ALAGAPPA UNIVERSITY

(A State University Established in 1985)

Karaikudi - 630003. Tamil Nadu, India

2017 Accredited with A+ Grade by NAAC (CGPA : 3.64)

2018 MHRD Govt. of India UGC Granted as Category - I & Granted Autonomy

2018 MHRD Swachh Campus Rank : 4

2021 nirf National Institutional Ranking Framework Rank : 33

2021 University Rankings Asia Rank : 199

FACULTY OF SCIENCE

DEPARTMENT OF GEOLOGY

M.Sc., APPLIED GEOLOGY

REGULATIONS AND SYLLABUS

(For the candidates admitted from the Academic Year 2022 - 2023)

DEPARTMENT OF GEOLOGY
M.Sc., Applied Geology

SYLLABUS

[For the candidates admitted from the Academic Year 2022 – 2023 onwards]

ALAGAPPA UNIVERSITY

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle andGraded as Category-I University by MHRD-UGC)
Karaikudi -630003, Tamil Nadu.

ALAGAPPA UNIVERSITY
DEPARTMENT OF GEOLOGY
Karaikudi -630003, Tamil Nadu.

REGULATIONS AND SYLLABUS - (CBCS-University Department)

[For the candidates admitted from the Academic Year 2022 – 2023 onwards]

Name of the Department : **Geology**

Name of the Programme : **M.Sc., Applied Geology**

Duration of the Programme : Full Time (Two Years)

Choice-Based Credit System

A choice-Based Credit System is a flexible system of learning. This system allows students to gain knowledge at their own tempo. Students shall decide on electives from a wide range of elective courses offered by the University Departments in consultation with the Department committee. Students undergo additional courses and acquire more than the required number of credits. They can also adopt an inter-disciplinary and intra-disciplinary approach to learning, and make the best use of the expertise of available faculty.

Programme

"Programme" means a course of study leading to the award of a degree in a discipline.

Courses

'Course' is a component (a paper) of a programme. Each course offered by the Department is identified by a unique course code. A course contains lectures/tutorials/laboratory/seminar/project / practical training/report writing /Viva-voce, etc or a combination of these, to meet effectively the teaching and learning needs.

Credits

The term "Credit" refers to the weightage given to a course, usually in relation to the instructional hours assigned to it. Normally in each of the courses credits will be assigned on the basis of the number of lectures/tutorial/laboratory and other forms of learning required completing the course contents in a 15-week schedule. One credit is equal to one hour of lecture per week. For laboratory work one credit is equal to two hours

Semesters

An Academic year is divided into two Semesters. In each semester, courses are offered in 15

teaching weeks and the remaining 5 weeks are to be utilized for conduct of examination and evaluation purposes. Each week has 30 working hours spread over 5 / 6 days a week.

Medium of Instruction:

English

Departmental committee

The Departmental Committee consists of the faculty of the Department. The Departmental Committee shall be responsible for admission to all the programmes offered by the Department including the conduct of entrance tests, verification of records, admission, and evaluation. The Departmental Committee determines the deliberation of courses and specifies the allocation of credits semester-wise and course-wise. For each course, it will also identify the number of credits for lectures, tutorials, practical, seminars etc. The courses (Core/Discipline Specific Elective/Non-Major Elective) are designed by teachers and approved by the Departmental Committees. Courses approved by the Departmental Committees shall be approved by the Board of Studies/Broad Based Board of Studies. A teacher offering a course will also be responsible for maintaining attendance and performance sheets (CIA -I, CIA-II, assignments and seminar) of all the students registered for the course. The Non-major elective programme, MOOCs coordinator and Internship Mentor are responsible for submitting the performance sheet to the Head of the department. The Head of the Department consolidates all such performance sheets of courses pertaining to the programmes offered by the department. Then forward the same to be Controller of Examinations.

Programme General Objectives (PGO)

PGO-1	The quality innovative research and teaching and interdisciplinary knowledge to develop specialist academicians and intellectual leaders with excellent professional skills in Earth sciences.
PGO-2	The programme will provide students with a firm to understanding the plate tectonic system works, including the role of different types of plate boundaries and the forces that help to drive the Earth system.
PGO-3	To develop into highly-skilled and knowledgeable scientists whom we expect to flourish in the structure of rocks, classification and grades.
PGO-4	To learn the field of structural deformation, chemical and mechanical behavior of the Earth.
PGO-5	To orient the students to solve laboratory skills such as planning of experiments, data management and analysis to a selected research problem in the mineral exploration industries.
PGO-6	To create a passion for research while inculcating a scientific temperament and field of geophysical survey and its explorations techniques.

PGO-7	To engage the students with the fundamental concepts in the field of groundwater pollution, Recharge methods and sea water intrusion.
PGO-8	To contributed in the field of research and development, involved in various environmental issues and Health impacts on climate change
PGO-9	To understand the concept of satellite data with remote sensing and GIS techniques to explore the Earth resources.
PGO-10	To learn the exploration of the minerals and oil resources.

Programme Specific Objectives-(PSO)

PSO-1	To understand the learners to acquire the exploration of earth materials.
PSO-2	To apply the knowledge for the evolution of Earth and its process.
PSO-3	To analyze the satellite data with remote sensing and GIS techniques.
PSO-4	To evaluate the instrumentation and advanced techniques.
PSO-5	To create the awareness of geological investigations in skill oriented.

Programme Outcome-(PO)

Program Outcome (POs)-On successful completion of the M.Sc. Applied Geology program(464)	
PO1	Students acquire fundamental knowledge and skills on the Earth science.
PO2	Gain knowledge on the plate tectonic system works, including the role of different types of plate boundaries and the forces that help to drive the Earth system.
PO3	Understand the structure of the rock and its classification and grade.
PO4	Familiarize the major factors influencing the strength and mechanical behavior of the Earth's crust.
PO5	Gain information on mining techniques and the roles of geologist in the mineral exploration industries.
PO6	Acquire skills in the field of geophysical survey in Seismic method, Magnetic survey, Radioactive Methods and its explorations
PO7	Aware of groundwater pollution, Recharge methods and sea water intrusion.
PO8	Assess the various environmental issues and Health impacts on climate change.
PO9	Execute collection of satellite data with remote sensing and GIS techniques to explore the Earth resources.
PO10	Students are familiar with good laboratory practices and the basic skill of Indian occurrences of minerals and Oil exploration techniques for research careers.

Programme Specific Outcome-(PSO)

Program Specific Outcome (PSOs)	
After the successful completion of the Applied Geology program, the students are expected to	
PSO1	Students will know the exploration aspects and broaden the recent techniques.
PSO2	Students infer the concepts for evolution of the Earth and its significance which leads to applying techniques to carry out high-quality teaching and scientific research
PSO3	Students gain relevant knowledge, skills, and remote sensing and GIS techniques to explore the Earth resources.
PSO4	Students are familiar with good field practices and the basic skill of recent geo instrumentation and geological techniques for lifelong learning.
PSO5	Familiarize with geological investigations skill and scope that helps their career.

Eligibility for admission

The Bachelor's Degree under 10+2+3 pattern of education in Geology with a minimum of 55% of marks and above, or equivalent CGPA. However, the minimum marks for the SC/ST students would be 50%.

Minimum Duration of programme

The programme is for a period of two years. Each year shall consist of two semesters viz. Odd and Even semesters. Odd semesters shall be from June / July to October / November and even semesters shall be from November / December to April / May. Each semester there shall be not less than 90 working days consisting of 6 teaching hours per working day (5 days a week) which shall comprise minimum of 450 teaching clock hours for each semester (exclusive of the days for the conduct of the University end- semester examination).

Components

A PG programme consists of a number of courses. The term “course” is applied to indicate a logical part of the subject matter of the programme and is invariably equivalent to the subject matter of a “paper” in the conventional sense. The following are the various categories of the courses suggested for the PG programmes:

A. Core courses (CC)- “Core Papers” means “the core courses” related to the programme concerned including practicals and project work offered under the programme and shall cover core competency, critical thinking, analytical reasoning, and research skill.

B. Discipline-Specific Electives (DSE) means the courses offered under the programme related to the major but are to be selected by the students, shall cover additional academic knowledge, critical

thinking, and analytical reasoning.

C. Non-Major Electives (NME)- Exposure beyond the discipline

- All PG programme students have to undergo a total of two Non Major Elective courses with 2 credits offered by other departments (one in II Semester another in III Semester).
- A uniform time frame of 3 hours on a common day (Tuesday) shall be allocated for the Non-Major Electives.
- Non Major Elective courses offered by the departments pertaining to a semester should be announced before the end of previous semester and the same shall be submitted to the Curriculum Design and Development Cell and posted in the University websites.
- Registration process: Students have to register for the Non-Major Elective course within 15 days from the commencement of the semester either in the department or online. The list of registered candidates shall be submitted to Director, Curriculum Design and Development Cell.

D. Self-Learning Courses from MOOCs platforms.

- MOOCs shall be on voluntary for the students.
- All PG programmes students have to undergo a total of 2 Self Learning Courses (MOOCs) one in II semester and another in III semester.
- The actual credits earned through MOOCs shall be transferred to the credit plan of programmes as extra credits.
- If the Self Learning Course (MOOCs) is without credit, 2 credits/course be given and transferred as extra credit
- While selecting the MOOCs, preference shall be given to the course related to employability skills.

E. Projects / Dissertation /Internships (Maximum Marks: 200)

The duration of the Project/Dissertation/internship shall be a minimum of three months in the fourth semester.

- **Plan of work**

Dissertation

The candidate shall undergo Dissertation Work during the final semester. The candidate should prepare a scheme of work for the dissertation/project and should get approval from the guide. The candidate, after completing the dissertation /project work, shall be allowed to submit it to the university departments at the end of the final semester. If the candidate is desirous of availing the facility from the departments/universities/laboratories/organizations they will be permitted only after getting approval

from the guide and HOD. In such a case, the candidate shall acknowledge the same in their dissertation/project work.

Internship

The students who have opted for an Internship must undergo industrial training in the reputed organizations to accrue industrial knowledge in the final semester. The student has to find industry related to their discipline (Public limited/Private Limited/owner/NGOs etc.,) in consultation with the faculty in charge/Mentor and get approval from the head of the department and Departmental Committee before going for an internship.

- **No. of copies of the dissertation/project report/internship report**

The candidate should prepare three copies of the dissertation/project/report and submit the same for the evaluation of examiners. After evaluation, one copy will be retained in the department library, one copy will be retained by the guide and the student shall hold one copy.

- **Format to be followed for dissertation/project report**

The format /certificate for thesis to be followed by the student are given below

- Title page
- Certificate
- Acknowledgment
- Content as follows:

Chapter No.	Title	Page number
1	Introduction	
2	Aim and objectives	
3	Materials and methods	
4	Result	
5	Discussion	
6	Summary	
7	References	

- **Format of the title page**

Title of Dissertation work

Dissertation submitted in partial fulfilment of the requirement for the degree of Master of Science to the Alagappa University, Karaikudi -630003.

By

(Student Name)

(Register Number)

University Logo

Department of ----------

Alagappa University

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank- 216, QS BRICS Rank-104,QS India Rank-20)

Karaikudi - 630003

(Year)

- **Format of certificates**

Certificate –Guide

This is to certify that the Dissertation entitled "----------" submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the degree of Master of Science in ---------- by Mr/Mis ----------(Reg No ----------) under my supervision. This is based on the results of studies carried out by him/her in the Department of----------, Alagappa University, Karaikudi-630 003. This dissertation/Project or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or any other similar titles or record of any University or Institution.

Place: Karaikudi **Research Supervisor**

Date:

Certificate - (HOD)

This is to certify that the thesis entitled "---------- " submitted by Mr/Mis ----------(Reg No ----------) to the Alagappa University, in partial fulfilment for the award of the degree of Master of --------in ---------- is a bonafide record of research work done under the supervision of Dr ---------- , Assistant Professor, Department of----------, Alagappa University. This is to further certify that the thesis or any part thereof has not formed the basis of the award to the student of any degree, diploma, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi Head of the Department

Date:

Declaration (student)

I hereby declare that the dissertation entitled " ---------- " submitted to the Alagappa University for the award of the degree of Master of -------- in ---------- has been carried out by me under the guidance of Dr. ----------, Assistant Professor, Department of ----------, Alagappa University, Karaikudi – 630 003. This is my original and independent work and has not previously formed the basis of the award of any degree, diploma, associateship, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi (----------)

Date:

Internship

- **Format to be followed for Internship report**

The format /certificate for internship report to be followed by the student are given below

- **Format of the title page**

Title of internship report

Internship report submitted in partial fulfilment of the requirement for the Master of degree in ---------

to the Alagappa University, Karaikudi -630003.

By

(Student Name)

(Register Number)

University Logo

Department of ----------

Alagappa University

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC, 2019: QS ASIA Rank- 216, QS BRICS Rank-104,QS India Rank-20)

Karaikudi - 630003

(Year)

Format of certificate (faculty in-charge)

This is to certify that the report entitled " ----------" submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the Master of Science in ----------by Mr/Mis---------- (Reg No ----------) under my supervision. This is based on the work carried out by him/her in the organization M/S ----------. This Internship report or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or any other similar record of any University or Institution.

Place:

Date:

Research Supervisor

Certificate (HOD)

This is to certify that the Internship report entitled " ---------- " submitted by Mr/Mis.----------(Reg No ----------) to the Alagappa University, in partial fulfilment for the award of the Master of Science in ---------- is a bonafide record of Internship report done under the supervision of ----------, Assistant Professor, Department of ----------, Alagappa University and the work carried out by him/her in the organization M/S ----------. This is to further certify that the thesis or any part thereof has not formed the basis of the award to the student of any degree, diploma, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi Head of the Department

Date:

Certificate-**(Format of certificate – Company supervisor or Head of the Organization)**

This is to certify that the Internship report entitled "----------" submitted to Alagappa University, Karaikudi-630 003 in partial fulfilment for the Master of Science in ----------by Mr/Mis----------(Reg No:----------) under my supervision. This is based on the work carried out by him/her in our organization M/S ---------- for the period of three months or ----------. This Internship report or any part of this work has not been submitted elsewhere for any other degree, diploma, fellowship, or any other similar record of any University or Institution.

