE GEOLOGY
4	PG2GEOC08	CLIMATOLOGY AND MARINE GEOLOGY
5	PG2GEOP02 Practical 2	PETROLOGY
6	PG2GEOF01	FIELD MAPPING TRAINING

COURSE CODE : **PG2GEOC05**

COURSE TITLE **: IGNEOUS AND METAMORPHIC PETROLOGY**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the physical properties, chemical composition and evolutionary mechanisms of magmas	U	2
2	Understand the application of thermodynamics and phase rule in igneous petrology	U	2
3	Mineralogy, texture and petrogenis of igneous rocks	U	2
4	Understand classification of metamorphic rocks and textures and structures of metamorphic rocks	U	2
5	Understand metamorphic facies, metamorphic reactions and metamorphism in relation to plate tectonics	U	2

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Magma characteristics- physical properties	14	1
	1.2. Diversification of magma- AFC process		1
	1.3. Magma generation in relation to tectonic setting- Mid ocean ridge volcanism, subduction related volcanism (Island arc and continental arc volcanism), Oceanic intraplate volcanism and continental flood basalts		1
	1.4. Large Igneous Provinces with Deccan Basalt Province as example.		1
II	2.1. Elementary thermodynamics	14	2
	2.2. Fitting of Poisson distribution		2

	2.3. Phase rule in igneous petrology and three component systems		2
	2.4. Ternary eutectic system- Di-An-Fo system		2
	2.5. Ternary system with solid solution- Di-An-Ab system		2
	2.6. Ternary peritectic system- Fo-Qtz-Di system		2
	2.7. Ternary system with solvus- Ab-Or-An system		2
III	3.1. Mineralogy, texture mode of occurrence and genesis of basalts	26	3
	3.2. Basalt tetrahedron (Yodder and Tilley)		3
	3.3. Ophiolite sequence and its significance		3
	3.4. Continental alkaline magmatism		3
	3.5. Mineralogy, texture, mode of occurrence, genesis and economic importance of Carbonatites, Lamprophyres, Kimberlites and Komatiites		3
	3.6. Mineralogy, texture, mode of occurrence and genesis of granites and granitoids		2
	3.7. Brief descriptionof granites in the South Indian shield		3
	3.8. Layered igneous complex and their significance		3
	3.9. Sittampundi layered complex, South India		3
	3.10. Anorthosites: Massif and layered types, origin and tectonic significance		3
	3.11. Intrusives of Kerala- distribution, petrography, geochemistry, tectonic setting, age and petrogenesis		3
IV	4.1. Elementary thermodynamics and phase rule in metamorphic petrology	24	2,4
	4.2. Metamorphic facies-zeolite,prehenite,pumpellyte,green schist,amphibole,granulite,blue schist,eclogite, facies series		2,4
	4.3. metamorphism of pelitic mafic and carbonate rocks		2,4
	4.4. Ultra High Temperature (UHT) and Ultra High Pressure (UHP) metamorphism.		2,4
	4.5. Pressure- Temperature-Time(P-T-t) paths		2,4
	4.6.Fabrics and their development		2,4

	4.7.Mineral paragenesis and chemographic diagrams- ACF, AKF and AFM diagrams – merits and demerits		2,4
	4.8.Schreinmaker's rule and petrogenetic grid		
V	5.1. Granulite facies rocks with special references to charnockites and khondalites of South India	30	5
	5.2. Fluid inclusions, importance of fluid inclusion in metamorphic studies		5
	5.3.Metamorphic reactions-polymorphic transformations, exsolution reactions, solid-solid transfer reactions,continuous reactions, devolatilization reactions, ion exchange reactions, oxidation/reduction reactions and reaction involving volatile species		5
	5.4. Geothermobarometry– basic concept		5
	5.5. Metamorphism in relation to plate tectonics - paired metamorphic belts		5
	5.6. Polymetamorphism, metasomatism, granitization and migmatites		5

References

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Second Semester

Programme – M.Sc.Geology

PG3GEOCO5– IGNEOUS AND METAMORPHIC PETROLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. What do you meant by Metasomatism and how it differ from Metamorphism?
2. Briefly describe about the distribution of granite rocks in South Indian Shield?
3. Give a note on physical properties of magma.
4. Briefly explain Schreinmaker's rule and petrogenetic grid?
5. Explain fluid inclusions, importance of fluid inclusion in metamorphic studies?
6. Geothermobarometry.
7. Phase rule.
8. Basalt tetrahedron.
9. Ion exchange reaction.
10. Anataxis and retrograde metamorphism.

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Discuss about ACF, AKF and AFM diagrams?
12. Give an account of granulite facies rocks of South India?
13. Ultra High Temperature (UHT) and Ultra High Pressure (UHP) metamorphism.
14. Explain Metamorphism in relation with Plate tectonics?
15. Explain Magma generation in relation with Plate tectonics?
16. Ternary system with solid solution
17. Give a note on Ophiolite sequence and its significance
18. Layered igneous complex and their significance.

(6x2=12Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Explain petrogenesis- partial melting in the lithosphere- depleted and fertile mantle, mantle melting mechanisms?
20. Explain about Ternary peritectic system & Ternary system with solvus
21. Mineralogy, texture, mode of occurrence and genesis of basalts.

    Or

    Mineralogy, texture, mode of occurrence and genesis of granites and granitoids.

22. Describe about Metamorphic facies & Metamorphic reactions

(2x5=10 Weights)

COURSE CODE : **PG2GEOC06**

COURSE TITLE : **SEDIMENTOLOGY AND GEOSTATISTICS**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand sedimentary processes, fundamentals of fluid flow	U	2
2	Understand depositional environment and textural study of sediment	U	2
3	Understand sedimentary structures and applications	U	2
4	Understands types of sedimentary baasins and concept of geostatitics	U	2

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hours	CO No.
I	1.1 . Sedimentary processes- weathering	14	1
	2.1. sediment transported by fluids		1
	1.3.fundamentals of fluid flow- open channel flow-laminar flow, turbulent flow Reynolds number, Froude Number, particle entrainment		1
	1.4. Particle settling velocity- Stoke's law		1
	1.5. Sediment load, process of sediment transport-by fluids, gravity and flow velocity		1
II	2.1. Depositional environments –Facies	*28*	*2*
	2.2. Terrestrial-Fluvial, glacial, Aeolian and lacustrine systems		*2*
	2.3.Transitional- deltaic, beach and barrier island,		*2*

	estuarine and tidal flat systems		
	2.4.Marine- Shallow and deep marine systems		*2*
	2.5.Textural study of sediments- Techniques of grain size measurement- Sieve analysis, Settling Analysis- sedimentation balance		*2*
	2.6.Grain Size parameters -graphic parameters of Folk and Ward- application in palaeo-environment studies		*2*
	2.7.Surface textures of sediments		*2*
	2.8.Heavy mineral assemblage in sedimentary rocks, methods of heavy mineral separation and analysis. ZTR index, provenance analysis		*2*
III	3.1Sedimentary structures– origin, classification- primary, secondary and organic structures	14	3
	3.2.palaeo- environmental significance of sedimentary structures		3
	3.3.Application of textures and structures in basin studies		3
	3.4.Origin, classification and petrography of sandstone and mudstone		3
IV	4.1.Types of sedimentary basins and their tectonic settings– divergent, intraplate, intraplate, convergent, transform and hybrid settings- fore arc, fack arc and retro arc basins	14	4
	4.2. Sedimentary basins of Indiaand its tectonic framework		4
	5.1.Basic Statistics- population and sample, collection of data	20	4
	5.2.Types of data – primary and secondary		4
	5.3.Methods of collecting primary data. Classification and tabulation		4
	5.4. Graphs and diagrams		4
	5.5. Graphs –frequency polygon, frequency curve, histogram, ogives		4
	5.6. Diagrams – bar diagram		4

	5.7.Population characteristics – measures of central tendency, dispersion, skewness and kurtosis		4
	5.8.Correlation and Regression		4
	5.9. Concept of geostatistics		4

References

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Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Second Semester

Programme – M.Sc.Geology

PG3GEOC–**SEDIMENTOLOGY AND GEOSTATISTICS**

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Explain about carbonate and evaporate environment.
2. Give classification and petrography of sandstone & conglomerate rocks?
3. Skewness and kurtosis.
4. Drainage morphometric parameters.
5. Probability.
6. Give a note on heavy mineral assemblage in sedimentary rocks.
7. Surface texture parameters.
8. Interpolation and approximation.
9. Hypothesis testing.
10. What is the difference between laminar flow & turbulent flow?