Place: Supervisor or in charge

Date:

Declaration (student)

I hereby declare that the Internship Report entitled **" ----------"** submitted to the Alagappa University for the award of the **Master of Science in ----------** has been carried out by me under the supervision of ----------, Assistant Professor, Department of----------, Alagappa University, Karaikudi – 630 003. This is my original and independent work carried out by me in the organization M/S ---------- for the period of three months or -------and has not previously formed the basis of the award of any degree, diploma, associateship, fellowship, or any other similar title of any University or Institution.

Place: Karaikudi

Date:

- Acknowledgment
- Content as follows:

Teaching methods

The classroom teaching would be through conventional lectures and use of OHP and Power Point presentations. The lecture would be in such a way that the student should participate actively in the discussion. Student seminars shall be conducted and scientific discussions shall be arranged to improve their communicative skill. In the laboratory, instruction shall be given for the experiments followed by demonstration and finally the students have to do the experiments individually. Periodic tests shall be conducted and special attention would be given to the slow learning students.

Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students who have earned 74% to 70% of attendance need to apply for condonation in the prescribed form with the prescribed fee. Students who have earned 69% to 60% of attendance need to apply for condonation in the prescribed form with the 14. Teaching methods:

The classroom teaching would be through conventional lectures and use of OHP and Power Point presentations. The lecture would be in such a way that the student should participate actively in the

discussion. Student seminars shall be conducted and scientific discussions shall be arranged to improve their communicative skill. In the laboratory, instruction shall be given for the experiments followed by demonstration and finally the students have to do the experiments individually. Periodic tests shall be conducted and special attention would be given to the slow learning students.

Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students who have earned 74% to 70% of attendance need to apply for condonation in the prescribed form with the prescribed fee. Students who have earned 69% to 60% of attendance need to apply for condonation in the prescribed form with the prescribed fee along with the Medical Certificate. Students who have below 60% of attendance are not eligible to appear for the End Semester Examination (ESE). They shall re- do the semester(s) after completion of the programme.

Examination

The examinations shall be conducted separately for theory and practical's to assess (remembering, understanding, applying, analyzing, evaluating, and creating) the knowledge required during the study. There shall be two systems of examinations viz., internal and external examinations. The internal examinations shall be conducted as Continuous Internal Assessment tests I and II (CIA Test I & II).

A. Internal Assessment

The internal assessment shall comprise a maximum of 25 marks for each subject. The following procedure shall be followed for awarding internal marks.

Theory -25 marks

S.No.	Content	Marks
1	Average marks of two CIA test	15
2	Seminar/group discussion/quiz	4
3	Assignment/field trip report/case study report	4
	Total	25

Practical -25 Marks

1	Average marks of two CIA test	10 Marks
2	Attendance	5 Marks
3	Observation note book	10 Marks
	Total	25

Dissertation/internship-50 Marks (assess by Guide/in charge/HOD/supervisor)

***B.* External Examination**

There shall be examinations at the end of each semester, for odd semesters in the month of October / November; for even semesters in April / May.

- A candidate who does not pass the examination in any course(s) may be permitted to appear in such failed course(s) in the subsequent examinations to be held in October / November or April / May. However, candidates who have arrears in Practical shall be permitted to take their arrear Practical examination only along with Regular Practical examination in the respective semester.
- A candidate should get registered for the first semester examination. If registration is not possible owing to shortage of attendance beyond condonation limit / regulation prescribed OR belated joining OR on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after completion of the programme.
- For the Project Report/ Dissertation Work / internship the maximum marks will be 100 marks for project report evaluation and for the Viva-Voce it is 50 marks (if in some programmes, if the project is equivalent to more than one course, the project marks would be in proportion to the number of equivalent courses).
- Viva-Voce: Each candidate shall be required to appear for Viva-Voce Examination (in defense of the Dissertation Work /Project/ internship).

C. Scheme of External Examination (Question Paper Pattern)

Theory - Maximum 75 Marks

Section A	10 questions. All questions carry equal marks. (Objective type questions)	10 x 1 = 10 Marks	10 questions – 2 each from every unit
Section B	5 questions Either / or type like 1.a (or) b. All questions carry equal marks and each answer should not exceed	5 x 5 = 25	5 questions – 1 each from every unit
Section C	5 questions Either / or type like 1.a (or) b. All questions carry equal marks and each answer should not exceed	5 x8 = 40	5 question – Should cover all units

Practical –Maximum 75 Marks

Section A	Major experiment	15 Marks
Section B	Minor experiment	10 Marks
Section C	Experimental setup	5 Marks
Section D	Spotters (5 x 5 marks)	25 Marks
Section E	Record note	10 Marks
Section F	Vivo voce	10 Marks

Dissertation /Project report/Internship report Scheme of evaluation

Dissertation /Project report/Internship report	100 Marks
Viva voce	50 Marks

Results

The results of all the examinations will be published through the Department where the student underwent the course as well as through University Website.

Passing minimum

- A candidate shall be declared to have passed in each course if he/she secures not less than 40% marks in the End Semester Examinations and 40% marks in the Internal Assessment and not less than 50% in the aggregate, taking Continuous assessment and End Semester Examinations marks together.
- The candidates not obtained 50% in the Internal Assessment are permitted to improve their Internal Assessment marks in the subsequent semesters (2 chances will be given) by writing the CIA tests and by submitting assignments.
- Candidates, who have secured the pass marks in the End-Semester Examination and in the CIA but failed to secure the aggregate minimum pass mark (E.S.E + C I.A), are permitted to improve their Internal Assessment mark in the following semester and/or in University examinations.
- A candidate shall be declared to have passed in the Project / Dissertation / Internship if he /she gets not less than 40% in each of the Project / Dissertation / Internship Report and Viva-Voce and not less than 50% in the aggregate of both the marks for Project Report and Viva-Voce.
- A candidate who gets less than 50% in the Project / Dissertation / Internship Report must resubmit the thesis. Such candidates need to take again the Viva-Voce on the resubmitted Project report.

Grading of the Courses

The following table gives the marks, Grade points, Letter Grades and classifications meant to indicate the overall academic performance of the candidate. Conversion of Marks to Grade Points and Letter Grade (Performance in Course / Paper)

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90 - 100	**9.0 – 10.0**	**O**	**Outstanding**
80 - 89	**8.0 – 8.9**	**D+**	**Excellent**
75 - 79	**7.5 – 7.9**	**D**	**Distinction**
70 - 74	**7.0 – 7.4**	**A+**	**Very Good**
60 - 69	**6.0 – 6.9**	**A**	**Good**
50 - 59	**5.0 – 5.9**	**B**	**Average**
00 - 49	**0.0**	**U**	**Re-appear**
ABSENT	**0.0**	**AAA**	**ABSENT**

a) Successful candidates passing the examinations and earning GPA between 9.0 and 10.0 and marks from 90 – 100 shall be declared to have Outstanding (O).

b) Successful candidates passing the examinations and earning GPA between 8.0 and 8.9 and marks from 80 - 89 shall be declared to have Excellent (D+).

c) Successful candidates passing the examinations and earning GPA between 7.5 – 7.9 and marks from 75 - 79 shall be declared to have Distinction (D).

d) Successful candidates passing the examinations and earning GPA between 7.0 – 7.4 and marks from 70 - 74 shall be declared to have Very Good (A+).

e) Successful candidates passing the examinations and earning GPA between 6.0 – 6.9 and marks from 60 - 69 shall be declared to have Good (A).

f) Successful candidates passing the examinations and earning GPA between 5.0 – 5.9 and marks from 50 - 59 shall be declared to have Average (B).

g) Candidates earning GPA between 0.0 and marks from 00 - 39 shall be declared to have Re-appear (U).

h) Absence from an examination shall not be taken as an attempt.

From the second semester onwards the total performance within a semester and continuous performance starting from the first semester are indicated respectively by Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA). These two are calculated by the following formulate.

$$\text{GRADE POINT AVERAGE (GPA)} = \sum_i C_i G_i / \sum_i C_i$$

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a Semester}}$$

Classification of the final result

CGPA	Grade	Classification of Final Result
9.5 – 10.0 9.0 and above but below 9.5	**O+ O**	First Class – Exemplary*
8.5 and above but below 9.0 8.0 and above but below 8.5 7.5 and above but below 8.0	**D++ D+D**	First Class with Distinction*
7.0 and above but below 7.5 6.5 and above but below 7.0 6.0 and above but below 6.5	**A++ A+ A**	First Class
5.5 and above but below 6.0 5.0 and above but below 5.5	**B+ B**	Second Class
0.0 and above but below 5.0	**U**	Re-appear

The final result of the candidate shall be based only on the CGPA earned by the candidate.

a) Successful candidates passing the examinations and earning CGPA between 9.5 and 10.0 shall be given Letter Grade (O+) and those who earned CGPA between 9.0 and 9.4 shall be given Letter Grade (O) and declared to have First Class –Exemplary*.

b) Successful candidates passing the examinations and earning CGPA between 7.5 and 7.9 shall be given Letter Grade (D), those who earned CGPA between 8.0 and 8.4 shall be given Letter Grade (D+) and those who earned CGPA between 8.5 and 8.9 shall be given Letter Grade (D++) and declared to have First Class with Distinction*.

c) Successful candidates passing the examinations and earning CGPA between 6.0 and 6.4 shall be given Letter Grade (A), those who earned CGPA between 6.5 and 6.9 shall be given Letter Grade (A+) and those who earned CGPA between 7.0 and 7.4 shall be given Letter Grade (A++) and declared to have First Class.

d) Successful candidates passing the examinations and earning CGPA between 5.0 and 5.4 shall be given Letter Grade (B) and those who earned CGPA between 5.5 and 5.9 shall be given Letter Grade (B+) and declared to have passed in Second Class.

e) Candidates those who earned CGPA between 0.0 and 4.9 shall be given Letter Grade (U) and declared to have Re-appear..

f) Absence from an examination shall not be taken as an attempt.

$$\text{CUMMULATIVE GRADE POINT AVERAGE (CGPA)} = \sum_n \sum_i C_{ni}\, G_{ni} \,/\, \sum_n \sum_i C_{ni}$$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire Programme}}{\text{Sum of the credits of the course for the entire Programme}}$$

Where '**Ci**' is the Credit earned for Course i in any semester; '**Gi**' is the Grade Point obtained by the student for Course i and 'n' refers to the semester in which such courses were credited.

CGPA (Cumulative Grade Point Average) = Average Grade Point of all the Courses passed starting from the first semester to the current semester.

Note: * The candidates who have passed in the first appearance and within the prescribed Semesters of the UG Programme (Major, Allied and Elective courses alone) are alone eligible for this classification.

Conferment of the Master's Degree

A candidate shall be eligible for the conferment of the Degree only after he/ she has earned the minimum required credits for the Programme prescribed therefore (i.e. 90 credits).

Field trip

Field trips are very important for geoscience students so they can learn their discipline out in the field while developing geoscience knowledge and field skills. Field trips are an opportunity to get experience on the ground, develop field skills like mapping and rock and mineral identification, learn how to do structural measurements, and sharpen observation skills. Collecting samples (e.g., rock samples, water samples) or data (e.g., the orientation of rock layers or faults) can also be an essential part of a field trip. In the first semester, the student has to go for the compulsory field trip. For field trip one credit is equal to one hour. The field trip hours (2 hours/week) can be pooled for the whole semester. The student will be awarded 2 credits (Internal marks -25; external marks -75) for their field report.

Village Extension Programme

The Sivaganga and Ramnad districts are very backward districts where a majority of people Lives in poverty. The rural mass is economically and educationally backward. Thus the aim of the introduction of this Village Extension Programme is to extend out to reach environmental awareness, social activities, hygiene, and health to the rural people of this region. The students in their third semester have to visit any one of the adopted villages within the jurisdiction of Alagappa University and can arrange various programs to educate the rural mass in the following areas for three day based on the theme.1. Environmental awareness 2. Hygiene and Health. A minimum of two faculty members can accompany the students and guide them.

M.Sc. APPLIED GEOLOGY-PROGRAMME STRUCTURE

S.No	Paper Code	Title of the paper		T/P	Credits	Hours/ Week	Marks		
		SEMESTER - I					**I**	**E**	**Total**
1	464101	Core 1	Physical Geology and Geomorphology	T	4	4	25	75	100
2	464102	Core 2	Advanced Crystallography and Mineralogy	T	4	4	25	75	100
3	464103	Core 3	Stratigraphy	T	4	4	25	75	100
4	464104	Core 4	Palaeontology	T	4	4	25	75	100
5	464105	Core 5	Practical I - Crystallography, Mineralogy and Palaeontology	P	4	8	25	75	100
6	464106	Field Trip		P	2	2	25	75	100
7		DSE*-1		T	3	3	25	75	100
		Library/ Counselling				1			
					25	**30**	**175**	**525**	**700**
		SEMESTER - II							
8	464201	Core 6	Igneous and Metamorphic Petrology	T	4	4	25	75	100
9	464202	Core 7	Sedimentary Petrology	T	4	4	25	75	100
10	464203	Core 8	Structural Geology and Geotectonics	T	4	4	25	75	100
11	464204	Core 9	Economic Geology and Mining Geology	T	4	4	25	75	100
12	464205	Core 10	Practical II-Petrology, Structural geology and Economic Geology	P	4	8	25	75	100
13		DSE*2		T	3	3	25	75	100
14		Non-Major Elective - I **		T	2	3	25	75	100
15		Self-Learning Course (SLC)–MOOCS***			Extra Credit				
					25	**30**	**175**	**525**	**700**
		SEMESTER - III							
16	464301	Core 11	Geophysics	T	4	4	25	75	100
17	464302	Core 12	Remote Sensing and GIS	T	4	4	25	75	100
18	464303	Core 13	Hydrogeology	T	4	4	25	75	100
19	464304	Core 14	Geochemistry	T	4	4	25	75	100
20	464305	Core 15	Practical III –Remote sensing and Hydrogeology	P	4	8	25	75	100
21		DSE*3		T	3	3	25	75	100
22		Non-Major Elective - II **		T	2	3	25	75	100
23		Self-Learning Course (SLC)–MOOCS***			Extra Credit				
					25	**30**	**175**	**525**	**700**
		SEMESTER - IV							
24	464999	Core 16	Dissertation or Internship Program		15	30	50	150	200
					15	**30**	**50**	**150**	**200**
			TOTAL		**90**	**120**	**575**	**1725**	**2300**

DSE – Student Choice and it may be conducted by parallel sections.
** NME – Students have to select courses offered by other (Faculty) departments.
***SLC – Voluntary basis
*** Dissertation report – Marks – Viva-voce (50) + thesis (100) + internal (50) = 200
T – Theory, P – Practical