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

1. Explain textural studies of sediments?
2. Give a note on sedimentary processes and transportation?
3. Sedimentary structures
4. Briefly describe about Sedimentary basins of India and its tectonic framework.
5. Explain about Graphs and diagrams in Geostatics
6. Statistical analysis
7. Describe diagenesis of carbonate and siliciclastic sediments?
8. Linear Krigging and Co-krigging.

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

9. Explain about Sedimentary Facies?
10. Application of textures and structures in basin studies.
11. Correlation and Regression.
12. Types of sedimentary basins.

(2x5=10 Weights)

COURSE CODE : **PG2GEOC07**

COURSE TITLE **: GEOCHEMISTRY AND ISOTOPE GEOLOGY**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the abundance of elements and behavior of elements in the crust, mantle and core of the earth	U	2
2	Learn application of geochemistry in petrogenesis	U	2
3	Understand isotope geochemistry.	U,AP	2

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Origin and cosmic abundance of elements	20	1
	1.2. Geochemical classification of elements		1
	1.3. Geochemical cycles		1
	1.4. Chemical evolution of the earth		1
	1.5. Primary geochemical differentiation		1
	1.6. Classification of meteorites		1
	1.7. Geochemical constitution of earth's crust, mantle, core and meteorites		1
	1.8. Phase transitions in the mantle.		1
	1.9. Goldschmidt's classification of elements		1
	1.10. Nernst's partition coefficient (compatible and incompatible elements), LILE and HFSE		1
	1.11. Major, minor and trace elements, REEs and PGEs		1
II	2.1. Application of geochemistry in petrogenesis	12	2
	2.2. Harker variation diagrams, differentiation index, AFM diagram, TAS classification diagram, spider diagrams, REE diagram and tectonic discrimination diagram for granitic and basaltic rocks		2
	2.3. Oxidation potential, Eh-pH diagrams and their applications in sedimentation process		2
III	3.1. Introduction to isotope geology	10	3
	3.2. Isotopes, isobars and isotones, stable and radioactive isotopes		3

	3.3. Marginal and conditional distributions		2,3
	3.4. Various decay mechanisms- alpha, beta (positron and negatron), gamma decay, electron capture and branched decay		2,3
	3.5. Radioactive decay, half-life and basic equation for age calculation		2,3
IV	4.1. Study of different radioactive systematics - Rb-Sr,Sm-Nd systematics, U-Th-Pb systematics, K-Ar systematics	26	2,3
	4.2 Fission track method of dating		2,3
	4.3.Cosmogenic radionuclides and their applications- 14C method of dating		2,3
V	5.1Stable isotope studies- Isotope fractionation	22	2,3
	5.2Delta notation and its significance		2,3
	5.3 significance of stable isotopes of Carbon, Oxygen and Sulphur in petrology		2,3
	5.4 Analytical techniques: Methods based on emission and absorption spectra- Basic concept of Flame photometer, Spectrophotometer, Atomic Absorption Spectrometer (AAS), Inductively coupled plasma - atomic emission and mass spectrometer (ICP-AES & MS), isotope mass spectrometer and x-ray fluorescence (XRF).		2,3

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1. Mason, B. and Moore, C.B. (1985) Principles of geochemistry, Wiley Eastern Ltd,Bangalore
2. Faure G. (1986) Principles of isotope geology1, John Wiley & Sons
3. Faure, G., Mensing, T. M., Tsotopes – Principles ans Applications, Wiley India Pvt. Ltd.,New Delhi
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6. Albarede F. (2003) Geochemistry- An introduction, Cambridge university press.
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Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	3	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Second Semester

Programme – M.Sc.Geology

PG3GEOC07– GEOCHEMISTRY AND ISOTOPE GEOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Give a note on Major, minor and trace elements?
2. Explain Isotopes, isobars and isotones with examples?
3. XRF.
4. Briefly explain paleoclimatic records of sediments?
5. Flame photometer & Spectrophotometer
6. ^{14}C method of dating.
7. TAS classification diagram.
8. Geochemical classification of elements.
9. Nernst's partition coefficient.
10. Meteorites

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Geochemical cycle
12. Eh-pH diagrams and their applications in sedimentation process.
13. Various decay mechanisms.
14. Significance of stable isotopes of Carbon, Oxygen and Sulphur in petrology.
15. Rb-Sr systematics
16. Give a note on isotopic evolution of Nd
17. Briefly explain geochemical constitution of earth's crust, mantle & core
18. LILE and HFSE.

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. U-Th-Pb systematics.
20. Goldschmidt's classification of elements.
21. Various decay mechanisms.
22. K-Ar systematics.

(2x5=10 Weights)

COURSE CODE : **PG2GEOC08**

COURSE TITLE : **CLIMATOLOGY AND MARINE GEOLOGY**

CREDITS **3**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand atmosphere and atmospheric process, greenhouse effect and global warming	U,E	2
2	Understand marine geology, ocean floor drilling programmes	U	2
3	Study marine sedimentation and distribution	U	2
4	Study Mineral resources of oceans and controlling factor	U	2
5	Learn offshore geological sampling	U, Ap	2

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
	1.1. Atmosphere and atmospheric processes	28	1
	1.2. structure and composition of the atmosphere		1
	1.3. role of ozone, water vapour and carbon dioxide		1
	1.4. Heat budget and radiation balance, factors affecting solar radiation		1
	1.5. Milankovitch Cycle, Koppen system of climate classification		1
	1.6. General concepts of atmospheric circulation and wind patterns - jet streams		1
	1.7. formation and types of clouds and precipitation		1

	1.8. Storms – tropical cyclones and anti-cyclones		1
	1.9. Greenhouse effect and global warming		1
	1.10. basics of El Niño and La Nina		1
	1.11. Fundamentals of Monsoon systems in India		1
II	2.1 Paleo oceanographic expeditions & development of Marine Geology	26	2
	2.2 Ocean floor drilling programmes – DSDP, ODP & JOIDES		2
	2.3 Surface currents - origin, distribution, influencing factors, Coriolis Effect and Ekman Transport, Geostrophic currents		2
	2.4 General distribution of temperature, salinity and density in sea water		2
	2.5 TS diagrams and water masses, deep ocean circulation and conveyor belt		2
	2.6 Concepts of coastal and deep water upwelling and downwelling		2
III	3.1 Marine sedimentation & distribution	12	3
	3.2.Terrigenous, biogenous and chemogenous sediments with particular reference to oozes		3
	3.3 Turbidity currents and turbidites		3
	3.4 Ocean floor morphology, tectonic origin of ocean basins, classification of marine environments		3
IV	4.1 Mineral resources of oceans and factors controlling their distribution	12	4
	4.2 Mineral resources of oceans and factors controlling their distribution- Polymetalic nodules, phosphatic and hydrothermal sulphide deposits, beach placers		4
	4.3 Coastal zone, Mud banks, Coral reefs - types and formation		4
	4.4 Eustatic sealevel changes and their impacts		4
	4.5 Law of the sea, EEZ and CRZ		4
V	5.1 Instruments used for offshore geological sampling - grabs, dredgers and corers. Position fixing systems – GPS and DGPS	12	5
	5.2 Ocean floor Survey – Single and Multi-beam echo sounding methods, sidescan sonar, ROVs & AUVs, and scuba diving		5

References

1. Pinet Paul, R. Oceanography – An Introduction to the Planet Oceanus, West PublishingCo, 1992.
2. King, C.A.M. Beaches and Coasts, Arnold, London, 1972.
3. Krumbein, W.C. and Pettijohn, F.J. Manual of Sedimentary Petrology, Appleton CenturyCo., 1938.
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7. Pond, S. and Pickard, G.L. Introductory Dynamical Oceanography, 2nd Ed., PergamonPress, 1983.
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11. William L. Donn – Meteorology, McGraw –Hill Books Co., New York, 1975
12. Narora B, Atmosphere, Weather and Climate: An introduction to Meteorology, SaundersCo., Philadelphia.
13. M. Grant Gross, Principles of Oceanography.
14. Emerson, E and Hedges, J – Chemical Oceanography and the Marine Carbon Cycle.Cambridge University Press, 2008

Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1
II	2	2	0/1
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Second Semester

Programme – M.Sc.Geology

PG3GEOC08– CLIMATOLOGY AND MARINE GEOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Green House Effect & Global Warming.
2. Briefly explain Coriolis Effect and its significance?
3. Mud banks
4. GPS and DGPS.
5. Monsoon systems in India.
6. Oceanographic expeditions.
7. Ocean floor morphology.
8. Atmospheric Layers.
9. Geostrophic currents.
10. Koppen system of climate classification.

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Heat budget and radiation balance.
12. Mineral resources of oceans.
13. Coral reefs - types and formation?
14. Milankovitch Cycle.
15. Formation and types of clouds and precipitation.
16. Surface currents.
17. Turbidity currents and turbidites.
18. Tectonic origin of ocean basins.

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Describe about distribution of temperature, salinity and density in sea water?
20. Explain about Marine sedimentation?
21. Give a note on Jet streams & Storms?
22. Ocean floor Survey.

COURSE CODE : **PG2GEOP02**

COURSE TITLE **: PETROLOGY (PRACTICAL-2)**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the megascopic and microscopic identification of igneous rocks, petrochemical calculation and application of Lever rule	U, Ap	2
2	Understand the megascopic and microscopic identification of metamorphic rocks	U, Ap	2
3	Understand the megascopic and microscopic identification of sedimentary rocks, heavy mineral separation, preparation of grain mount	U, Ap	2

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Megascopic and microscopic study of the following rocks with special stress to genetic significance: granite, syenite, diorite, pegmatite, aplite, lamprophyre, gabbro, dolerite, basalt, dunite, peridotite, pyroxenite, anorthosite and kimberlite	24	1
	1.2 Petrochemical Calculations: CIPW Norm and related calculations- 15 exercises		1
	1.3. Use of IUGS triangular diagrams for classification of' igneous rocks- 15 Nos		1
	1.4. Problem of application of Lever rule– 10 nos		1
II	2.1 Megascopic and microscopic identification of the following rocks with special references to genetic significance of their mineralogy, textures/structures: slate, phyllite, schist, charnockite, khondalite, gneiss, pyroxene granulite, amphibolite, marble,	24	2

	quartzites and leptynite		
	2.2 Graphical representation of metamorphic mineral paragenesis using ACF and AKF diagrams of the following facies -1 each. Greenschist, Amphibolite, Granulite, Eclogite, Albite-Epidote-Hornfels, hornblende-hornfels, Pyroxene- hornfels and Sanidinite facies		2
	2.4 Simple thermobarometric calculations		2
III	3.1 Textural analysis of sediments: Sieve analysis, settling analysis, Size analysis. Size measurement and calculation of Shape parameters, plotting and interpretation of such data	24	3
	3.2 Preparation of grain mounts -10 numbers		3
	3.3 Heavy mineral separation		3
	3.4 Megascopic and microscopic study of limestone, sandstone, shale, conglomerate, breccia, clay, laterite, grit and arkoses		3

Question Paper Blue Print

Total No. of questions	Maximum weightage
2/3	**10**

MODEL QUESTION PAPER

Second Semester

Programme – M.Sc. Geology

PG2GEOP02 – PETROLOGY PRACTICAL

(2022 Admission – Regular)

Time: Three Hours Maximum Weight:

I. Identify the given rock specimen and elaborate the physical properties ,origin and Indian occurrence. (weight 5)

II. Identify the given thin section and write the diagnostic features. (weight 5)

THIRD SEMESTER

Sl. No.	Course Code	Course Name
1	PG3GEOC09	EXPLORATION GEOLOGY AND GEOPHYSICS
2	PG3GEOC10	ADVANCED ECONOMIC GEOLOGY
3	PG3GEOC11	MINING AND ENGINEERING GEOLOGY
4	PG3GEOC12	HYDROGEOLOGY
5	PG3GEOP03 Practical 3	EXPLORATION GEOLOGY, ECONOMIC GEOLOGY AND HYDROGEOLOGY

COURSE CODE : **PG3GEOC09**

COURSE TITLE **: EXPLORATION GEOLOGY AND GEOPHYSICS**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the principles of geological prospecting and mineral exploration	U	3
2	Understand sampling methods, drilling and borehole logging	U,Ap	3
3	Learn principles of geochemical exploration and Geochemical cycle	U	3
4	Understands concept of geophysical exploration	U	3
5	Learns the concept of magnetic prospecting	U	3

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1 Principles of geological prospecting and mineral exploration	12	1
	1.2 Resource and reserve- McKelvey and UNFC classification		1
	1.3Stages of exploration: Reconnaissance & Prospecting - General, Detailed, and Mine Exploration.		1
	1.4Criteria for exploration - guides to ores		1
II	2.1 Collection of exploration data and sampling techniques – Pitting, trenching and underground workings	12	2
	2.2 Rock sampling methods – channel sampling, chip sampling, bulk sampling and bore hole sampling		2
	2.4 Drilling - Design of drilling programme, types of drilling – coring and non- coring, vertical and inclined drilling		2
	2.5 Borehole logging, ore reserve estimation, geostatistical method - concept, and conventional method		2
III	3.1 Principles of Geochemical exploration	26	3
	3.2 Geochemical cycle		3
	3.3 Geochemical mobility of element, factors controlling mobility		3

	of elements in the surficial and deep seated environments populations		
	3.4 Indicators and Pathfinders		3
	3.5 Threshold values and geochemical anomalies		3
	3.6 Dispersion pattern		3
	3.7 Geochemical survey and sampling – lithological & pedological		3
	3.8 Atmospheric and hydrogeochemical surveys, Geobotanical survey techniques, Biogeochemical survey		3
IV	4.1 Concept of geophysical exploration	24	4
	4.2 Electrical prospecting, Resistivity survey, concept of resistivity and current flow within ground, Vertical Electrical Sounding (VES) and Constant Separation Traversing (CST)		4
	4.3 Fundamental types of electrode spreading – Wenner, Schlumberger and Dipole-Dipole configurations, apparent resistivity curves, limitations of resistivity survey, Induced Polarization and Self Potential methods		4
V	5.1 Concept of magnetic prospecting, Magnetometers, Magnetic anomalies and Magnetic time scale	34	5
	5.2 Concept of Gravity survey		5
	5.3 concepts of seismic survey		5
	5.4 Radiometric methods - basic concepts of radioactivity and radioactive particles, radioactive rocks and minerals, instruments used in detection and measurements of radiation		5

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER
Third Semester
Programme – M.Sc.Geology
PG3GEOC09- EXPLORATION GEOLOGY AND GEOPHYSICS
(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions
*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Define an assured mineral reserve?
2. Explain is United Nation's framework classification?
3. Define trenching.
4. Evaluate Square and rectangular method of ore reserve estimation?
5. Mention the classification of primary dispersion pattern.
6. Mention the importance of biogeochemical survey?
7. Explain VES in the resistivity survey ?
8. Explain magnetic anomalies.
9. List down the applications of seismic refraction survey.
10. Name any four radioactive rocks present in the Earth's crust? (8x1=8 Weights)

Part B

Short Essay Questions/Problems
*(Answer any **six** questions. Each question carries Weight **2**)*

10. Draw a diagram for Mc Kelvey classification of Reserves?
11. What does channel, bulk and borehole sampling mean?
12. Evaluate principle and types of geochemical survey?
13. Briefly differentiate atmospheric and hydrogeochemical survey?
14. Discuss self potential method in mineral prospecting
15. Define gravimeter? Discuss their types.
16. Discuss various instruments use for seismic survey.
17. Discuss the basic concepts of radioactivity and radioactive particles

(6x2=12 Weights)

Part C

Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

18. Differentiate greenfield & brownfield discovery. Also with the help of appropriate diagram, explain in detail the Mc Kelvey and UNFC Classification of resource and reserve?
19. Add a note on the interpretation of Apparent resistivity curves. Discuss how they are useful in Ground water exploration
20. Discuss various corrections used in gravity survey according to the factors that affect the gravity measurements
21. Give a detailed account of single & multi channel seismic reflection survey methods with applications and limitations

(2x5=10 Weights)

COURSE CODE :**PG3GEO10**

COURSE TITLE **: ADVANCED ECONOMIC GEOLOGY**

CREDITS : **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the classification of ore deposits and formation	U	3
2	Understand metamorphic, metasomatic, volcanic, sedimentary, hydrothermal ore formation processes	U	3
3	Study metamorphic deposits, application of laser Raman techniques	U, Ap	3
4	Understand global metallogenic epochs and provinces	U	3
5	Study textures of ores and ore paragenesis	U	3

PSO – Programme Specific Outcome, CO-Course Outcome;

Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Introduction to Mineral deposits	30	1
	1.2 Morphology of ore bodies		1
	1.3 Genetic classification of ore deposits		1
	1.4 Physico- chemical environment of ore formation- source, migration and traps in ore formation		1
	1.5 Magmatic deposits in ultramafic rocks		1
	1.6 chromite - podiform and stratiform, diamonds in Kimberlites, PGE deposits		1
	1.6 Deposits associated with mafic rocks- Cu-Ni-Fe sulphide deposits		1
	1.7 Deposits associated with felsic rocks - REE deposits, Pegmatitic deposits		1
II	2.1Hydrothermal deposits- types, formation and properties of hydrothermal fluids, conditions favouring hydrothermal deposit formation- P-T-X condition and tectonic	30	2

	environment		
	2.2 Magmatic hydrothermal deposits- Prophyry, Greisen, Skarn deposits. Seawater hydrothermal deposits- VHMS, Sedex, MVT. Other types- Unconformity-type U, Epithermal Ag-Au, lode Au deposits		2
	2.3 Sedimentary deposits- Syn sedimentary- QPC type U, phosphatic nodules, nodular Fe-Mn. BIF		2
	2.4 Deposits formed by mechanical concentration- Placer deposits and types		2
	2.5 Deposits formed by residual concentration- Bauxite and laterite		2
	2.6 Infiltration- sandstone-type U; Supergene enrichment- Gossan		2
III	3.1Metamorphic deposits- Graphite and Aluminium refractory minerals	24	3
	3.2 Metamorphosed deposits- Gondit		3
	3.3 Non-metallic deposits – Asbestos, Talc, Clay and Tourmaline		3
	3.4 Introduction to Geothermometric studies using indicator mineral, trace element and stable isotope of ore		3
	3.5 Fluid inclusion studies in relation to ore genesis. Application of Laser Raman techniques in fluid inclusion studies		3
IV	4.1 Global metallogenic epochs and provinces with special references to Witwatersrand and Bushweld	12	4
	4.2 Major metallogenic episodes in India.		4
	4.3 Mineralisation at plate boundaries.		4
V	5.1 Texture of ores and ore paragenesis	12	5
	5.2 Ore microscope- parts and principles, use of reflected light in ore microscopy		5
	5.3 Optical properties of following ore minerals; galena, pyrrhotite, pyrite, chalcopyrite, sphalerite, hematite, magnetite, psilomelane, bauxite		5

References

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Third Semester

Programme – M.Sc.Geology

PG3GEOC10 – ADVANCED ECONOMIC GEOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. What are the characteristics of syngenetic and epigenetic mineral deposits?
2. What are the traps in ore mineralization ? Write their significance
3. Prepare a short note on magmatic deposits associated with mafic rocks
4. Discuss criteria for hydrothermal deposition.
5. What are chemical sedimentary ores? Comment on their processes
6. Write on general characteristics of graphite and its uses
7. What are indicator minerals ? write their uses
8. Write the significance of Bushweld mineral deposit
9. Illustrate tectonic relation with ore mineralization
10. Discuss is kink banding? (8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

8. Discuss various morphological features of orebodies
9. Discuss the geological settings of REE deposits
10. Give an account of Epithermal deposits with examples
11. Write a note on bauxite association in laterite
12. Explain the functioning of ore microscope
13. What are the optical properties of ore minerals ? Give two example for each
14. Explain the process of formation of nonmetallic minerals
15. Application of laser raman techniques in fluid inclusion studies

(6x2=12 Weight)

Part C

Long Essay Questions

*(Answer any **two** questions. Each question carries Weight**5**)*

16. Elaborate on the mode of occurrence and genesis of diamond deposits of India
17. Describe the mode of occurrence and genesis of copper deposits in India
18. Discuss the mechanical concentration deposits, and add a note on economic significance of sedimentary deposit in at Manavalakurichi, Tamilnadu
19. Describe metallogenesis through geological time. illustrate your answer with major ore deposits of India (2x5=10 Weights)

COURSE CODE : **PG3GEO11**

COURSE TITLE **: MINING AND ENGINEERING GEOLOGY**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand mining methods	U,Ap	3
2	Understand principles of mineral dressing, mining plan and mineral policiy	U,Ap	3
3	Understand role of geology in civil engineering	U,Ap,E	3
4	Study reservoir sedimentation, coastal erosion and mechanisms	U	3

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1Mining terminologies	10	1
	1.2 Methods of mining – Open cast-Manual and Mechanised, Glory hole, Underground – Gophering, Breast stoping, Open Underhand stoping, Open Overhand stoping, Pillar and Chamber and Alluvial mining - Sluicing, Hydraulicking, Drift mining, Dredging, Derrick and Cableway. Shaft sinking		1
	1.3 Mine support and ventilation		1
II	2.1 Coal mining methods: Surface Mining Methods – Strip mining, Open-pit mining, Auger mining, Mountaintop removal mining	8	1
	2.2 Underground Mining Methods– Room-and-pillar mining, Longwall mining, Retreat mining, Blast mining and Horizon mining		1
	2.3 Sea Bed mining – Marine mining equipments and methods – General ideas		1
III	3.1 Principles of mineral dressing	18	2
	3.2 Types and uses of Crushers, Grinding mills, Screens and Classifiers		2
	3.3 Physical methods of separation by grain size, gravity and magnetism		2
	3.4. Chemical methods – reagents and their functions		2
	3.5 Floatation. Flowsheets and its importance		2

	3.6 Canonical discriminant analysis (Basic concepts)		2
IV	4.1. Role of Geology in Civil engineering	18	3
	4.2 Engineering properties of rocks		3
	4.3 Rock as construction and foundation material, raod aggregate		3
	4.4. Rock mass classification – general ideas of RMR, RQD and SMR		3
	4.5 Soils – Geological and Engineering classification		3
	4.6 Geological considerations in the following engineering projects: Dams, reservoirs and tunnels, bridges and highway roads		3
V	5.1 Reservoir sedimentation: Causes and effects, desilting methods	18	4
	5.2 Coastal erosion – Near shore dynamics, erosion mechanisms and long shore drift		4
	5.3 Measures for controlling coastal erosion – sea walls, groins and harbours		4
	5.4 Seismicity in stable continental regions of India and Seismic Zonation maps, Earthquake resistant structures		4

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2. Howard L Hartman,Jan M.Mutmansky,Introductory Mining Engineering, John Wiley andSons Inc 2002.
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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Third Semester

Programme – M.Sc.Geology

PG3GEOC011– MINING AND ENGINEERING GEOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Strip mining.
2. Floatation method and its importance.
3. Explain about engineering properties of rocks?
4. Seismic zonation maps.
5. RQD
6. Dredging
7. Flowsheets and its importance
8. Groins
9. Grinding mills
10. Explain about longshore drift and its erosion mechanism?

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Discuss about measures for controlling coastal erosion?
12. Discuss about National Mineral Policy?
13. Explain about Room and pillar mining?
14. Geological consideration in Dams?
15. Engineering and geological classification of soils?
16. Earthquake resistant structures?
17. Mining and environment
18. Give a note on coal mining?

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Explain types of Crushers?
20. Explain about different methods of mining?
21. Mining hazards.
22. Measures for controlling mining?

(2x5=10 Weights)

COURSE CODE : **PG3GEOC12**

COURSE TITLE **: HYDROGEOLOGY**

CREDITS **3**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand and describe the origin, occurrence, distribution and movement of groundwater in relation to hydrological cycle and aquifers	U	3
2	Understand groundwater hydraulics with reference to Darcy's law, aquifer parameters and describe the procedures of pumping test and data analysis for determination and quantification of aquifer parameters	U,Ap	3
3	Understand the various methods of groundwater exploration and prospecting with special emphasis on geo-electrical – electrical resistivity method; Remote sensing and GIS application, describe the methods of drilling for groundwater and explain water well construction and maintenance of production wells.	U,AP	3
4	Understand groundwater provinces of India, ground water management saline water intrusion and groundwater conditions in Kerala	U,E	3