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)

464501	Natural Hazards and Management	3	3
464502	Engineering Geology and Environmental Geology	3	3
464503	Petroleum Geology	3	3
464504	Disaster Risk Reduction	3	3
464505	Basics of Remote Sensing and GIS	3	3

NON-MAJOR ELECTIVE COURSES (FOR OTHER DEPARTMENT)

NME - 1	Disaster Management and Mitigation	2	3
NME - 2	Remote Sensing and Geographic Information Systems	2	3

SEMESTER - I					
Core	**Course code: 464101**	**PHYSICAL GEOLOGY AND GEOMORPHOLOGY**	**T**	**Credits: 4**	**Hours: 4**

Unit - I		
Objective 1	**Learn the theory of plate tectonics, different types of plate boundaries, sea floor Spreading, formation of submarine canyons, and evolution of arc-trench-gap magmatism.**	
Evaluation of Earth, Earth Structure and composition. Plate tectonics, Plate boundaries, Plate movement-Causes and Mechanism of Plate movements, Palaeomagnetism, Seismicity, Sea floor spreading – Theory, evidence and mechanism, submarine canyons, Island arc system, Mid oceanic ridges, Evolution of Arc- Trench gap-Magmatism, Intensity and Petrology, Different Island arc systems.		
Outcome 1	**Acquire knowledge on earth and interior earth**	**K3**
Unit - II		
Objective 2	**Understand the concept of isostasy, distribution of mountains, oceans, marine transgression and regression and volcanic activity and mountain building.**	
Isostasy – Airy and Pratt Hypothesis, Marine Transgression and Regression - Effects of sea level changes – Definition and sea level trends during geologic time causes. Volcanoes–description, Origin of volcanoes, Structure and types of Volcano, Plate tectonics and volcanic activity. Mountain building movements- Orogeny and Epiorogeny, Types of mountains.		
Outcome 2	**Acquire knowledge about shoreline changes and mountain collision**	**K4**
Unit - III		
Objective 3	**Understand about the denudation, weathering, erosion, transportation and differenttypes of weathering and how they affect the Earth's surface.**	
Basic principles of Geomorphology Denudational geomorphology-Process of weathering- Types of land forms- Resources, Hazards and Environmental appraisals and Management in Denudational Geomorphic Systems. Tectonic Geomorphology-Types of Landforms-Resources and Hazards.		
Outcome 3	**Learners understand the weathering of earth surface**	**K2**
Unit - IV		
Objective 4	**To understand the different types of drainage systems and to learn the different typesof constructional and destructive landforms that are found in coastal zones.**	
Fluvial Geomorphology - Drainages (Classification, Morphology and Types) - Life Cycle of River Systems(Youthful, Mature and Old Stages), Migratory Behavior of Rivers-Resources and Hazards. Coastal Geomorphology-Coastal Zone Processes, Classification of Shorelines, Constructional and DestructionLandforms (Emerging and Submerging coasts) - Resources and Hazards.		
Outcome 4	**Acquire knowledge about drainage systems and coastal zones**	**K4**
Unit - V		
Objective 5	**To learn the Aeolian landforms, landforms, groundwater generated landforms andglacial landforms.**	
Aeolian Geomorphology - Processes in Arid Region, Landform Types and Morphology, Resources and Hazards. Volcanic Geomorphology-Origin of Volcanoes, Landforms, Resources and Hazards. Ground Water Generated Landforms and its types- Biogenic Landforms, Glacial Geomorphology Landform Types. Major geomorphic features of India–coastal, peninsular and extra peninsular.		
Outcome 5	**Learners understand the landforms created from wind, volcanic, groundwater and glacial**	**K3**

Suggested Readings:

Chernicoff, S., &Whitney, D.L. (2007).Geology: An introduction to physical geology. Upper Saddle River,NJ: Pearson Prentice Hall.

Fletcher, C. H. (2017). Physical geology: The science of Earth. Hoboken, NJ: John Wiley & Sons. Guhey,

R. (2018).Geology: Principles and practical manual. New Delhi: New India Publishing Agency. Mahapatra, G. B. (2016). A textbook of geology. New Delhi: CBS Publication.

Mathur, S. M. (2010). Elements of geology. New Delhi: PHIL earning Pvt.

McConnell, D. (2018). The good Earth: Introduction to earth science. New York: McGraw-Hill Education. Norton, W. H. (2017).Textbook of geology: Elements and theories. New Delhi: Dominant & Dis.

Hara, K. D. (2018). A brief history of geology. Cambridge University Press. Sunil Kumar. (2016). Text Book of Geology. New Delhi: Sonali Publication. Tyrrell, G. W. (1958). The earth and its mysteries. London: G. Bell.

Online Resources

https://opengeology.org/textbook/

https://openpress.usask.ca/physicalgeology/

https://www.britannica.com/science/geomorpholgy

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course Designed by : Dr.K.Prabakaran

Course Outcome VS Programme Outcomes

464101 - PHYSICALGEOLOGY AND GEOMORPHOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	S(3)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	M(2)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)
CO-4	S(3)	L(1)	S(3)	M(2)	S(3)	M(2)	L(1)	M(2)	M(2)	L(1)
CO-5	L(1)	M(2)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**2.2**	**1.8**	**2.6**	**2.2**	**2.4**	**1.8**	**1.8**	**2**	**2.2**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	L (1)	M (2)	L (1)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER - I					
Core	**Course code: 464102**	**ADVANCED CRYSTALLOGRAPHY AND MINERALOGY**	**T**	**Credits:4**	**Hours:4**

Unit-I		
Objective-1	**To learn the systems and the classes of the crystals, various types of projections and equation of normal, zone symbols**	
Crystal systems and symmetry for 32 classes- Schoen flies' notation and Hermann Mauguin symbols. Projection of crystals belonging to Normal class– Spherical, Stereographic and Gnomonic projections. Cotangent and Tangent Relations. Equation of Normal Zone symbols. Napier's Theorem. Interfacial angle.		
Outcome 1	**Understand the crystals and its systems, projection of crystals and theories.**	**K4**

Unit-II		
Objective 2	**To know the crystal elements, irregularities, types of morphisms and spacelattice. To know the XRD principles, Braggs law, Electron microscopy.**	
Elements of Crystal-Irregularities of crystal. Twinning and zoning; polymorphism, pseudo morphism, isomorphism and solid solution; physical properties of minerals; Space Lattice – 14 Bravais lattices. Principles of X-ray diffraction -Braggs law and powder method. Electron microscopy and its mineralogical applications. Thermal Analytical techniques.		
Outcome 2	**Gain knowledge about the types of morphisms, XRD principles, Electron microscopy and thermal analytical techniques.**	**K3**

Unit-III		
Objective 3	**Acquire knowledge about the minerals and its physical & optical properties, optical anomalies, optic axis, sign of elongation and extinction.**	
Optical properties of Minerals under polarization and cross Nicols. Optical accessories – Quartz wedge, Mica plate and Gypsum plate. Berek compensator – Micrometer ocular. Pleochroic scheme – Birefringence – optic anomalies – Dispersion. Optic axial angle. Determination of Signs of elongation. Determination of Extinction angle. Determination Of Signs of uniaxial and biaxial minerals by using optical accessory plates.		
Outcome 3	**Understand the mineral characters, optical properties and optical signs.**	**K4**

Unit-IV		
Objective 4	**To study the various types of mineral groups such as silicates, Olivine, Garnet, Epidote, Zircon etc.**	
Classification of Minerals – Description of physical, optical and chemical properties and paragenesis of the following; Ortho & Ring Silicate - Olivine group, Garnet group. Aluminosilicates – Epidote group,Zircon, Sphene, Topaz, Staurolite, Beryl, Cordierite, Tourmaline.		
Outcome 4	**Gain knowledge about the minerals and its classifications (Silicate groups, Olivine, Garnet, Zircon, Epidote, Sphene, Topaz, Beryl etc.), physical, chemical and optical properties.**	**K3**

Unit-V		
Objective 5	**To learn about the minerals and its groups such as Mica, Chlorite, Pyroxene and Amphibole group.**	
Sheet silicate–Mica group, Chlorite group and clay minerals. Chain silicate–Pyroxene and Amphibole group and pyroxenites – Wollastonite, Framework silicates –Quartz, Feldspar, feldspathoid groups, zeolite and scapolite groups. Non-silicate groups–Spinel group, Carbonates and Phosphates.		
Outcome 5	**Acquire a knowledge about the Mica, Chlorite, Amphibole and Pyroxene group minerals**	**K3**

Suggested Readings:

Akhtar, A. (2016). The DBS handbook of mineralogy and petrology. New Delhi: DBS Imprints.Alexander,
P. O. (2009). A handbook of minerals, crystals, rocks and ores. New Delhi: New India Publication.
DexterPerkins. (2013). Minerology (3rded.). New Delhi: PHILearning Pvt.
Dexter Perkins. (2017). Minerology (3rd ed.). Noida: Pearson India Education Services Pvt.Ford, W. E. (2006). Dana's textbook of mineralogy (4th ed.). New Delhi: CBS Publication.Gribble, C. D. (2005). Rutley's elements of mineralogy (27th ed.). New Delhi: CBS Publication.Klein,C., &Dutrow,B. (2008). Mineral science (23rd ed.). NewDelhi: JohnWiley & Sons.
Rabindra,H. N. (2017).Practical approach to crystallography and mineralogy(2nded.). New Delhi: Cbs & Distribution

Online Resources

https://www.doc-developpement-durable.org/file/Mines-Mineurs/Livres/Dana-s%20textbook%20of%20Mineralogy.pdf. https://www.geokniga.org/bookfiles/geokniga-advanced-mineralogy-volume-1.pdf. https://pubs.usgs.gov/bul/0509/report.pdf.
https://faculty.ksu.edu.sa/sites/default/files/ebooksclub.org Introduction_to_Crystallography Dover_Classics_of_Science_and_Mathematics_.pdf.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course Designed by : Dr.K.Prabakaran

Course Outcome VS Programme Outcomes

464102-ADVANCED CRYSTALLOGRAPHY AND MINERALOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	H(3)	H(3)	H(3)	H(3)	M(2)	M(2)	M(2)	M(2)	H(3)	M(2)
CO-2	H(3)	H(3)	M(2)	H(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-3	H(3)	S(1)	S(1)	H(3)	S(1)	H(3)	S(1)	S(1)	S(1)	H(3)
CO-4	H(3)	S(1)	M(2)	H(3)	S(1)	M(2)	S(1)	M(2)	H(3)	M(2)
CO-5	H(3)	M(2)	S(1)	H(3)	H(3)	S(1)	H(3)	S(1)	M(2)	S(1)
W.AV	3	2	1.8	3	1.8	2	1.8	1.6	2.2	2

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H(3)	H(3)	H(3)	H(3)	M(2)
CO-2	H(3)	H(3)	H(3)	H(3)	M(2)
CO-3	H(3)	S(1)	H(3)	H(3)	S(1)
CO-4	H(3)	S(1)	H(3)	H(3)	S(1)
CO-5	H(3)	M(2)	H(3)	H(3)	H(3)
W.AV	**3**	**2**	**3**	**3**	**1.8**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER –I					
Core	**Course code: 464103**	**STRATIGRAPHY**	**T**	**Credits:4**	**Hours:4**

Unit - I		
Objective 1	**Students should be able to collect stratigraphic data in the field**	
Principles of Stratigraphy and its concepts– Lithostratigraphy, Biostratigraphy, Chronostratigraphy, Magnetostratigraphy, Chemostratigraphy and Event stratigraphy. Nomenclature and the modern stratigraphic code. Geological Time Scale. Imperfections in Geological Records.		
Outcome 1	**It focuses specifically on settings and time periods that the students will encounter on fieldtrips, emphasizing the combined use of sedimentological characteristics**	**K2**
Unit - II		
Objective 2	**To Construct and interpret stratigraphic sections and correlate their sections.**	
Precambrian formation of India - (Dharwar, Singhbum, Aravalli, Bundelkh and Meghalaya, Nagpur, Sausar and Sakoli series). Proterozoic –Vindhyan, Cuddapah and Kurnool, Bhima, Kaladgi and Badami, Delhi System. Cambrian Salt range, Ordovician, Silurian, Devonian and Carboniferous systems.		
Outcome-2	**Learn about the fossil content for interpreting paleo-environments and facies changes.**	**K3**
Unit - III		
Objective-3	**Students should be able to synthesize geological and biological information**	
Triassic of Spiti, Jurassic of Kutch, Cretaceous of Trichinopoly. Deccan traps, Siwalik Formations, Tertiary and Quaternary deposits of India. Paleozoic formation of India.		
Outcome 3	**Students are described and measure sections, and record data on fossil assem**	**K2**
Unit - IV		
Objective 4	**Interpret local and regional geologic history to realize the different geological epoch formations**	
Gondwana Super Group - Distribution, succession, classification, flora and fauna, lower and upper age limit, structure of Gondwana basin, climate and paleogeography. Deccan Traps and associated sedimentary formations. Age of Deccan traps. Himalayan orogeny. Glacial and interglacial deposits.		
Outcome 4	**Students should learn the different types of systems that help to study present formations.**	**K4**
Unit - V		
Objective 5	To Understand the history of the Himalayan Mountain and learn the Indian stratigraphy.	
Lithostratigraphy- Geological time units, litho stratigraphic units. Application of lithostratigraphy- Biostratigraphy- Fossils and Stratigraphy. Classification of organisms, evolutionary trends, biostratigraphic correlation- chronostratigraphy concepts- Sequence Stratigraphy-principles and units of sequence Stratigraphy, methods and applications of sequence Stratigraphy.		
Outcome 5	**To realize the various groups such as Triassic, Jurassic, Gondwana that helps to study the current stratigraphical divisions.**	**K3**

Suggested Readings:

Krishnan,M.S.(2010).Geology of India and Burma(6thed.).NewDelhi:CBS Publication.
SamBoggs,J.R.(2016).Principlesofsedimentologyandstratigraphy(5thed.).Noida: Pearson India Education Services Pvt.
Gary Nichols (2012). Sedimentology and Stratigraphy (2nd ed.). New Delhi: Wiley India Pvt. Ltd.RavindraKumar(2015).FundamentalsofHistoricalGeologyandStratigraphyofIndia.NewDelhi: NewAge International (P)Limited, Publishers.
Weller.A.K.(1988)Principles of Stratigraphy. Asia Publishing House, Delhi.