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1 Hydrology and hydrogeology	20	1
	1.2 Hydrological cycle		1
	1.3 Geologic structures favoring groundwater occurrence and movement		1
	1.4 Vertical distribution of groundwater		1
	1.5 Groundwater reservoirs		1
	1.6 Types of aquifers		1
	1.7 Aquifer properties: Porosity, Permeability, Void Ratio, Specific Yield and Specific Retention		1
	1.8 Aquifer parameters– Hydraulic conductivity, Transmissivity and Storativity		1
	1.9 Hydraulic conductivity, Transmissivity and Storativity		1
	1.10 Hydraulic Conductivity determination -Lab tests – Permeameter methods and Field tests – Auger Hole test, Tracer test and Pump test		1
	1.11 Aquifer properties in relation to rock types and rock structures		1
II	2.1 Groundwater exploration- Remote sensing and GIS applications- brief idea	22	3
	2.2 Surface investigations- test drilling, resistivity logging, SP logging, radiation logging- brief description		2
	2.3 Groundwater movement – Water table and Piezometric level (surface) – Theory of groundwater flow – Darcy's law and its experimental verification – differential equation governing groundwater flow		2
	2.4 Darcy's law and its experimental verification – differential equation governing groundwater flow		2
	2.5 Hydrogeologic boundaries, flow nets, hydraulic conductivity		2

	and its determination in lab and field		
	2.6 Groundwater level fluctuations, global climatic change in relation to groundwater		2
III	3.1 Well hydraulics: Aquifer tests, Organization and conduct of pumping tests, Pumping test data analysis and Recovery test, Drawdown and cone of depression	12	3
	3.2 Steady radial flow to a well in confined and unconfined aquifers		2
	3.3 Thiem's equation and Dupuit-Forchheimer equation		2
	3.4 Unsteady radial flow into wells in confined and unconfined aquifers		2
	3.5 Theis equation – Theis, Chow and Cooper-Jacob methods – Isotropic non-leaky artesian aquifer		2
IV	4. 1 Well design criteria	24	2,3
	4.2 Water wells– types of wells		2,3
	4.3 Methods for drilling deep wells		2,3
	4.4 Well production, specific capacity of pumps and specification of pumps		2,3
	4.5 Quality of groundwater		2,3
	4.6 Graphical representation of water quality data		2,3
	4.7 Interpretation of hydrochemical analysis data		2,3
	4.8 Hill-Piper Trilinear diagram, Durov's diagram and U. S. Salinity diagram – Sodium Adsorption Ratio (SAR)		2,3
	4.9 Water quality standard: Domestic Water Criteria, Irrigation Water Criteria and Industrial Water Criteria– a brief idea		2,3
V	5.1 Saline water intrusion in coastal and other aquifers and its prevention	22	4
	5.2 Ghyben-Herzberg relationship– methods and need for artificial		4

	recharge to aquifers		
	5.3 Groundwater management: consumptive use, conjunctive use		4
	5.4 Groundwater development– safe yield and optimal mining policy		4
	5.5 Groundwater provinces of India		4
	5.6 Groundwater conditions in Kerala		4

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2. Davis, S.N. and Dewiest, R.J.N. Hydrogeology, John Wiley and Sons Inc. New York,1966.
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6. Todd, D. K. Groundwater Hydrology, John Wiley and Sons, 1980.
7. Walton, W. C. Groundwater Resource Evaluation, Mc Graw Hill Inc., 1970.
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9. Sharma H.S. Well Hydraulics and Tube Wells.

Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	2	0/1*
II	2	2	0/1*
III	2	2	1
IV	2	1	1
V	2	1	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Third Semester

Programme – M.Sc.Geology

PG3GEOC10 – HYDROGEOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

11. Define Porosity?
12. Give an account on Hydrological cycle?
13. What do you meant by SP logging?
14. Salt water intrusion
15. Explain about GIS applications?
16. What are Specific retension and Specific yield? Write their significance.
17. Explain the difference between Water table and piezometric level?
18. Explain Hydraulic conductivity, Transmissivity and storativity?
19. Explain global climatic change in relation to ground water?
20. Briefly explain ground water province in India?

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

21. Discuss about ground water movement and distribution?
22. Discuss about different types of Aquifers?
23. Explain chemical quality of water?
24. Give an account on Hill-Piper Trilinear diagram, Durov's diagram?
25. Explain briefly about Ground water management?
26. Write a note on subsurface investigation of ground water?
27. Ghyben – Herzberg relationship – methods and need for artificial recharge ?
28. Darcy's law
29. Give an account on aquifer properties?

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight**5**)*

30. Explain Geophysical methods in ground water exploration?
31. Explain about different well drilling methods?
32. Describe Aquifer tests?
33. Give a note on different methods of hydraulic conductivity determination

(2x5=10 Weights)

COURSE CODE : **PG3GEOP03**

COURSE TITLE **: EXPLORATION GEOLOGY, ECONOMIC GEOLOGY AND HYDROGEOLOGY (PRACTICAL-3)**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the Ore reserve estimation, Interpretation of borehole data and Geological section preparation	U, Ap	3
2	Understand the megascopic and microscopic identification of ore minerals	U	3
3	Understand the Preparation and interpretation of water table contour maps, Computation of aquifer parameters from pumping data and Graphical representationof hydrochemical data	U, Ap	3

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Ore reserve estimation –grade and tonnage calculation, geological section preparation	20	1
	1.2. Interpretation of borehole data		1
	1.3. Geological section preparation		1
II	2.1. Megascopic identification of ore minerals. Characterization, paragenesis. Occurrence and uses of important economic mineral deposits in India	22	2
	2.2. Identification of ore minerals under ore microscope - 5 Nos		2
III	3.1. Solution of problems based on Darcy's Law	30	3
	3.2 . Preparation and interpretation of water table contour maps		3
	3.3. Computation of aquifer parameters from pumping data Graphical representation of hydrochemical data:-Piper Trilinear diagram		3
	3.4. Vector diagram. Circular diagrams, Stiff's polygon		3

	3.5. Determination of pH and TDS of ground water samples - 10 nos.		3
	3.6. Determination of Ca, Na and K using Flame photometer		3

Question Paper Blue Print

Part	Weight
A	3
B	4
C	3
Total	**10**

MODEL QUESTION PAPER

Third Semester

Programme – M.Sc. Geology

PG2GEOP03 – EXPLORATION GEOLOGY, ECONOMIC GEOLOGY AND HYDROGEOLOGY PRACTICAL

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 10

PART-A

1. In an area of zinc mineralization, a north south series of five vertical bore holes were drilled at an interval of 60m,30m, 80m and 30m respectively. The core and sludge samples were analyzed at 5m intervals, and the following observations were made. (weight 3)

Bore hole	**A**	**B**	**C**	**D**
R.L	200	210	240	250
R.L of barren zone	160	175	180	180
Assay value of the sample	0.3	Trace	0.2	0.5
	0.9	1.0	1.5	1.5
	3.1	3.3	3.2	3.1
	3.5	6.1	5.2	3.5
	0.3	5.5	6.7	5.0

Assuming the cut off grade 3.0% of zn and specific gravity of 3.0 and strike influences 20 m

1.Determine the average grade of the ore body
2.Estimate the ore reserve

PART-B

I. Identify the given ore minerals and elaborate the physical properties ,Paragenesis and economic uses. (weight 2)

II. Identify the given thin section and write the diagnostic features. (weight 2)

PART-C

I. The total observed runoff volume during a storm of 5 hr duration with a uniform intensity of 16 mm/hr is 20Mm3. If the area of the basin is 400 k.m2. Calculate the infiltration rate (weight 1.5)

II. Analytical data of ground water sample is given below. Plot the data in the hill-piper Trillinear diagram and comment on the quality of groundwater for domestic purposes. Calculate the values of TDS in the groundwater samples.

(Weight 1.5)

Sample No	PH	EC Ms/cm	Concentrations of ions in ppm							
			Ca	Mg	Na	K	CO3	HCO3	Cl	SO4
1	7.5	1400	16	52	251	4	16	174	213	20
2	6.6	1520	8	102	152	3	120	250	35	12

FOURTH SEMESTER

Sl. No.	Course Code		Course Name
1	Elective A	PG4GEOEA01	FUEL GEOLOGY AND MICROPALAEONTOLOGY
2		PG4GEOEA02	ADVANCED PALAEONTOLOGY
3		PG4GEOEA03	ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT
4		PG4GEOEAP01	ELECTIVE PRACTICAL
5	Elective B	PG4GEOEB01	GEMMOLOGY
6		PG4GEOEB02	PLANETARY GEOLOGY
7		PG4GEOEB03	ANALYTICAL GEOCHEMISTRY
8		PG4GEOEBP02	ELECTIVE PRACTICAL
9		PG4GEOD01	Dissertation
10		PG4GEOV01	Viva Voce

COURSE CODE : **PG4GEOEA01**

COURSE TITLE : **FUEL GEOLOGY AND MICROPALAEONTOLOGY**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand origin, classification and distribution of coal	U	4
2	Understand origin,physical and chemical properties of petroleum ,characteristics of reservoirs, types of traps and petroliferous basins.	U	4
3	Understand mud logging and well logging, uranium and thorium deposits in india.	U,Ap	4
4	Scope and application of microfossils, application of microfossils in petroliferous basin	U	4
5	Classification, morphology,ecology and stratigraphic importance of microfossils	U	4