Online Resources

http://www.qsc.uh.edu/pdf/courses/Janok_AAPG_Short_Course_Notes.pdf.
https://www.scribd.com/doc/315335009/Geology-of-India-and-Burma-by-M-S-krishnan#.
https://www.amazon.in/Fundamentals-Historical-Geology-Stratigraphy-India/dp/9393159203

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course Designed by : Dr.K.Prabakaran

Course Outcome VS Programme Outcomes

464103 - STRATIGRAPHY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	H(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	H(3)	M(2)	M(2)	S(1)	S(1)	H(3)	M(2)	M(2)	S(1)	S(1)
CO-3	H(3)	H(3)	S(1)	M(2)	M(2)	M(2)	H(3)	S(1)	M(2)	M(2)
CO-4	H(3)	M(2)	S(1)	S(1)	S(1)	S(1)	M(2)	S(1)	S(1)	S(1)
CO-5	H(3)	S(1)	H(3)	S(1)	M(2)	S(1)	S(1)	H(3)	S(1)	M(2)
W.AV	**3**	**2**	**1.8**	**1.4**	**1.6**	**1.8**	**2)**	**1.8**	**1.4**	**1.6**

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H (3)	M(2)	M(2)	M(2)	M(2)
CO-2	H (3)	M(2)	M(2)	S(1)	S(1)
CO-3	H (3)	H (3)	S(1)	M(2)	M(2)
CO-4	H (3)	M(2)	S(1)	S(1)	S(1)
CO-5	H (3)	S(1)	H (3)	S(1)	M(2)
W.AV	**3**	**2**	**1.8**	**1.4**	**1.6**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER -I					
Core	**Course Code: 464104**	**PALAEONTOLOGY**	**T**	**Credits:4**	**Hours:4**

Unit-I		
Objective 1	**To understand the basic principles of paleontology and its divisions, history. To study about the fossils and its morphological characters, types and classifications.**	
Paleontology– definition, divisions and history– Paleontology in India-fossils, Morphology of fossils, Types of fossils, Significance of fossils–Classification of organisms- Morphology, classificationof ecology.		
Outcome 1	**Gain the knowledge about the fossils and microfossils and its characters, classification etc.**	**K4**
Unit-II		
Objective 2	**To observe the knowledge about the Trilobites, Ammonites and Graptolites and itsevolution. To study about the evolution of Equus, Elephas, Man, Bird etc.**	
Evolution of Trilobite, Ammonite and Graptolite. Vertebrate Evolution– Equus, Elephas, Man, Bird (Archaeopteryx). Life through various ages. Gondwana and Tertiary Flora of India. Devonian fishes, Mesozoic reptiles and Dinosaurs.		
Outcome 2	**Understand the evolution of the all kinds of living beings in the earth**	**K3**
Unit-III		
Objective 3	**Study about the microfossils such as foraminifera, Ostracods, Diatoms and its morphology, significance, paleontological evidences.**	
Foraminifera, Ostracoda, Bryozoa–Diatoms. Brief introduction of morphology- radiolarian, conodonts, Stromatolites and Pteropods. Morphology of spores and pollen and significance in petroleum exploration, environmental importance of microfossils. Determination of age and correlation of paleontology and tectonics in macrofaunal evidence		
Outcome 3	**To learn the microfossils' environmental importance, significance in petroleum field and tectonics evidences**	**K2**
Unit-IV		
Objective 4	**To understand the vertebrate and invertebrate paleontology, its importance in environmental studies, classifications, provenances etc.**	
Review of Invertebrate and vertebrate paleontology and its significance in paleoenvironment studies. Morphology, classification, Paleoecology and geological significance of fauna and flora fossil records. Fossil dating techniques, Usage of Paleontology tool in interpretation of geo-history of sedimentary basins of India.		
Outcome 4	**To get a clear knowledge about the vertebrate and invertebrate Paleontology.**	**K3**
Unit-V		
Objective 5	**Give to realize the microfossils such as foraminifera, ostracods to interpret the climatic conditions and fossil fuels.**	
Evolution, morphology and taxonomy of benthic and planktic of multi microfossil groups- Foraminifera, Ostracoda, Nannofossil, Algae and palynomorphs. Interpretation of paleo bathymetry and sedimentary depositional studies. Trilinear diagram-plotting of fossil abundance and determination of environment of deposition. Preparation of bio facies map–panel diagram. Preparation of spatial and temporal charts. Applications in Petroleum exploration.		

Outcome 5	**To study the origin of fossil fuels, its abundance and the method of exploration.**	**K3**

Suggested Readings:

Bilwa, L.M. (2017).*Paleontology:Apracticalmanual*.NewDelhi:StuderaPress.

Clarkson, E. K. (2012). *Invertebrate paleontology and evolution* (4th ed.). New Delhi: Wiley India Pvt.Jain,

P.C.,&Anantharaman,M.S.(2015).*Paleontology(Paleobiology)EvolutionandAnimalDistribution*. Jalandhar: Vishal publishing.

Kavitha.(2007).*Fossils*.NewDelhi:AITBS.

Raup,D.M.,&Stanley,M.S.(2004).*Principlesofpaleontology*(2nded.).NewDelhi: CBS Publication.

Subramani, K., & Manivannan, V. (n.d.). *Paleontology Practical Manual*. Jalandhar: Vishal publishing.Woods,H. (2004).*Paleontologyinvertebrate*(8thed.).New Delhi: CBSPublication.

K1-Remember	***K2-Understand***	***K3- Apply***	***K4-Analyze***	***K5-Evaluate***	***K6-Create***

Course Designed by : Dr.K.Prabakaran

Course Outcome VS Programme Outcomes

464104 - PALAEONTOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	S(3)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	M(2)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)
CO-4	S(3)	L(1)	S(3)	M(2)	S(3)	M(2)	L(1)	M(2)	M(2)	L(1)
CO-5	L(1)	M(2)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**2.2**	**1.8**	**2.6**	**2.2**	**2.4**	**1.8**	**1.8**	**2**	**2.2**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	L (1)	M (2)	L (1)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER – I					
Core	**Course code: 464105**	**PRACTICAL I - CRYSTALLOGRAPHY, MINERALOGY AND PALAEONTOLOGY**	**P**	**Credits:4**	**Hours:8**

Objectives

To Learn the different crystal models and stereographic projections, Understand the megascopic features of different group of minerals, CO3- Understand the microscopic features of different group of minerals, Know the basic features and characteristics of mega fossils, Gain knowledge to methods of separation of microfossils

1. Crystal models of type minerals in each class of systems
2. Plot the mathematical relations of crystals by stereographic projection
3. Megascopic & Microscopic identification of Quartz, Feldspar, Feldspathoid, Pyroxene, Amphibole groups
4. Megascopic & Microscopic Identification of important Silicates: Tourmaline, Topaz, Beryl, Zircon, Rutile, Apatite.
5. Megascopic & Microscopic Identification of Metamorphic Minerals: Garnet, Cordierite, Kyanite, Sillimanite, Andalusite, Sphene, Staurolite, Chondrodite.
6. Determination of Optical properties of Minerals
7. Identification and description of Mega Fossils.
8. Methods of separation of microfossils- Identification of selected Taxa of the following micro fossil groups under the stereo binocular microscope and observation of morphological characters of some particular species of Benthic and Planktonic Foraminifera.

Course Outcome	CO1- Learn the different crystal models and stereographic projections CO2- Understand the megascopic features of different group of minerals CO3- Understand the microscopic features of different group of minerals CO4- Know the basic features and characteristics of mega fossils CO5-Gain knowledge to methods of separation of microfossils

Suggested Readings:

Dana,Willam E.Ford(2006) text book of mineralogy.
Dana,William E.Ford (2006) Text book of mineralogy
RabindranathHota,secondEdition (2017) practical approach to crystallography and mineralogy.Paul F kerr (2014) forthEdition, optical mineralogy.
Mahesh Bilwa (2017) paleontology manual.

Online resources

https://www.geologyin.com/2014/11/crystal-structureandcrystalsystemhtml
https://egyankosh.ac.in/bitstream/23456789/58886/1/Experiment%209
https://opengeology.org/mineralogy/5-opticalmineralogy
https//en.wikipedia.org/wiki/macrofossil

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Creat*

Course Designed by : Dr.K.Prabakaran

Course Outcome VS Programme Outcomes

464105 - CRYSTALLOGRAPHY, MINERALOGY AND PALAEONTOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	H(3)	H(3)	H(3)	H(3)	M(2)	M(2)	M(2)	M(2)	H(3)	M(2)
CO-2	H(3)	H(3)	M(2)	H(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-3	H(3)	S(1)	S(1)	H(3)	S(1)	H(3)	S(1)	S(1)	S(1)	H(3)
CO-4	H(3)	S(1)	M(2)	H(3)	S(1)	M(2)	S(1)	M(2)	H(3)	M(2)
CO-5	H(3)	M(2)	S(1)	H(3)	H(3)	S(1)	H(3)	S(1)	M(2)	S(1)
W.AV	**3**	**2**	**1.8**	**3**	**1.8**	**2**	**1.8**	**1.6**	**2.2**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H(3)	H(3)	H(3)	H(3)	M(2)
CO-2	H(3)	H(3)	H(3)	H(3)	M(2)
CO-3	H(3)	S(1)	H(3)	H(3)	S(1)
CO-4	H(3)	S(1)	H(3)	H(3)	S(1)
CO-5	H(3)	M(2)	H(3)	H(3)	H(3)
W.AV	**3**	**2**	**3**	**3**	**1.8**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER - I					
DSE - 1	**Course code: 464501**	**NATURAL HAZARDS AND MANAGEMENT**	**T**	**Credits:3**	**Hours:3**

Unit-I		
Objective 1	**To educate the process of natural and man-made hazards.**	
Introduction to natural hazard: Natural Disaster, Vulnerability, Resilience, Risks – Disasters: Types of disasters -Earthquake, Landslide, Flood, Drought, Volcanic eruption, Cyclone, Cloud burst, Manmade disasters - CBRN – Chemical disasters, biological disasters, radiological disasters, nuclear disasters. Fire – building fire, coal fire, forest fire, Oil fire–Disaster Cycle stages – Disaster event, Disaster Response, Recovery.		
Outcome 1	**The students evaluate the natural and manmade hazards.**	**K3**

Unit-II		
Objective 2	**To understand the major threats to the coastal ecosystem.**	
Remote Sensing & GIS in Tsunami and flood disasters: Tsunami, Tsunami inundation mapping using field & Satellite data – Elucidation of interface dynamics between Tsunami & coastal land systems – Mitigation strategies – Tsunami vulnerability mapping. Flood: Flood Vulnerability mapping using historical flood data and post- flood Remote Sensing data – Detection of causative factors of flood – Remedial strategies.		
Outcome 2	**Students should be able to learn the disaster mitigation of Tsunami and floods.**	**K4**

Unit-III		
Objective 3	**To evaluate the recent disasters and its mitigation processes.**	
Recent Disasters: Global Dimensions of Disasters, Hot waves, Cold Waves, Global warming, Sea level rise- Ozone Depletion, Mapping and mitigation of disasters (Cyclonic - drought - Volcanic - Glacial - Desert - Coastal erosion - Saltwater intrusion - Soil erosion and Reservoir Siltation, Pollution – Air, water and soil. Pandemics. Overview of Natural Disasters in India. Vulnerability Profile of India.		
Outcome 3	**Students understand the recent disasters and its impact, mitigation processes.**	**K2**

Unit-IV		
Objective 4	**To understand the ecological status of the coastal environment.**	
Coastal Protection Structures: Bio shields and their impact on coasts, beach stability, ocean and sea beach nourishment; interaction of waves with structures like seawalls, groins, breakwaters, revetments and replantation. Implementation of CRZ regulation and their Protection.		
Outcome 4	**Learns acquire the knowledge of coastal ecosystem and its problems.**	**K4**

Unit-V		
Objective 5	**To learn the various disaster management organizations.**	
Managerial organization: International Approach to Disaster Management, Significance of Disaster Prevention, Role of national and international organizations. UNEP, UNDP, NIOT, NIO, MOEFs, CPCB, NIDM, NGO.		
Outcome 5	**Students may create the awareness about the natural hazards and its management processes.**	**K3**

Suggested Readings

Godschalk, D.R. (2005). Natural hazard mitigation: Recasting disaster policy and planning.Washington, DC: Island Press.
Groman, J. (2002). The Atlas of Natural Disasters. Friedman/Fairfax Publishing.
Gubbay, S. (1995). Marine protected areas: Principles and techniques for management. London: Chapman & Hall.
Ingleton, J. (1999). Natural disaster management: A presentation to commemorate the International Decade for Natural Disaster Reduction (IDNDR), 1990-2000. Leicester: Tudor Rose.
Kelleher, G., Phillips, A. (1999). Guidelines for establishing marine protected areas. Gland: IUCN.
Gamble, J. K. (1977). Law of the sea. Inference outcomes and problems of implementation (E. Miles,Ed.). Ballinager: Cambridge Mass.
Waugh, W. L. (2000)."Living with Hazards, Dealing with Disasters: An Introduction to Emergency Management". Newyork: Sharpe80 Business Park.

Online Resources

https://www.nios.ac.in/media/documents/333courseE/12.pdf
https://nios.ac.in/media/documents/316-New/Book-1/Ch-13.pdf

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Creat*

Course Designed by : Dr.K.Prabakaran

Course Outcome VS Programme Outcomes

464501 - NATURAL HAZARDS AND MANAGEMENT										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	S(3)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	M(2)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)
CO-4	S(3)	L(1)	S(3)	M(2)	S(3)	M(2)	L(1)	M(2)	M(2)	L(1)
CO-5	L(1)	M(2)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	2.2	1.8	2.6	2.2	2.4	1.8	1.8	2	2.2	1.4

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	L (1)	M (2)	L (1)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER –II					
Core	**Course code: 464201**	**IGNEOUS AND METAMORPHIC PETROLOGY**	**T**	**Credits:4**	**Hours:4**

Unit - I

Objectives 1	**To describe factors affects the formation of magma and Compare and contrast the different types of magma**

Origin of Magma- Process of partial melting of magma. Bowen's Reaction and its application to petrogenesis. Viscosity, temperature and pressure relationships in magmas; IUGS classification of plutonic and volcanic rocks, Magma evolution and differentiation. Liquid immiscibility and Assimilation. Forms and structures of intrusive and extrusive igneous rocks and their petrogenetic significance. Classification of igneous rocks- CIPW, IUGS, Niggli, Tyrrel, Rosenbusch.

Outcome 1	**Students will know broad review of formation of magma and compare and contrast the different types of magma.**	**K3**

Unit - II

Objectives 2	Phase Rule provides the theoretical foundation, based in thermodynamics, for characterizing the chemical state of (geologic) system

Phase Rule and equilibrium in silicate system. Binary and Ternary magma system- Two- component system of crystallization. Three-component systems. Basic rocks - Acidic rocks - Alkaline rocks. Diversity of igneous rocks, Petrographic Provinces, Variation diagrams. Petrogenetic provinces of Deccan traps, Columbia River basalts. Bushveld igneous complex, Skaergaard intrusion, Stillwater Complex, Carbonatite and Alkaline rock complex of India

Outcome 2	**Students will know Phase Rule, theoretical foundation and Thermodynamics.**	**K4**

Unit - III

Objectives 3	**To know metamorphism rock Identification, classification, type of metamorphism occurred and grade of metamorphism rock**

Agents and types of metamorphism. Limits and physic-chemical controls of Metamorphism; Common minerals of metamorphic rocks, Field observations, and Petrographic classification of common metamorphic rocks. Texture and structures metamorphic rocks. Metamorphic Grades and Zone concept– Depth Zones, Contact metamorphic zones and paired metamorphic belts.

Outcome 3	**Students will learn metamorphism rock Identification, classification, type & grade of metamorphic rock**	**K2**

Unit - IV

Objectives 4	**To study metamorphic facies is a set off mineral assemblages in metamorphic rocks formed under similar pressures and temperatures.**

Metamorphic facies and concepts. View of Eskola, Winkler, Turner and Verhogen of facies. Graphical representation of facies – diagram ACF, AKF and AFM. Gibbs phase rule and Goldschmidt mineralogical phase rule. Metamorphic differentiation, metasomatism, Granitisation. Thermal, Cataclastic and Regional metamorphism and their effects on Carbonates, Argillaceous, Arenaceous. Acid, Basic and Ultra basic igneous rock. Grade of metamorphism.

Outcome 4	**Students will know metamorphic facies, mineral assemblages.**	**K4**

Unit - V

Objectives 5	**To know geological process and diagenes is between the metamorphism and Magmatism with the greatest characteristic of partial re-melting and diverse fluid.**

Migmatisation, Charnockitisation, Palingenesis and Anataxis, Origin of Ecologite, Origin of Amphiboite, Metamorphic concerning platetectonics, Magmaticem placement and Orogenesis. Application of trace elements, REE and stable isotope geochemistry in metamorphism.		
Outcome 5	**Students will understand geological process and diagenesis betweenthe metamorphism and magmatism.**	**K2**

Suggested Readings:

Ehlers,E.G., Blatt,H. (1999). Petrology: Igneous, sedimentary, and metamorphic.CBS Publication. New Delhi.

Hatch, F.H., Wells,A. K.,Wells,M.K.(2003). Petrology of the igneous rocks, 13thEds.CBS Publication. New Delhi.

Hyndman,D.W.(2014). Petrology of igneous and metamorphic rocks, 2ndEds.McGraw-Hillpubl. Company. New Delhi.

Johnson,W.M., Maxwell,J.A.(2017). Rock and mineral analysis, 2ndEds.MEDTECH.NewDelhi.

McBirney, A.R. (1993). Igneous petrology, 2ndEds. Jones &Bartlett. Boston, London.

Philpotts,A.R., Ague,J.J. (2016). Principles of igneous and metamorphic petrology, 2ndEds. Cambridge University Press. New Delhi.

Online Resources

https://www.geokniga.org/bookfiles/geokniga-principlesofigneousandmetamorphicpetrologybyjohndwinterz-liborg.pdf.

https://www.geokniga.org/bookfiles/geokniga-anintroductiontoigneousandmetamorphicpetrologywinter.pdf.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course Designed by : Dr.K.Prabakaran

Course Outcome VS Programme Outcomes

464201 - IGNEOUS AND METAMORPHICPETROLOGY										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	H(3)	H(3)	H(3)	M(2)	M(2)	H(3)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	H(3)	H(3)	M(2)	M(2)	H(3)	M(2)	M(2)	S(1)	S(1)
CO-3	S(1)	M(2)	M(2)	H(3)	S(1)	H(3)	H(3)	S(1)	M(2)	M(2)
CO-4	M(2)	H(3)	H(3)	M(2)	S(1)	H(3)	M(2)	S(1)	S(1)	S(1)
CO-5	S(1)	M(2)	H(3)	S(1)	H(3)	H(3)	S(1)	H(3)	S(1)	M(2)
W.AV	1.8	2.6	2.8	2	1.8	3	2	1.8	1.4	1.6

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H(3)	H(3)	H(3)	M(2)	H(3)
CO-2	M(2)	H(3)	H(3)	M(2)	H(3)
CO-3	S(1)	M(2)	M(2)	H(3)	H(3)
CO-4	M(2)	H(3)	H(3)	M(2)	H(3)
CO-5	S(1)	M(2)	H(3)	S(1)	H(3)
W.AV	**1.8**	**2.6**	**2.8**	**2**	**3**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER - II					
Core	**Course code: 464202**	**SEDIMENTARY PETROLOGY**	**T**	**Credits :4**	**Hours:4**

Unit-I

Objective 1	**To learn the basic concepts and classification of sedimentary rocks.**

Weathering of Pre-existing Rocks – Physical and Chemical Weathering Processes. Statistical parameters of sediments Size, Shape, Sphericity and Roundness. Classification of Sedimentary rocks-General classification, Classification based on texture and composition, Genetic classification. Sedimentary Structures-Classification of Structures - Mechanical and chemical Structures; sedimentary environments and facies models for fluvial, deltaic, silica clastics hallow and deep marine environments.

Outcome 1	**Students will come with an elaborate knowledge about the sedimentary rocks**	**K2**

Unit-II

Objective 2	**To study about the physical, chemical and sedimentary properties of rocks in detail.**

Nature and Origin of Sedimentary Rocks: Broad Classification and Composition of Sedimentary rocks–Textures, Structures and their Environmental Significance-Petrography of Clastic and Non-clastic rocks- Mineralogy and Chemical composition of Siliceous, Iron bearing rocks-Phosphorites and Evaporites-Nodules and Diagnostic Segregates-Folk and Dunham's Classification-lithification and Diagenesis; quantitative grain size analysis.

Outcome 2	Students will gain the detail knowledge about the Properties of rocks	**K4**

Unit - III

Objective 3	**To learn about the evolution of basins controlled by the tectonic and oil formation.**

Transitional and Marine Environments-Products of Environment-Subsurface Environments-Subsurface Pressure–Temperature–Fluids and Fluid flow in sedimentary basins- Sedimentology. Evolution ofSedimentary Basins: Tectonics and evolution of basins, Origin of Petroleum and Gas and Metallogeny–Geophysical models and Tectonic theory.

Outcome 3	**Students to explore the knowledge of evolution of basins controlled by the tectonism and oil formation**	**K4**

Unit - IV

Objective 4	**To understand the process of transportation and deposition by Aeolian and glacial sediments**

Aeolian and Glacier deposits – Process and Depositional environment. Grain size analysis of sediments and their geological significance. Graphical representation of Textural data-Histogram, Frequency Curve, Cumulative curve. Non-Marine deposits, Transitional and marine deposits.

Outcome 4	**Students will understand the process of transportation and Deposition by Aeolian and glacial sediments.**	**K2**

Unit - V

Objective 5	**To learn about the various sediment and heavy mineral analyses.**

Heavy mineral analysis, mineral geochemistry, depositional environments and provenance. Scanning Electron Microscope, Sieve analytical instruments, Heavy mineral separations (mechanical andelectromagnetic).

Outcome 5	**Students recognize the methodology of carryout scientific research in the field of sedimentary geology.**	**K5**

Suggested Readings:

Boggs,S.(2016). Principles of Sedimentology and Stratigraphy 5thEds.Pearson India Pvt.Ltd. Noida.
Gokhale, N. W. (2013). Fundamentals of sedimentary rocks. CBS Publication. New Delhi.
MacLane,M. (1995). Sedimentology. Oxford Univ. Press. NewYork.
Nichols, G. (2012). Sedimentology and Stratigraphy2ndEds. Wiley India Pvt. Ltd. New Delhi.
Paarikh,S. S.(2017). Sedimentary rocks in the field. Random Publications. New Delhi.
Pettijohn,F.J.(2004). Sedimentary rocks3rdEds.CBSPublications. New Delhi.
Sengupta, S. M. (2016). Introduction to sedimentology2ndEds. CBS Publication. New Delhi.

Online resources

https://egyankosh.ac.in/handle/123456789/66698
https://www.geokniga.org/bookfiles/geokniga-petrology- sedimentary-rocks_0.pdf

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464202 - SEDIMENTARY PETROLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	H(3)	M(2)	H(3)	M(2)	H(3)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	H(3)	H(3)	M(2)	H(3)	S(1)	S(1)	M(2)	M(2)	S(1)
CO-3	S(1)	M(2)	M(2)	H(3)	H(3)	M(2)	M(2)	H(3)	S(1)	M(2)
CO-4	S(1)	S(1)	H(3)	M(2)	H(3)	S(1)	S(1)	M(2)	S(1)	S(1)
CO-5	M(2)	H(3)	M(2)	S(1)	H(3)	S(1)	M(2)	S(1)	H(3)	S(1)
W.AV	**1.8**	**2.2**	**2.6**	**2**	**3**	**1.4**	**1.6**	**2**	**1.8**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H(3)	H(3)	H(3)	H(3)	H(3)
CO-2	M(2)	H(3)	H(3)	M(2)	H(3)
CO-3	S(1)	H(3)	M(2)	H(3)	H(3)
CO-4	S(1)	H(3)	H(3)	M(2)	H(3)
CO-5	M(2)	H(3)	M(2)	S(1)	H(3)
W.AV	**1.8**	**3**	**2.6**	**2**	**3**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER -II					
Core	**Course code: 464203**	**STRUCTURAL GEOLOGY AND GEOTECTONICS**	**T**	**Credits:4**	**Hours:4**

Unit-I		
Objective 1	**To learn the fundamentals of structural analysis and geotectonics and learn thetechniques necessary for analyzing and interpreting geological structures.**	
Basic Principles, Definition, Primary and Secondary structures– Trends of outcrops. Relation Between True dip and Apparent dip, True thickness and vertical Thickness and their mutual relation.		
Outcome 1	**The student will learn the basic principles of geological structures in detail and also recognize and classify geologic structures**	**K4**
Unit-II		
Objective 2	**To learn the kinematic and dynamic analytical techniques and study detailedabout the properties of rocks and factors influencing the strength and mechanical behavior of the Earth's crust and underlying mantle lithosphere.**	
Mechanical properties of rock. Stress, strain – Kinematic and dynamic analysis of deformation; definition and types, Stress and Strain ellipsoid, Mohr cycle. Physical properties of rocks– Deformation–brittleness, Plastic and elastic properties. Foliation and lineation, types of cleavages, schistosity, crenulations – Orientation of foliation with in strain ellipsoid. Time relationship between crystallization and deformation, calculation of paleo stress.		
Objective 2	**Student will learn the properties of rocks and Recognize geologic structures**	**K3**
Unit-III		
Objective 3	**To detailed study about the folds and their mechanisms.**	
Folds: Geometry of fold, Fold terminology classification of scheme for folds and Mechanism of folding. Recognition of folds in the field. Salt intrusion and salt domes. Unconformities and their types.		
Objective 3	**Students will, Recognize fold structures, Describe and Analyze geologic structures**.	**K2**
Unit-IV		
Objective 4	**To gain the knowledge of joints and their properties**	
Joints: Geometry of Joints, classification joints and its significances. Mechanism of joints. Faults– Classification–types of faults. Mechanism of faults. Recognition of Faults in the field.		
Objective 4	**Students will gain the knowledge of joints, Fault and their properties**	**K1**
Unit-V		
Objective 5	**To gain an understanding of the structures of the Earth's crust and the processes that lead to their development. To learn to make field observations and to draw conclusions about the structural and tectonic history of an area.**	
Plate tectonics, oceanic and continental drift, Geological and Geophysical evidence, Determination of the order of super position in the fields, Geological surveying and Mapping– Use of contour and topographical maps.		
Objective 5	**Students will, Gain proficiency in making observations and measurements using laboratory, field, and seismic data and in presenting those observations in well-written, succinct reports.**	**K3**

Suggested Readings:

Billings, M. P. (2016). Structural geology, 3rdEds. Pearson India Education Services Pvt. Noida.
Chadha,S.K.(2010). Elements of geological maps: For geology, 2ndEds.CBS Publication. New Delhi. Gokhale, N.W. (1996).Exercise on geological and dip-strike problems. CBS Publication. New Delhi. Gokhale, N. W. (2012). A manual of problems in structural geology. CBS Publication. New Delhi.
Gokhale,N. W.(2013).Manual of geologicalmaps.CBS Publication. New Delhi. Gokhale, N. W. (2015). A guide for field geology. CBS Publication. New Delhi. Gokhale,N.W. (2017). Theory of Structural Geology. CBS Publication. New Delhi.
Hobbs,B. E., &Ord, A.(2015). Structural geology: The mechanics of deforming metamorphic rocks. Waltham,MA. Elsevier.
Lahee, F.H. (2002). Field geology 6thEds.CBS Publication. New Delhi. Mathur S.M. (2001).Guide to Field Geology. Prentice Hall of India.
Marshak,S.,Mitra,G.(2018). Basic methods of structural geology. Pearson India Education Services Pvt.Ltd. Noida.