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.4. Coal Geology – Origin of Coal, Coalification process, insitu and transported theory of coal formation	34	1
	1.5. Microscopic and Megascopic constituents of Coal		1
	1.6. Macerals and its types		1
	1.7. Microlithotype and Lithotype		1
	1.8. Impurities in Coal		1
	1.9. Humic and sapropelic coal		1
	1.10. Concept of coal maturity and ranks of coal		1
	1.11. Thermal maturity indicator – Vitrinite reflectance		1
	1.12. Concept of coal maturity and ranks of coal		1
	1.13. Classification of coal - Peat, lignite, bituminous and anthracite coal		1
	1.14. Analysis for the assessment of coal quality - Proximate and		1

	ultimate analysis		
	1.15. Spatial and temporal distribution of coal in India – Gondwana and Tertiary coal		1
II	2.1. Petroleum geology: Introduction – Chemical and physical properties of petroleum	34	2
	2.2. Origin of petroleum- Organic and Inorganic concepts		2
	2.3. Kerogen and its types		2
	2.4. Migration, accumulation and entrapment of petroleum		2
	2.5. Source and Reservoir rocks		2
	2.6. Characteristics of reservoirs		2
	2.7. Types of reservoir traps –Classification of traps- Stractural, Diapiric, Stratigraphic, Hydromorohic traps and Combination traps		2
	2.8. Geological age of reservoir rocks		2
	2.9. Reservoir mechanics – Methods of petroleum exploration – surface, sub surface and geophysical methods		2
	2.10. Petroliferous basins with special reference to India		
III	3.1. Mud logging and well logging	30	3
	3.2 .Profile of a petroleum drilling well		3
	3.3. Duties of a petroleum geologist		3
	3.4. Shale factor and Shale density analysis		3
	3.5. Master log		3
	3.6. Reservoir engineering – Analysis of Resistivity, Gamma, SP, Neutron and Density log		3
	3.7. Non-conventional Petroleum resources – Introduction to Coal Bed Methane (CBM), Shale gas, Gas hydrates, Tar sands, Oil shales		3
	3.8. Plastic and solid hydrocarbons		3
	3.9.Radioactive mineral deposits		3
	3.10. Geological characteristics and genesis of major types of Uranium and Thorium deposits and their distribution in India		3
	3.11. Black sand deposits of Kerala and Tamil Nadu		3
IV	4.1. Micropaleontology- scope and classification of Microfossils	14	4
	4.2. Application of microfossils in petroleum exploration and paleoenvironment reconstruction		4
	4.3. Collection and preparation of Microfossils		5
V	5.1.Classification, morphology, ecology and stratigraphic	14	5

	importance of foraminifera, radiolaria, diatoms, ostracoda		
	5.2. Introduction to Palynology- applications in petroleum exploration.		5

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3. North, F.K., Petroleum geology, Unwin Hyman Inc, USA, 1990.
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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	1	0/1*
II	2	1	0/1*
III	2	2	1
IV	2	2	1
V	2	2	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc.Geology

PG4GEOEOEA01 – FUEL GEOLOGY AND MICROPALEONTOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Origin of coal
2. Mudd logging
3. Reservoirs
4. classification of coal
5. Palynology
6. classification traps
7. Radio active minerals
8. foraminifera
9. Classification of microfossils
10. Coal maturity and coal ranking (8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Migration and accumulation of petroleum
12. Distribution of Coal
13. Uranium and Thorium deposits of India
14. Radiolaria
15. Geophysical exploration methods
16. Coal analysis
17. Ostracoda
18. Duties of petroleum geologist

(6x2=12 Weights)

Part C
Long Essay Questions
*(Answer any **two** questions. Each question carries Weight **5**)*

1. Application of microfossils in petroleum exploration and paleoenvironment
2. Black sand deposits of Kerala
3. Petroliferous basins of India
4. Non conventional petroleum resources (2x5=10 Weights)

COURSE CODE : **PG4GEOEA02**

COURSE TITLE **: ADVANCED PALEONTOLOGY**

CREDITS **3**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the origin of life, theories of evolution and application of stable isotopes	U	4
2	Understand the evolution and the major mass extinction events in earth's history	U	4
3	Understand morphology, classification and application of Palynology	U	4

PSO – Programme Specific Outcome, CO-Course Outcome;

Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Applications of paleontology	20	1
	1.2. Phylogenic tree		1
	1.3. Origin of life		1
	1.4. Theories of organic evolution		1
	1.5. Application of stable isotope studies of oxygen, carbon and sulphur in paleontology		1
II	2.1. Stromatolites – types, classification and stratigraphic importance	30	2
	2.2. Evolutional history of Ammonites, Trilobites and Graptolites		2
	2.3. Major mass extinction events in earth's history		2
	2.4. Early fishes – morphology, jawless, armored & lung		2

	fishes		
	2.5. Evolution, classification and chronological distribution of Pisces		2
	2.6. Amphibians – early & modern forms		2
III	3.1. Primitive reptiles, Mesozoic reptiles – dinosaurs, aquatic & marine reptiles, flying reptiles	30	2
	3.2. Mesozoic birds – Anchiornis, Archaeopteryx, Confuciusornis, Hesperornis & Ichthyornis		2
IV	4.1. Mammals, Family Elephantidae – Stegotetrabelodon, Mammuthus, Loxodonta & Elephas	32	2
	4.2. Evolution of horses from Hyracotherium to Equus		2
	4.3. Human evolution from apes to Homo Sapience		2
	4.4. Siwalik vertebrates		2
V	5.1. Palynology – Spores & Pollens – morphology, classification, and applications	14	3
	5.2. Preparation of palynofossils		3

References

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	1	0/1*
II	2	1	0/1*
III	2	2	1
IV	2	2	1
V	2	2	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc.Geology

PG4GEOEOEA02 – ADVANCED PALEONTOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Origin of life
2. Stable isotopes
3. Reservoirs
4. Stromatoltes
5. Palynology
6. Marine reptiles
7. Graptolites
8. Trilobites
9. Mesozoic birds
10. Mammuthus

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Applications of Paleontology
12. Evolution history of Ammonites
13. Theories of organic evolution
14. Spores and Pollens
15. Evolution of horse
16. Ambibians
17. Mesozoic reptiles
18. preparation of palynofossils

(6x2=12 Weights)

Part C
Long Essay Questions
*(Answer any **two** questions. Each question carries Weight **5**)*

1. Application of stable isotope studies in paleontology
2. Siwalik vertebrates
3. Major mass extinction events in earth history
4. Human Evolution (2x5=10 Weights)

COURSE CODE : **PG4GEOEA03**

COURSE TITLE **: ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the concepts of global warming, evolution of biosphere	U	4
2	Study water pollution, marine pollution, soil pollution, erosion and conservation	U,E	4
3	Understand coastal environment, coastal erosion, biochemical environmental health, environmental problems of mining activities	U, E	4
4	Understand the concepts of introduction to key, types and classifications of disasters, disaster management, national disaster management policy and Kerala state disaster management policy	U	4
5	Understand the risk management of natural hazards	U	4

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. The geosphere as a natural environment of the Earth	12	1
	1.2. Evolution of biosphere as a consequence of interaction of primary geospheres, viz., atmosphere, hydrosphere and lithosphere		1
	1.3. Concepts ofglobal warming and its impacts		1
II	2.1. Water pollution– sources- solutions to water pollution	34	2
	2.2. Soil pollution		2
	2.3. soil quality parameters		2
	2.4. industrial waste effluents and their interaction with soil		2
	2.5. Soil erosion and conservation		2
	2.6. Controls of groundwater pollution– natural, induced– source,		2

	control, surface barriers, runoff controls– hydrodynamic controls, collection and treatment, detoxification and biodegradation		
	2.7. health hazards due to groundwater pollution		2
	2.8. Marine pollution– causative factors– land based sources, marine based sources		2
	2.9. Types of pollution – oil spills – effects on ecosystems		2
III	3.1. Coastal environments	32	3
	3.2. Distribution, variation and interaction of physicochemical and geological parameters on near shore and fore shore ecosystems		3
	3.3. Impacts of coastal erosion		3
	3.4. Wetlands – environmental significance		3
	3.5. Ramsar sites of Kerala		3
	3.6. Mangroves		3
	3.7. Environmental impact analysis – basic concepts and models		3
	3.8. Environmental problems of mining activities		3
	3.9. Environmental impacts of river sand mining and hydroelectric projects		3
	3.10. Biogeochemical factors in environmental health, Human use, trace elements and health		3
IV	4.1. Introduction to key concepts, terminologies and their complexities (Hazard, vulnerability, Exposure, Risk, Crisis, emergencies, Vulnerability, Disasters, Resilience)	28	4
	4.2. Periodogram		4
	4.3. Types and classifications of disasters		4
	4.4. Comprehensive disaster management plan		4
	4.5. The Disaster ManagementCycle: Mitigation, preparedness, Response and Recovery phases		4
	4.6. Relevance of disaster management plan in Kerala		4
	4.7. Land use planning		4
	4.8. Disaster management Act, 2005		4
	4.9. Institutional arrangements for Disaster Management		4
	4.10. Role of the Union and the States in Disaster Management Role of Local self- Government		4
	4.11. National Disaster Management Policy, Kerala State Disaster Management Policy.		4
V	5.1. Risk management for natural hazards	20	5
	5.2. Earthquake-risk and impact- prediction and preparedness, post-		5

	earthquake recovery		
	5.3. Tsunami- Indicator of tsunamis- propagation in deep and shallow water- prediction of tsunamis		5
	5.4. Community based mitigation		5
	5.5. Landslide risk- Causes, Effects, Preparedness and Mitigation measures with special reference to Kerala, Landslide zonation mapping		5
	5.6. Flood risk- Types of flood, major causes, flood risk analysis and management		5
	5.7. Cyclone risk- framework for preparedness and mitigation- risk mapping, early warning andcommunication		5
	5.8. Draught risk- Drought and development-drought monitoring- issues in drought management- use of information technology in drought monitoring		5