Online Resources:

https://www.geokniga.org/bookfiles/geokniga-structural-geology.pdf.
https://www.geokniga.org/bookfiles/geokniga-tectonics-and-structural-geology-indian-context.pdf.
https://www.perlego.com/book/1609283/foundation-of-structural-geology-pdf

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464203 - STRUCTURAL GEOLOGY AND GEOTECTONICS										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	H(3)	H(3)	H(3)	M(2)	M(2)	H(3)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	H(3)	H(3)	M(2)	M(2)	H(3)	M(2)	M(2)	S(1)	S(1)
CO-3	S(1)	M(2)	M(2)	H(3)	S(1)	H(3)	H(3)	S(1)	M(2)	M(2)
CO-4	M(2)	H(3)	H(3)	M(2)	S(1)	H(3)	M(2)	S(1)	S(1)	S(1)
CO-5	S(1)	M(2)	H(3)	S(1)	H(3)	H(3)	S(1)	H(3)	S(1)	M(2)
W.AV	**1.8**	**2.6**	**2.8**	**2**	**1.8**	**3**	**2**	**1.8**	**1.4**	**1.6**

S-Strong (3), M-Medium (2), L-Low (1)

Course outcome VS Programme Specific Outcome

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H(3)	H(3)	H(3)	M(2)	H(3)
CO-2	M(2)	H(3)	H(3)	M(2)	H(3)
CO-3	S(1)	M(2)	M(2)	H(3)	H(3)
CO-4	M(2)	H(3)	H(3)	M(2)	H(3)
CO-5	S(1)	M(2)	H(3)	S(1)	H(3)
W.AV	**1.8**	**2.6**	**2.8**	**2**	**3**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER –II					
Core	**Course code: 464204**	**ECONOMIC AND MINING GEOLOGY**	**T**	**Credits:4**	**Hours:4**

Unit - I		
Objective 1	**To understand the mineral resources, mineral concession rules and different ways that mineral resources are recycled and reused.**	
Brief outline of World's mineral Resources- Tenor, grade, Mode of formation of mineral processes. Minerals used in the manufacture of cement, Abrasives, Refractories, Paints, Pigments and Insulators. Strategic, critical and essential minerals, Marine mineral resources. Mineral Concession Rules; Marine minerals resources and laws of the sea.		
Outcome 1	**Learners understand the world mineral resources with concession rules**	**K3**

Unit - II		
Objective 2	**To understand the different methods of mineral exploration and process of magmatic differentiation and concentration and hydrothermal processes.**	
Geologic thermometer, Magmatic differentiation, Magmatic concentration, Sublimation, contact metamorphism/metasomatism, Hydrothermal Process, Sedimentation, Evaporation, Residual/Mechanical concentration, oxidation and supergene enrichment. Controls of ore localization, Fluid inclusion, Metallogenetic epochs and Provinces. Classification of Mineral deposit, Bateman and Lindgren classification. Geophysical exploration of mineral deposits.		
Outcome 2	**Learners acquire knowledge about mineral exploration methods and hydrothermal processes**	**K2**

Unit - III		
Objective 3	**To understand the different types of mineral deposits and properties of coal, including rank, grade and classifications.**	
Geologic setting and genesis, World and Indian occurrences of Gold, Silver, Platinum, Copper, Lead, Zinc, Tin, Aluminum, Iron, Manganese, Nickel, Chromium, Cobalt, Molybdenum Tungsten, Vanadium,Uranium and Thorium. Coal– the origin of coal and coalification processes, Properties of Coal; Rank, Grade, Classifications of coal, Macroscopic and microscopic constituents of coal, Coal petrology; Proximate and ultimate analysis.		
Outcome 3	**Learners acquire knowledge about mineral settings and coal formations**	**K3**

Unit - IV		
Objective 4	**To understand the different types of mining methods such as long wall mining, Room-and-pillar mining and pillar-and-stall mining.**	
Ore prospecting methods, sampling techniques, ore reserve estimation methods. Classification of mining methods, surface mining methods, alluvial mining methods and outline of granite mining methods. Various sub-surface mining methods, the outline of underground coal mining methods. Underground hydraulic mining, Methods. Minemachinery. Screening –principles.		
Outcome 4	**Acquire knowledge about different types of mining methods**	**K4**

Unit - V		
Objective 5	**Learners to understand the different kinds of mining hazards and different mining laws and regulations.**	
Mining Hazards–control measures, Mining Lease–Mining Laws of Major and Minorminerals; NMP, NMEP–Law and Regulation of coastal Mining–Environmental impact in onshore and offshore mining. Reserve estimation of mine through UNFC-Environmental impact and management plans formining projects.		
Outcome 5	**Learners acquire knowledge about mining hazards and mining laws**	**K4**

Suggested Readings:

Anthony, M. Evans. (2012). *Ore Geology and industrial minerals; An Introduction*, 3rdEds. Wiley IndiaPvt.Ltd.New Delhi.

Arogyaswamy, R. N. P. (2017). *Course in mining geology,* 4thEds.CBS Publication. New Delhi.

Baliyan,

N. (2018). *Rare Earth Elements*. Random publication. New Delhi.

Guilbert, J. M., Park,F.C.(2015). *The geology of ore deposits*. CBSPublication, New Delhi.

Gupta, R. C. (2016). *Fuels, furnaces and refractories*. Prentice-Hall of India. New Delhi. Jain, S. K. (2016). *Mineral processing*.CBS Publication. New Delhi.

Mc Kinstry H.E.(1960).*Mining Geology.* Asia Publishing House.

Pohl, W. L. (2011). *Economic Geology: Principles and Practice*. Somerset.

Online Resources:

https://www.southalabama.edu/geology/haywick/GY111/111-8.pdf

https://science.asu.edu.eg/ResearchGroup/storage/uploads/mediacenter/2022/t0zMG76YLufW55bJ.p df

https://www.geokniga.org/bookfiles/geokniga-economic-geology-principles-and-practice-metals-minerals-coal-and-hydrocarb.pdf

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464204 - ECONOMIC AND MINING GEOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	S(3)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	M(2)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)
CO-4	S(3)	L(1)	S(3)	M(2)	S(3)	M(2)	L(1)	M(2)	M(2)	L(1)
CO-5	L(1)	M(2)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**2.2**	**1.8**	**2.6**	**2.2**	**2.4**	**1.8**	**1.8**	**2**	**2.2**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	L (1)	M (2)	L (1)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER-II					
Core	**Course code: 464205**	**PRACTICAL II - PETROLOGY, STRUCTURAL GEOLOGY AND ECONOMIC GEOLOGY**	**P**	**Credits: 4**	**Hours: 8**

Objective

To learn how to identify and classify rocks, analyze the composition of rocks using ternary diagrams and other petro genetic tools. To learn how to interpret geological maps and sections. To learn how to determine the dip and apparent dip of a bed and identify minerals based on their spectral signature. To study and estimate the ore reserve.

1	Megascopic identification of Igneous, sedimentary and metamorphic rocks.
2	Microscopic identification of Rock Fabrics, Mineral assemblages of Igneous, sedimentary and metamorphic rocks.
3	Calculation of C.I.P.W, Norms calculation-Niggli/Harker.
4	Ternary diagrams-ACF, AKF and AFM diagrams - REE distribution patterns and petrogenetic significance of rocks.
5	Grain size analysis of sediments- Graphical representation of data- Statistical parameters of grain size Variation of grain size with the distance of transport and their environmentalinterpretation
6	Heavy mineral analysis (methods of separation and analysis. Provenance interpretation). Interpretation of geological maps and drawing sections
7	Structural problems-Determination of true thickness calculation of the depth. Representing various planes in a stereogram.
8	Determination of dip apparent dip of a
9	bed.Hyper-Spectral mineral identification.
10	Find and estimate the Ore reserve.

Outcomes

Learners acquire knowledge about rocks and their composition and spectral reflectance and how toestimate the ore deposits?

Suggested Readings:

Anthony, M. Evans. (2012). *Ore Geology and industrial minerals; An Introduction*, 3rdEds. Wiley IndiaPvt.Ltd.New Delhi.

Arogyaswamy, R. N. P. (2017). *Course in mining geology,* 4thEds.CBS Publication. New Delhi. Baliyan, N.(2018). *Rare Earth Elements*. Random publication. New Delhi.

Best, M. G. (1986). Igneous and Metamorphic Petrology. New Delhi: CBS Publication.

Ehlers, E. G., & Blatt, H. (1999). Petrology: Igneous, sedimentary, and metamorphic. New Delhi: CBS. Hatch, F. H., Wells, A. K., & Wells, M. K. (2003). Petrology of the igneous rocks(13th ed.). New Delhi:CBS Publication.

Hyndman, D. W. (2014). Petrology of igneous and metamorphic rocks(2nd ed.). New Delhi: McGraw-Hill publ. Company.

Billings, M. P. (2013). Structural geology (3rd ed.). New Delhi: PHI Learning Pvt.

Billings, M. P. (2016). Structural geology (3rd ed.). Noida: Pearson India Education Services Pvt.Chadha, S. K. (2010). Elements of geological maps: For geology (2nd ed.). New Delhi: CBS Publication.

Gokhale, N. W. (1996). Exercise on geological and dip-strike problems. New Delhi: CBSPublication.

Online Resources:

https://www.academia.edu/33615095/Practical_Igneous_Petrology_for_Dummies

https://openpress.usask.ca/geolmanual/chapter/exercises-on-folds-faults-and-unconformities/

https://www.southalabama.edu/geology/haywick/GY111/111-8.pdf

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464205 - PRACTICAL II - PETROLOGY, STRUCTURAL GEOLOGY AND ECONOMIC GEOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	H(3)	M(2)	H(3)	M(2)	H(3)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	H(3)	H(3)	M(2)	H(3)	S(1)	S(1)	M(2)	M(2)	S(1)
CO-3	S(1)	M(2)	M(2)	H(3)	H(3)	M(2)	M(2)	H(3)	S(1)	M(2)
CO-4	S(1)	S(1)	H(3)	M(2)	H(3)	S(1)	S(1)	M(2)	S(1)	S(1)
CO-5	M(2)	H(3)	M(2)	S(1)	H(3)	S(1)	M(2)	S(1)	H(3)	S(1)
W.AV	**1.8**	**2.2**	**2.6**	**2**	**3**	**1.4**	**1.6**	**2**	**1.8**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H(3)	H(3)	H(3)	H(3)	H(3)
CO-2	M(2)	H(3)	H(3)	M(2)	H(3)
CO-3	S(1)	H(3)	M(2)	H(3)	H(3)
CO-4	S(1)	H(3)	H(3)	M(2)	H(3)
CO-5	M(2)	H(3)	M(2)	S(1)	H(3)
W.AV	**1.8**	**3**	**2.6**	**2**	**3**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER-II					
DSE - 2	**Course code: 464502**	**ENGINEERING GEOLOGY AND ENVIRONMENTAL GEOLOGY**	**T**	**Credits:3**	**Hours: 3**

Unit-I		
Objective 1	**To understand the Physical and Engineering properties of rocks and soils.**	
Engineering properties of rocks – Dimensional stone properties and its importance, roadmaterials and its properties. Physical and Engineering properties of Soil. Test for selecting rock sites for construction. Laboratory, field and instrument testing of rocks.		
Outcome 1	**Students will be able to understand the Physical and Engineeringproperties of rocks and soils.**	**K4**
Unit-II		
Objective 2	**To optimize the geological conditions for various foundations in civil Engineering projects.**	
Role of Engineering geology in civil engineering projects – Dams, Reservoirs, Tunnel, Road cuts, Roads, Highways and Bridge construction, site improvement for Engineering constructions.		
Outcome 2	**Students will be able to optimize the geological conditions for various foundations in civil engineering projects.**	**K4**
Unit-III		
Objective 3	**To explore the role of Engineering geology in civil engineering projects.**	
Foundations definition: types, settlement of foundations, geological conditions and site investigations. Bearing capacity and pile foundations. Short note on bridge foundations and geological conditions.		
Outcome 3	**Students will be able to explore the role of Engineering geology incivil engineering projects**	**K2**
Unit-IV		
Objective 4	**To understand the knowledge of Environmental impact of mineral extraction**	
Environmental impact of mineral extraction and processing. Marine oil pollution. Health hazards associated with mining. Coal mining hazards. Acid mine drainage. Hydrologiceffects of urbanization.		
Outcome 4	**Students will be able to understand the knowledge of Environmental impact of mineral extraction.**	**K3**
Unit-V		
Objective 5	**To emphasize the various environmental issues and Health impacts on climate change.**	
Environmental issues: Climatic change and its causes. Health impacts on climate change. Globalwarming and its impact upon Ecosystem. Acid rain. Ozone layer depletion.		
Outcome 5	**Students will be able to emphasize the various environmental issues and Health impacts on climate change**	**K4**

Suggested Readings:

Bangar,K.M.(2016).*Principles of engineering and geology.* New Delhi: Standard publishers' distributors.
Bell,F.G.(2007).*Engineering geology* (2nded.). Amsterdam: Butterworth-Heinemann.
Blyth, F. G. H., Freitas, M. H. (2017). *A geology for engineers* (7th ed.). Boca Raton: CRC Press.Doren,K. L.(2016). *Airpollution*.New Delhi: CBS Publication.
Kehew,A.E.(2017).*Geology for engineers and environmental scientists* (3rded.).Chennai: PearsonIndia Education Services.
Kramer,S.L.(2014).*Geotechnical earthquake engineering*. Harlow: Pearson Education.

Online Resources:

http://jiwaji.edu/pdf/ecourse/earth_sci/PSK_GEOLOGY_GT%20403_1.2,1.3_%20engineering%20properties%20of%20rocks.pdf
https://ocw.mit.edu/courses/12-001-introduction-to-geology-fall-2013/pages/lecture-notes-and- slides/
https://www.academia.edu/37295502/Lecture_Notes_in_Environmental_Geology

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464502 - ENGINEERING GEOLOGY AND ENVIRONMENTAL GEOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	L(1)	S(3)	M(2)
CO-2	M(2)	S(3)	L(1)	L(1)	S(3)	M(2)	L(1)	M(2)	M(2)	L(1)
CO-3	S(3)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)
CO-4	L(1)	L(1)	S(3)	M(2)	L(1)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-5	L(1)	M(2)	M(2)	S(3)	S(3)	L(1)	S(3)	L(1)	S(3)	L(1)
W.AV	**1.8**	**2.2**	**2.0**	**2.2**	**2.2**	**2.0**	**1.8**	**1.8**	**2.2**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M (2)	S (3)	M (2)	S (3)	M (2)
CO2	S (3)	M (2)	L (1)	M (2)	M (2)
CO3	L (1)	L (1)	M (2)	M (2)	S (3)
CO4	M (2)	S (3)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2.0**	**2.0**	**2.2**	**2.0**	**2.4**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER-III					
Core	**Course code 464301**	**GEOPHYSICS**	**T**	**Credits:4**	**Hours:4**

Unit-I

Objective 1	**To learn the basic concepts and introduction of various Geophysical Survey Methods.**

Introduction to Geophysics - Geological and geophysical investigations and its methods-Geophysical Survey and its various applications-Problem of ambiguity in geophysical interpretations - Principle, types, origin, instruments, field procedure and interpretations of Self Potential, Resistivity and Induced Polarization methods - A brief account on the application of electrical methods in mineral and petroleum exploration - Electrical well logging techniques.

Outcome 1	**Leaners understand the basic concept of geophysics and its various methods.**	**K2**

Unit-II

Objective 2	**To understand the Gravity survey and its properties.**

Geodesy of the earth - The earth's gravitational field - Density of rocks, Principles of gravity and measurements – Gravity Instruments – Gravity data processing Gravitational effects over subsurface Bodies of the different shapes-Gravity survey at land and sea – Interpretation of gravity data and depth problems -Brief account of density logging – Elastic properties of the earth materials.

Outcome 2	**Students discuss the gravity survey and its properties.**	**K4**

Unit-III

Objective 3	**To know the Seismic methods and its explorations techniques.**

Seismic methods - Seismic waves, Types of seismic waves and their propagation and characteristics - Snell"s law – Critical refraction – Instruments and field procedures for seismic refraction method -Corrections, Interpretation of data-Seismic reflection methods for oil exploration - Equipment for seismic reflection –Problems in the seismic survey-An outline of sonic logging-Time and depth sections.

Outcome 3	**Students understand the various seismic methods and applications**	**K3**

Unit-IV

Objective 4	**To grasp the knowledge of magnetic methods and its interpretation.**

Magnetic methods - Basic concepts and principles of magnetic prospecting - Magnetism of the earth and paleomagnetism-Field instruments for magnetic measurement, Magnetic susceptibility of rocks and effects of the simple shapes-Magnetic survey on land and ocean-Processing and interpretation of the magnetic data-Air-borne magnetic survey.

Outcome 4	**Learns acquire the knowledge of magnetic survey and itsinterpretation.**	**K4**

Unit-V

Objective 5	**To learn the Radioactive Methods and its applications.**

Radioactive methods – Introduction of Radioactive Methods-Principles of radioactive prospecting. Radioactive decay, the radioactivity of rocks and minerals-Instruments, field procedure and interpretations employed in radioactive survey-Application of radiometric methods, brief account of radiometric logging methods and their applications.

Outcome 5	**Learners critically evaluate the different radioactive methods and its Applications.**	**K3**

Suggested Readings:

Kearey, P., Brooks, M. (1984). An Introduction to Geophysical Exploration- ELBS.Lowire,W. (1997).-Fundamentals of Geophysics. Cambridge Lowprice Editions.
Mussett, A.E., Khan, M.A. (2000). Looking into the Earth: An introduction to GeologicalGeophysics. Cambridge university Press, New delhi.493pp.
Philip, K., Michael, B., Ian, H. (2003). An introduction to Geophysical exploration Ramachandra, R. M.B. (1993). Outline of Geophysical Prospecting EBD, Dhanbad. 400pp.Robinson.E.S. and Coruh.C.(2002)-Basic Exploration Geophysics–John Wiley.
Telford, W.M.,Geldart, L.P.,Sheriff, R.E.,(1990). Applied Geophysics.2nded. Cambridge University Press, New Delhi.760pp.

Online Resources:

https://ocw.mit.edu/courses/12-201-essentials-of-geophysics-fall-2004/pages/lecture-notes/
https://ocw.mit.edu/courses/12-201-essentials-of-geophysics-fall-2004/
https://www.freebookcentre.net/physics-books-download/Introduction-to-Geophysics- Lecture-Notes.html

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Creat*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Specific Outcomes

464301 - GEOPHYSICS										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	L(1)	M(2)	M(2)	S(3)	S(3)	M(2)	M(2)	S(3)	L(1)	M(2)
CO-4	L(1)	L(1)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	L(1)	L(1)
CO-5	M(2)	S(3)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**1.8**	**2.2**	**2.6**	**2**	**3**	**1.4**	**1.6**	**2**	**1.8**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	M (2)	M (2)	M (2)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER-III					
Core	**Course code: 464302**	**REMOTE SENSING AND GIS**	**T**	**Credits:4**	**Hours:4**

Unit: I		
Objective 1	**To learn the three dimensional coordinates of objects on the ground, detect and identify objects on the ground.**	
Principles of Photogrammetry, types of Aerial photographs, Properties of aerial photos, and Photographic scale. Flight planning, Parallax relief displacement and vertical exaggeration. Stereoscopy and tereoscopes.Aerial Photo stereoscopes mosaics.		
Outcome 1	**Learners acquire knowledge on aerial photographs and stereoscopes**	**K3**
Unit: II		
Objective 2	**Obtain information about earth objects and monitor changes to the Earth's surface over time.**	
Introduction to Remote sensing, Electro Magnetic Radiation and spectrum; electromagnetic bands in remote sensing; Spectral signatures of soil, rock, Water and vegetation; EMR interaction with Atmospheric window. Spectral reflectance of earth objects and land covers. Interpretation keys and elements.		
Outcome 2	**Acquire knowledge on EMR interact with earth features**	**K2**
Unit: III		
Objective 3	**To learn about the different satellite information, image processing and image classification**	
Satellite data acquisition, Resolution (Spectral, Spatial, Temporal and Radiometric). Platforms–Sensors–scanning and orbiting mechanics of satellite data – LANDSAT, IRS and SPOT series of satellites – Thermal, near-infrared and Microwave Remote Sensing – digital image processing; High-resolution satellites (IKONOS, Quick Bird) - Remote sensing Development in India- Image Classification (Supervised and Unsupervised).		
Outcome 3	**Learners acquire knowledge on different country satellites and satellitedata classifications**	**K3**
Unit: IV		
Objective 4	**To learn about Collect, store, and manage spatial data. Analyze spatial data. Display spatial data. Link spatial data to non-spatial data. Share spatial data.**	
Basic of GIS – definition, components of GIS, Data structure – Point, Line, and Polygon. Data basic structures-Raster and vector data structure. Data conversion (Vector to raster; raster to vector). Sources of data, Different types of data entry methods. Linking of spatial and non-spatial data. Data outputs (Types of output).		
Outcome 4	**Learners acquire knowledge on Geographic Information System**	**K4**
Unit: V		
Objective 5	**Understand the concepts of DEM, DTM and GPS.**	
Data analysis – DEM and DTM (Contour, shaded relief map, slope, line of sight, drainage analysis, volume estimation, usefulness of DEM). GPS- Basic, control and user segments. Signal components-error in GPS observation.GPS positioning, differential GPS, Real-Time Kinematic (RTK) NavigationSystem and GPS Mapping.		
Outcome 5	**Learners acquire knowledge on Digital Elevation Model, Digital Terrain Model and Global Positioning System**	**K2**

Suggested Readings:

Burrough, P.A. ,Mc Donnell,R.,& Lloyd,C.D.(2015). *Principles of geographical information systems (3rded.).* New York: Oxford University Press.

Chandra, A.M., & Ghosh, S.K.(2015). *Remote sensing and geographic information system* (2nded.).New Delhi: Narosa Publishing House.

Dwivedi,R.S.,& Roy,P.S.(2016). *Geospatial technology: For integrated natural resources management*. Chennai, Tamil Nadu, India: Yes Dee Publishing Pvt.

Elangovan, K.(2006).*GIS; Fundamentals Application and Implementations*. New Delhi: New India Publishing Agency.

Jain, A.K.(2015). *Fundamentals of digital image processing*. Noida: Pearson India Education ServicesPvt.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Specific Outcomes

464302 - REMOTE SENSING AND GIS										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	L(1)	M(2)	M(2)	S(3)	S(3)	M(2)	M(2)	S(3)	L(1)	M(2)
CO-4	L(1)	L(1)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	L(1)	L(1)
CO-5	M(2)	S(3)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**1.8**	**2.2**	**2.6**	**2**	**3**	**1.4**	**1.6**	**2**	**1.8**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	M (2)	M (2)	M (2)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER-III					
Core	**Course code: 464303**	**HYDROGEOLOGY**	**T**	**Credits: 4**	**Hours:4**
Unit-I					
Objective 1	**To know the basic terminology of hydrology**				
Hydrological cycle, origin and occurrence of groundwater, Vertical distribution of groundwater. Aquifer– Definition types of the aquifer, water yielding properties of Rocks – Porosity, void ratio, Permeability, Specific Yield, Specific Retention, Transmissibility, Hydraulic conductivity andranges in representative.					
Outcome 1	**Student will Know the basic terminology of hydrology**				**K2**
Unit-II					
Objective 2	**To Learn the groundwater Recharge methods and seawater intrusion**				
Groundwater Recharge methods – Spreading, Flooding, Irrigation, Pit, Recharge well, Watershed and management. Rainwater harvesting, Seawater intrusion –Physical and other characteristics of seawater intrusion within the coastal basin and Islands Recognition of seawater intrusion–Preventionand control of seawater intrusion.					
Outcome 2	**Absorb the groundwater Recharge methods and seawater intrusion**				**K4**
Unit III					
Objective 3	**To understand the various methods of pump test**				
Pump test – Methodology and necessity for pumping test. Pump testing in non-flowing wells- constant discharge test, constant drawdown test, step draw down test pump test in flowing wells-Theims, Jacob's and chow's methods. Groundwater provinces of India.					
Outcome 3	**Learners Understood the various methods of pump test**				**K4**
Unit IV					
Objective 4	**To grasp the techniques of groundwater exploration**				
Hydrological exploration–Study of the water table, surface water bodies, springs and seepages. Geophysical exploration methods-Electrical Resistivity -Wenner and Schlumberger – Depth sounding curving, cumulative curving and inverse slope methods of interpretation. Drilling techniques and well construction, Resistivity well logging, self-potential logging.					
Outcome 4	**Learners Grasped the techniques of groundwater exploration**				**K2**
Unit V					
Objective 5	**To learn the groundwater quality and management**				
Groundwater Quality-major ions, trace elements and Isotope applications. Water pollution, types of pollution and controlling methods, water purification					
Outcome 5	**Learned the groundwater quality and management.**				**K5**

Suggested Readings::

Chahar, B. R. (2015). Groundwater hydrology. New Delhi: McGraw Hill.Chaturvedi,M. C.(2012).India'swaters. BocaRaton,FL: CRCPress.
Chidambaram,S.(2018). Groundwater: Hydrogeochemical investigations of using integrated technique.New Delhi: My Research Publications.
Davie, T., & Quinn, N. W. (2019). Fundamentals of hydrology. London: Routledge. Grughanam, B. (2009). Essentials of Hydrogeology, New Delhi, New India Publishing Agency.Healy, R.W. (2017). Estimating Ground Water Recharge, Cambridge, Cambridge Univ. Press Manahan,S.E. (2011).Water chemistry: Greenscience and technology of nature's most
L., Sharma K. K., (2018). Principles of Pharmacology, Paras medical
publisher (ed.).

Suggested Readings

Brownlow, A.H. (1996). Geochemistry. Upper Saddle River, NJ: Prentice Hall. Drever,J.I.(2002).The geochemistry of natural waters: Surface and groundwater environments.Upper Saddle River, NJ: Prentice Hall.
Faure,G.(1986).Principles of isotope geology. New York: Wiley.
Mason, B. (1966).Principles of geochemistry. New York: J.Wiley & Sons.
Misra. (2011).Introduction to Geochemistry; Principles and Applications. Cambridge UniversityPress.
Rabindra, H.N. (2011).Geochemical analysis: Cbs & Distribu.
Winter, J.D. (2001).An introduction to igneous and metamorphic
petrology. Upper Saddle River,NJ: Prentice Hall.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464303 - HYDROGEOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	H(3)	H(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	H(3)	M(2)
CO-2	H(3)	M(2)	H(3)	S(1)	S(1)	M(2)	M(2)	M(2)	M(2)	S(1)
CO-3	H(3)	M(2)	M(2)	M(2)	M(2)	H(3)	S(1)	S(1)	S(1)	M(2)
CO-4	H(3)	S(1)	S(1)	S(1)	S(1)	M(2)	S(1)	M(2)	H(3)	S(1)
CO-5	H(3)	H(3)	S(1)	S(1)	M(2)	S(1)	H(3)	S(1)	M(2)	S(1)
W.AV	**H(3)**	**2.2**	**1.8**	**1.4**	**1.6**	**2**	**1.8**	**1.6**	**2.2**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	H(3)	H(3)	M(2)	M(2)	M(2)
CO-2	H(3)	M(2)	H(3)	S(1)	S(1)
CO-3	H(3)	M(2)	M(2)	M(2)	M(2)
CO-4	H(3)	S(1)	S(1)	S(1)	S(1)
CO-5	H(3)	H(3)	S(1)	S(1)	M(2)
W.AV	**3**	**2.2**	**1.8**	**1.4**	**1.6**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER –III					
Core	**Course code: 464304**	**GEOCHEMISTRY**	**T**	**Credits:4**	**Hours:4**
Unit - I					
Objective 1	**To know the geochemical structure and its compositions**				
Geochemical structure and composition of earth, Geochemical distribution of elements in the geosphere, Geochemical affinity, and Geochemical classification of elements. Geochemistry of geosphere, lithosphere, hydrosphere, biosphere and atmosphere. Geochemical cycle, Geochemical mobility of ions.					
Outcome 1	**Student will Know the geochemical structure and its compositions**				**K3**
Unit - II					
Objective 2	**To understand mineral geochemistry and its components**				
Mineral stability, compositional changes in minerals, Geochemistry of River Water, seawater, seafloor hydrothermal systems, groundwater and lakes. Characteristics of magma, melting of rocks, water in magmas Eutectic melting point. Distribution of trace components between rocksand melts. Geochemical Keys and pathfinder elements.					
Outcome 2	**Understand mineral geochemistry and its components**				**K2**
Unit - III					
Objective 3	**To learn the Isotope geochemistry**				
Isotope geochemistry – Radioactive Decay, Determining Isotope, Decay time, Potassium-Argon systematics, Uranium – Thorium – Lead systematics, Types of Isotopes–Fractionation, Isotope exchange between minerals and water. Carbon, Oxygen and Sulphur Isotopes, First-order decayand grow the equation.					
Outcome 3	**Learn the Isotope geochemistry and Types**				**K4**
Unit - IV					
Objective 4	**To grasp the geo chemical sampling and exploration**				
Exploration geochemistry – Primary and Secondary dispersion pattern – background values. Geochemical anomaly – Geochemical sampling. Principles and techniques used in the design and implementation of geochemical exploration survey.					
Outcome 4	**Grasp the geochemical exploration and sampling**				**K2**
Unit - V					
Objective 5	**To absorb the Environmental geochemistry**				
Environmental geochemistry –Atmosphere aquatic environment – Marine, fluvial, lacustrine and Aerosol. Litho-geochemical, Hydro-geochemical and Bio- geochemical survey. Geochemical Instrumentation.					
Outcome 5	**Absorb the Environmental geochemistry**				**K3**

Suggested Readings

Brownlow, A.H. (1996). Geochemistry. Upper Saddle River, NJ: Prentice Hall. Drever,J.I.(2002).The geochemistry of natural waters: Surface and groundwater environments.Upper Saddle River, NJ: Prentice Hall.