References

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	1	0/1*
II	2	1	0/1*
III	2	2	1
IV	2	2	1
V	2	2	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc.Geology

PG4GEOEA03 – ENVIRONMENTAL GEOLOGY AND DISASTER MANAGEMENT

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. What is Green House Effect?
2. Define water pollution?
3. Name one health hazard due to ground water pollution?
4. Define coastal ecosystem?
5. What is an environmental Audit?
6. What are natural disasters?
7. What is combrehensive disaster management plan?
8. What is landslide?
9. Major challenges in monitoring droughts
10. What is national Disaster Management Policy?

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Discuss the biosphere as a part of primary geospheres?
12. Discuss various methods of soil conservation?
13. Briefly describe land and sea based sources of marine pollution?
14. Briefly describe sand mining impact on the riparian zone?
15. What is the relevance of disaster management plan in Kerala?
16. What are the major risks and impact of Earthquake?
17. Ramsar sites of Kerala.
18. Discuss the role of Union, States and Local self governments in Disaster Management?

(6x2=12 Weights)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Describe industrial waste effluents and their interactions with soil ?
20. Give an account of the various controls on groundwater pollution. Add a note on the health hazards due to groundwater pollution?
21. Describe the role of biogeochemical factors in environmental health?
22. Explain cyclones on regards to cyclone risk mapping. Mention the major cyclones which hit our country in recent past.

(2x5=10 Weights)

COURSE CODE : **PG4GEOEAP01**

COURSE TITLE **: FUEL GEOLOGY AND MICROPALEONTOLOGY PRACTICAL-4(ELECTIVE)**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the analysis and Interpretation of log data and coal analysis	U, Ap	4
2	Understand the microscopic identification of microfossils	U, Ap	4

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO no.
I	1.1. Coal analysis- Proximate analysis	72	1
	1.2. Analysis and interpretation of log data		1
	1.3. Identification of micro fossils- Foraminifera		2

Question Paper Blue Print

Total No. of questions	Maximum weightage
2/3	**10**

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc. Geology

PG2GEOEAP01 – FUEL GEOLOGY AND MICROPALEONTOLOGY

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 10

1. The following results were obtained in a proximate analysis of a coal sample

Heating regime	Weight of coal/g	Weight remaining/g
Air oven, 105ºC, I h	1.077	0.750
Furnace, open, 800 ºC, I h	0.994	0.085
Furnace, closed, 930 ºC, 7 min	1.065	0.391

Calculate the percentage weight of moisture, ash, volatile matter and fixed carbon content**.**
Comment on maturity of the coal. (Weight5)

Identify the given microfossil and give notes on morphology, ecology, and stratigraphic importance. (Weight5)

COURSE CODE : **PG4GEOEB01**

COURSE TITLE **: GEMMOLOGY**

CREDITS **4**

Course Outcome:

CO No.	Course outcome (expected)	Cognitive Level	PSO No.
1	Understand the processes, classification and deposits of gems	U	4
2	Study optical properties, fashioning, synthesis and treatments of gemstones	U	4

PSOProgramme Specific Outcome, CO-Course Outcome;

Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Content

Module	Course Description	Hours	CO no.
I	1.4. Gems – introduction, natural gems, mineral gems, organic gems	38	1
	1.5. Gem rarity, durability and prices		1
	1.6. Classification – precious and semi-precious, faceted and carbochon, natural and synthetic, enhanced and unenhanced, simulant and fake		1
	1.7. Geological sources of gems		1
	1.8. Processes of gem formation – solution, precipitation, petrifaction, hydrothermal processes, crystallization, condensation		1
	1.9. Gem Deposits – primary, secondary – alluvial and eluvial		1
	1.10. Chemical composition of gemstones		1
	1.11. Nature of gem crystals- crystallography, form, habit and twinning		1
	1.12. Physical properties – hardness, specific gravity and cleavage		
II	2.1. Optical properties – colour, transparency, light reflection, double refraction, total internal reflection, dispersion, polarization,	20	2

	absorption, luster, sheen, play of colours, opalescence, adularescence, iridescence, chatoyancy, asterism		
	2.2. Isotropism and anisotropism in gemstones. Pleochroism, interference		2
III	3.1. Fashioning of gemstones - cutting styles, critical angle, composite stones, gemstone polishing, lapidary techniques and gemstone carving	36	2
	3.2. Diamonds: Diamond cutting and polishing methods, diamond grading including cut, colour, clarity and carat weight		2
	3.3. Gemstone simulants: Glass, plastics, diamond simulants, assembled or composite stones		2
	3.4. Differentiating natural gemstones from its synthetics and simulants		2
	3.5. Different Types of synthetics & its identification		2
IV	4.1. Gemstone synthesis and treatments - methods of staining, heat treatment, diffusion treatment,fracture filling, cavity filling, coatings, dyeing, laser drilling, atomic irradiation and theirdetection	14	2
	4.2. Synthesis of gemstones: Diamond synthesis, thin diamond films, chemical vapourdeposition (CVD)		2
	4.3.Methods of manufacture: flame-fusion (Vernueil), flux-melt, hydrothermal, Crystal-pulling (Czochralski), skull-crucible method, zone melting		2
V	5.1.Description of following gem stones: Beryl: emerald, aquamarine, heliodor, morganite, goshenite, Calcite; Coral; Diamond; Epidote; Smithsonite; Sphene Chrysoberyl: alexandrite, cat's eye Corundum: ruby, sapphire, star ruby/sapphire Feldspar Group: moonstone, albite, amazomte, orthoclase, plagioclase, labradorite, sunstone Garnet Group: almandme, pyrope, grossular, andradite, spessartite, uvarovite Tourmaline: achroite, rubellite, indicolite Chalcedony Group: chalcedony carnelian,chrysoprase, moss agate, onyx, sardonyx;jasper; bloodstone	18	2

	Opal: fire opal, white opal; black opal, water opal Pearl: natural marine, freshwater Quartz: rock crystal, amethyst, citrine, smoky quartz, rose quartz, aventurine, quartz cat's eye,tiger's eye, rutilated quartz		

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Question Paper Blue Print

Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	1	0/1*
II	2	1	0/1*
III	2	2	1
IV	2	2	1
V	2	2	1
Total	10	8	4

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc.Geology

PGGEOC– **GEMMOLOGY**

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

34. What do you meant by gems?
35. Explain petrifaction?
36. Briefly explain physical properties of gems?
37. Critical angle?
38. How to differentiate natural gemstones from its synthetics?
39. Flame-fusion & flux-melt
40. Pleochroism.
41. Zone melting.
42. Amazonite
43. Smithsonite

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

1. Give the classification of gems?
2. Gem deposits.
3. Fashioning of gemstones.
4. Different Types of synthetics & its identification.
5. Diamond synthesis.
6. Chemical composition of gemstones.
7. Describe about Tourmaline group of gemstones.
8. Describe about Garnet group of gemstones.

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

9. Nature of gem crystals?
10. Optical properties of gems?
11. Gemstone synthesis and treatments
12. Describe about Chalcedony Group of gemstones?

(2x5=10 Weights)

COURSE CODE : **PG4GEOEB02**

COURSE TITLE **: PLANETARY GEOLOGY**

CREDITS **3**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	understand basic concepts of Bigbang theory, origin of planets,	U	1,2,5
2	Understand origin and evolution of moon, terrestrial planets other planetary objects and planetary exploration	U	1,2,5

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Earth in space - Universe, Big Bang theory, Milky Way, solar system, sun, Astronomical units, Inner planets, Outer planets, planetoids, moons	30	1
	1.2. Origin of planets - Nebular hypothesis, Planetesimal hypothesis, double star hypothesis, condensation hypothesis, Urey's hypothesis		1
II	2.1. Portraits of planets - Earth's moon, general features, surface aspects	16	2
	2.2. Origin of lunar surface		2
	2.3. Geology of surface cover, sediment, volcanic flows, lunar craters		2
	2.4. Structure of moon - crust and interior		2
	2.5. Absence of atmosphere, origin and evolution of moon		2
III	3.1. Terrestrial planets - Mercury, Venus, and Mars - physical attributes	34	3
	3.2. General survey of atmosphere, atmospheric temperature, planetary surfaces and their morphology		3
	3.3. Structure of planet-lithological make up of crust and interior and origin of the crust		3
	3.4.Outer planets - Jupiter, Uranus, Saturn, and Neptune- physical		

	attributes. General survey of atmosphere, atmospheric temperature, planetary surfaces and their morphology		
IV	4.1. Other planetary objects- meteorites	28	4
	4.2. classification of meteorites, asteroids, comets, origin, evidence of giant impacts spinifex texture, tektites, petrology of meteorites		4
	4.3. Closer look on Saturn, observation methods, Saturn's rings, Saturn's moons, Kuiper Belt		
V	5.1. Planetary exploration - Indian initiatives	18	
	5.2. Space crafts- Gemini series, Apollo missions, lunar rovers, first lunar landing, International Space station		
	5.3. Seismic method of exploration		
	5.4. Remote Sensing of physical and chemical attributes of planets		

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Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	1	0/1*
II	2	1	0/1*
III	2	2	1
IV	2	2	1
V	2	2	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc.Geology

PG3GEOEB02– **PLANETARY GEOLOGY**

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*Milky way

1.Saturn's moons.

2. Astronomical units.

3. briefly origin of Earth's atmosphere.

4.Planetoids

5.Asteroids & Comets?

6.Tektites.

7.Kuiper Belt.

8.Nebular hypothesis.

9.Remote Sensing of physical attributes of planets

10.Space crafts

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. Planetesimal hypothesis.

12. Structure of moon - crust and interior.

13.Apollo missions.

14.Meteorites and classification of meteorites.

15.International Space station.

16.Seismic method of exploration

17.Urey's hypothesis.

18. Lunar rovers.

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Explain terrestrial planets?

20. Planetary exploration.

21. Space crafts.

22. Outer planets.

(2x5=10 Weights)

COURSE CODE : **PG4GEOEB03**

COURSE TITLE **: ANALYTICAL GEOCHEMISTRY**

CREDITS **4**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Understand the techniques in sampling and mapping program of GSI, geological controls on geochemical data and sample preparation methods	U, Ap	4
2	Understand wet chemical methods, analytical methods on emission techniques, Analytical methods on absorption techniques, analytical methods on electron microscopic techniques and application of geochemical data	U, Ap	4

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Course Content:

Module	Course Description	Hours	CO No.
I	1.1. Sampling- Different techniques in soil, rock and water sampling	18	1
	1.2.National Geochemical sampling and mapping program of GSI		1
	1.3. Geological controls on geochemical data		1
	1.4. Sample Preparation methods- Cleaning, drying, crushing, grinding, and powdering- mortar and pestle, pulveriser - planetary mill, Wilfley table, isodynamic separator, Isomagnetic separator		1
	1.5. Sample solution preparation of rocks/sediments/soils/minerals – Open digestion, High Pressure- temperature digestion- Microwave digestion		1
	1.6. Applications of Platinum crucible and Teffloncrucible		1
	1.7. Preparation of thin section slides for microprobe and EDX analysis. Epoxy mounting and polishing		1
	1.8. Preparation of thin section slides for microprobe and EDX analysis		1
	1.9. Epoxy mounting and polishing		

II	2.1.Wet chemical methods- Gravimetry, volumetric methods, calorimetric method UV- Spectrophotometer	34	2
	2.2. Hydrochemistry– EC, TDS, pH, bicarbonates, cation analysis		2
	2.3. Multi- elemental analysis for water quality studies – coliform analysis		2
	2.4. Analytical methods on emission techniques- Flame Photometer, X-ray fluorescence (XRF), Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES), Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), Instrument Neutron Activation Analysis(INAA)		2
III	3.1. Analytical methods on absorption techniques- Atomic Absorption Spectrometer (AAS), Inductively Coupled Plasma Mass Spectrometer (ICP-MS), Laser Ablation ICP-MS, Multicollector and Magnetic Sector ICP-MS, Thermal Ionization Mass Spectrometer (TIMS), Secondary Ion Mass Spectrometry (SIMS), Sensitive high-resolution ion microprobe (SHRIMP), Isotope Ratio Mass Spectrometer (IRMS), Electron Probe Micro Analyzer (EPMA)	40	2
	3.2. Analytical methods on electron microscopic techniques- Scanning Electron Microscope (SEM- EDX), Transmission Electron Microscope (TEM)- HR-TEM, Atomic Force Microscope		2
IV	4.1. Application of geochemical data: major, minor, trace elements	18	2
	4.2. Trace element geochemistry- Rare Earth Elements (REE), Platinum Group of Elements (PGE) and Transition metals		2
	4.3. Compatible and incompatible elements, High Field Strength Elements (HFSE) and Large Ion Lithophile Elements (LILE)		2
	4.4. REE- HREE and LREE, Eu anomaly		2
	4.5. REE chemistry, normalization, REE patterns for igneous rocks, sediments, sea water and river water		2
	4.6. PGE- Chemistry, chondrite and primitive mantle normalization, interpreting PGE patterns		2
	4.7. Spider diagram-normalization using chondrite, MORB, Primitive mantle, interpretation of spider		2

	diagrams		
V	5.1. Geochemical data for mineral exploration, and mineral genesis, environmental water quality monitoring	16	2
	5.2. Geochemical anomalies and Bull's eye		2
	5.3. Pollution of soil and water from Point and non-point sources		2
	5.4.Geochemical data for understanding petrogenesis – Discrimination diagrams and tectonic environments		
	5.5. Tectonic discrimination diagrams for basaltic-andesitic, granitic rocks, clastic sediments- their merits and limitations		2

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Module	**Part A** (Weight 1) 8/10	**Part B** (Weight 2) 6/8	**Part C** (Weight 5) 2/4
I	2	1	0/1*
II	2	1	0/1*
III	2	2	1
IV	2	2	1
V	2	2	1
Total	**10**	**8**	**4**

*Either questions from this module can be or cannot be included

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc.Geology

PG3GEOEB03– **ANALYTICAL GEOCHEMISTRY**

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 30

Part A

Short Answer Questions

*(Answer any **eight** questions. Each question carries Weight **1**)*

1. Sampling
2. Pollution of soil
3. Flame photometer
4. AAS
5. EPMA
6. REE
7. Coliform analysis
8. Geochemical anomalies
9. petrogenesis
10. hydrochemistry.

(8x1=8 Weights)

Part B

Short Essay Questions/Problems

*(Answer any **six** questions. Each question carries Weight **2**)*

11. geological controls on geochemical data
12. water quality study
13. trace element geochemistry
14. SEM-EDX and TEM-HR-TEM
15. PGE
16. Tectonic environments
17. Geochemical data for mineral exploration
18. Mapping program of GSI

(6x2=12 Weight)

Part C
Long Essay Questions

*(Answer any **two** questions. Each question carries Weight **5**)*

19. Analytical methods on absorption techniques
20. Wet chemical methods
21. Sample preparation methods
22. Application of geochemical data

(2x5=10 Weights)

COURSE CODE : **PG4GEOEB04**

COURSE TITLE **: GEMMOLOGY (ELECTIVE PRACTICAL)**

CREDITS **3**

Course Outcome:

Upon the successful completion of the course students will be able to:

CO No.	Course Outcome (Expected)	Cognitive Level	PSO No.
1	Study the megascopic identification of minerals	U, Ap	4

PSO – Programme Specific Outcome, CO-Course Outcome;
Cognitive Levels: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hours	CO No.
I	1.1. Megascopic identification of following gem minerals and its varieties Beryl, Calcite, Coral, Diamond, Epidote, Smithsonite, Sphene, Chrysoberyl, Corundum, Feldspar group, Garnet group, Tourmaline, Chalcedony group, Jasper, Bloodstone, Opal and Quartz	72	1

Question Paper Blue Print

Total No. of questions	Maximum weightage
1/2	**10**

MODEL QUESTION PAPER

Fourth Semester

Programme – M.Sc. Geology

PG4GEOEBP01 – GEMMOLOGY PRACTICAL-4(ELECTIVE)

(2022 Admission – Regular)

Time: Three Hours Maximum Weight: 10

1. Identify the given mineral specimen and elaborate the physical properties ,origin and Indian occurrence. (weight10)

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