Faure,G.(1986).Principles of isotope geology. New York: Wiley.

Mason, B. (1966).Principles of geochemistry. New York: J.Wiley & Sons.

Misra. (2011).Introduction to Geochemistry; Principles and Applications. Cambridge UniversityPress.

Rabindra, H.N. (2011).Geochemical analysis: Cbs & Distribu.

Winter, J.D. (2001).An introduction to igneous and metamorphic petrology. Upper Saddle River,NJ: Prentice Hall.

Online Resources:

https://www.amazon.in/Geochemistry-William-M-White/dp/0470656689.

https://www.geokniga.org/bookfiles/geokniga-introduction-geochemistry-principles-and-applications.pdf.

https://www.irsm.cas.cz/materialy/oddeleni/2/Geochemistry-book.pdf.

https://recordcenter.sgc.gov.co/B23/662_19MemExPl_373_Las_Acacias/Documento/pdf/Anexo1_InveRecoBibl/Mason%20(1952).%20Principles%20of%20geochemistry.pdf.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Creat*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464304 - GEOCHEMISTRY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	M(2)	H(3)	H(3)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	S(1)	S(1)	H(3)	S(1)	M(2)	M(2)	S(1)	S(1)	M(2)	M(2)
CO-3	M(2)	H(3)	H(3)	M(2)	H(3)	S(1)	M(2)	M(2)	H(3)	S(1)
CO-4	M(2)	S(1)	H(3)	S(1)	M(2)	S(1)	S(1)	S(1)	M(2)	S(1)
CO-5	M(2)	S(1)	H(3)	S(1)	S(1)	H(3)	S(1)	M(2)	S(1)	H(3)
W.AV	**1.8**	**1.8**	**3**	**1.4**	**2**	**1.8**	**1.4**	**1.6**	**2**	**1.8**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	M(2)	H(3)	H(3)	M(2)	M(2)
CO-2	S(1)	H(3)	H(3)	S(1)	M(2)
CO-3	M(2)	H(3)	H(3)	M(2)	H(3)
CO-4	M(2)	H(3)	H(3)	S(1)	M(2)
CO-5	M(2)	H(3)	H(3)	S(1)	S(1)
W.AV	**1.8**	**3**	**3**	**1.4**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER –III					
Core	**Course code: 464305**	**PRACTICAL - III-REMOTESENSING AND HYDROGEOLOGY**	**P**	**Credits: 4**	**Hours: 8**
Objective	Understand about aerial photographs, black and white images and false color multi-band imagery. Map drainage systems and watersheds. Target groundwater in hard rock aquifer systems using remote sensing. Conduct resistivity surveys and interpret the results for groundwater Targeting. Map areas of salt water intrusion from resistivity data. Map groundwater suitability for drinking, agriculture, and industrial purposes. Use remote sensing and GIS for artificial recharge.				
1	Interpretation of Aerial Photographs (Stereovision).				
2	Study of various Visual Remote sensing Equipment's.				
3	Interpretation of Black & White and False color Multi-Band Imagery.				
4	Preparation of Histogram generation for raw satellite data and plot cumulative frequency curve.				
5	Stretch the rectified range of digital number given raw satellite data using the linear stretching Method.				
6	Generation of the non-spatial database with Unique-Id and Linking of Spatial and Non Spatial Data.				
7	Mapping of structural trend lines and folds using raw & digitally processed satellite images				
8	Drainage mapping and watershed delineation and codification.				
9	Groundwater targeting in hard rock aquifer systems using remote sensing.				
10	Hydro-geomorphic mapping.				
11	Resistivity survey and interpretation for groundwater targeting.				
12	Working out Transmissivity, permeability and storage co-efficient using Teim, Theis, Jacob and Walton methods.				
13	Mapping of areas of salt water intrusion from resistivity data.				
14	Mapping of groundwater suitability for drinking, agriculture and industrial purpose.				
15	Remote Sensing and GIS for artificial recharge.				
Outcome	**Learner's ability to use stereovision to interpret aerial photographs, black and white andfalse color multi-band imagery. This will allow you to identify different features on the Earth's surface from satellite images.**				

Suggested Readings:

Burrough, P.A. , Mc Donnell,R.,& Lloyd,C.D.(2015). Principles of geographical information systems (3rded.). NewYork: Oxford University Press.

Chandra, A.M., & Ghosh, S.K.(2015). Remote sensing and geographic information system (2nded.).New Delhi: Narosa Publishing House.

Chahar, B. R. (2015). Groundwater hydrology. New Delhi: McGraw Hill. Chaturvedi, M. C. (2012). India's waters. Boca Raton, FL: CRC Press.

Chidambaram, S. (2018). Groundwater: Hydro-geochemical investigations of using integrated technique. New Delhi: My Research Publications.

Davie, T., & Quinn, N. W. (2019). Fundamentals of hydrology. London: Routledge.

Online Resources:

https://gis-lab.info/docs/books/aerial-mapping/cr1557_15.pdf

https://kanchiuniv.ac.in/coursematerials/REMOTE_SENSING_GIS.pdf

https://www.earthdata.nasa.gov/learn/backgrounders/remote-sensing https://geol260.academic.wlu.edu/course-notes/

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464305 - PRACTICAL - III-REMOTESENSING AND HYDROGEOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	L(1)	M(2)	M(2)	S(3)	S(3)	M(2)	M(2)	S(3)	L(1)	M(2)
CO-4	L(1)	L(1)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	L(1)	L(1)
CO-5	M(2)	S(3)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**1.8**	**2.2**	**2.6**	**2**	**3**	**1.4**	**1.6**	**2**	**1.8**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	M (2)	M (2)	M (2)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

DSE-III					
DSE - 3	**Course code: 464503**	**PETROLEUM GEOLOGY**	**T**	**Credits: 3**	**Hours: 3**

Unit - I

Objective 1	**To know the principles of petroleum and its forms.**	
Petroleum – Composition, Origin – Inorganic and organic theories. Generation, Migration and Accumulation of oil and gas. Reservoir rocks, Porosity and Permeability. Structural, stratigraphic and combination traps. Geo Technical order (GTO), Petroleum basins in India.		
Outcome 1	**Student will know about the origin of petroleum and natural gas.**	**K2**

Unit - II

Objective 2	**To understand the hydrocarbon and its reservoir management.**	
Reservoir pressure measurement and its significance, Geothermal gradients and its measurements, Recovery of hydrocarbon and reservoir management. Source and effects of heat energy.		
Outcome 2	**Understand the reservoir management**	**K3**

Unit - III

Objective 3	**To learn the various type of exploration in Hydrocarbon**	
Geophysical exploration – Seismic Refraction and Reflection method – Processing of Seismic data– Migration, Seismic interpretation – Interpretation of geology from data, VSP (Vertical SeismicProfile) data acquisition, Gravity and Magnetic exploration methods.		
Outcome 3	**Learn the Geophysical exploration**	**K2**

Unit - IV

Objective 4	**To grasp the Hydrocarbon origin and occurrence**	
Carbon cycle, Origin, Composition and structure of organic matter, accumulation of organic matter and generation of Hydrocarbon. Optical and geochemical methods for source rock characterization and maturation assessment.		
Outcome 4	**Students grasp the Hydrocarbon origin and occurrence**	**K1**

Unit - V

Objective 5	**To absorb the various techniques and drilling methods**	
Well site Geological techniques, Drilling methods, well planning, classification and selection of Drilling pits. Monitoring of drilling wells. Exploration policy and project Management of oilwells.		
Outcome 5	**Absorb the various techniques and drilling methods**	**K2**

Suggested Readings:

Chandra, D., Singh, R. M., & Singh, M. P. (2000). Text Book of Coal (Indian Context). Varanasi:Tara Printing Works.

Glick, D. C., & Taylor, G. H. (1998). Organic petrology: a new handbook incorporating some revised parts of Stachs Text book of coal petrology; with70 tables In the text. Berlin: Borntraeger.Levorsen,A.

I.(2004).Geology of petroleum (2nded.).New Delhi: CBS Publication.

Russel,F.(2012).Petroleum geology & petrography. Nottingham: Auris Reference.

Selley, R.C. (2016).Elements of petroleum geology (2nded.).New Delhi: Academic Press.

Online Resources

https://raregeologybooks.files.wordpress.com/2014/10/elements-of-petroleum-geology.pdf.

https://www.geokniga.org/bookfiles/geokniga-basicpetroleumgeologybypeterlinkz- liborg.pdf.

https://www.researchgate.net/publication/266321762_Petroleum_geology.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Created*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464503 - PETROLEUM GEOLOGY										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	M(2)	H(3)	H(3)	H(3)	M(2)	H(3)	M(2)	H(3)	M(2)	H(3)
CO-2	H(3)	S(1)	H(3)	H(3)	M(2)	H(3)	S(1)	M(2)	M(2)	M(2)
CO-3	H(3)	H(3)	M(2)	H(3)	S(1)	H(3)	M(2)	S(1)	S(1)	S(1)
CO-4	H(3)	S(1)	M(2)	H(3)	S(1)	H(3)	S(1)	S(1)	M(2)	H(3)
CO-5	H(3)	S(1)	M(2)	H(3)	H(3)	H(3)	M(2)	M(2)	S(1)	M(2)
W.AV	**2.8**	**1.8**	**2.4**	**3**	**1.8**	**3**	**1.6**	**1.8**	**1.6**	**2.2**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	M(2)	H(3)	H(3)	H(3)	M(2)
CO-2	H(3)	S(1)	H(3)	H(3)	M(2)
CO-3	H(3)	H(3)	M(2)	H(3)	S(1)
CO-4	H(3)	S(1)	M(2)	H(3)	S(1)
CO-5	H(3)	S(1)	M(2)	H(3)	H(3)
W.AV	**2.8**	**1.8**	**2.4**	**3**	**1.8**

S-Strong (3), M-Medium (2), L-Low (1)

DSE-IV					
DSE - 4	**Course code: 464504**	**DISASTER RISK REDUCTION**	**T**	**Credits:3**	**Hours:3**

Unit-I		
Objective 1	**To know the various types of disaster.**	
Introduction to Disaster - Natural Disaster, Vulnerability, Resilience, Risks- Disasters: Types ofdisasters - Earthquake, Landslide, Flood, Drought, Volcanic eruption, Cyclone, Cloud burst, Manmade disasters- CBRN- Chemical disasters, biological disasters, radiological disasters, nuclear disasters. Fire-building fire, coal fire, forest fire, Oil fire– Disaster Cycle stages-Disaster event, Disaster Response, Recovery.		
Outcome 1	**Student will know the various types of disaster**	**K3**

Unit-II		
Objective 2	**To understand the disaster risk reduction and management**	
Disaster cycle - Prevention, mitigation and preparedness community-based Disaster RiskReduction. Roles and responsibilities of- community, Panchayat Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre.		
Outcome 2	**Students understand the disaster risk reduction and management**	**K4**

Unit-III		
Objective 3	**To learn the vulnerabilities factors and impacts.**	
Impacts and assessments: Factors affecting Vulnerabilities, differential impacts, the impact of development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- Scenarios in the context of India - Relevance of indigenous knowledge, appropriatetechnology and local resources.		
Outcome 3	**Students learn the vulnerabilities factors and impacts**	**K2**

Unit-IV		
Objective 4	**To grasp the disaster relief and damage assessments**	
Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements - Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.		
Outcome 4	**Students will be able to grasp the disaster relief and damage assessments**	**K4**

Unit-V		
Objective 5	**To emphasize the various case studies of disaster**	
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man-Made disasters: Case Studies, Space-Based Inputs for Disaster Mitigation and Management and field work related to disaster management.		
Outcome 5	**Students will get the knowledge of the various case studies of disaster**	**K2**

Suggested Readings:

Agardy, T. (Ed.). (1994). The science of conservation in the coastal zone, new insights on how todesigner, implements and monitor marine protected areas (Vol. 8). Switzerland: A marine conservation and development report. IUCN, Gland.

Burby, R. J. (1999). Cooperating with nature: Confronting natural hazards with land-use planningfor sustainable communities. Boulder, CO: Net Library.

Gamble, J. K. (1977). Law of the sea. Inference outcomes and problems of implementation (E.Miles, Ed.). Ballinger: Cambridge Mass.

Godschalk, D. R. (2005). Natural hazard mitigation: Recasting disaster policy and planning.Washington, DC: Island Press.

Groman, J. (2002). The Atlas of Natural Disasters. Friedman/Fairfa Publishing.

Gubbay, S. (1995). Marine protected areas: Principles and techniques for management. London:Chapman & Hall.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Creat*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464504 - DISASTER RISK REDUCTION										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	M(2)	S(3)	S(3)	M(2)	L(1)	M(2)	S(3)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	M(2)	L(1)	M(2)	M(2)	L(1)
CO-3	L(1)	M(2)	M(2)	M(2)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)
CO-4	L(1)	S(3)	L(1)	L(1)	L(1)	L(1)	M(2)	M(2)	M(2)	S(3)
CO-5	M(2)	M(2)	M(2)	S(3)	M(2)	L(1)	S(3)	L(1)	L(1)	L(1)
W.AV	**1.8**	**2.4**	**2.0**	**2.2**	**2.2**	**1.8**	**1.8**	**2.0**	**2.0**	**1.8**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	M (2)	M (2)	S (3)	M (2)
CO2	S (3)	M (2)	M (2)	M (2)	S (3)
CO3	M (2)	L (1)	M (2)	L (1)	L (1)
CO4	M (2)	S (3)	S (3)	M (2)	S (3)
CO5	L (1)	M (2)	L (1)	M (2)	M (2)
W.AV	**2.2**	**2.0**	**2.0**	**2.0**	**2.2**

S-Strong (3), M-Medium (2), L-Low (1)

DSE-V					
DSE - 5	**Course Code: 464505**	**BASICS OF REMOTESENSING AND GIS**	**T**	**Credits:3**	**Hours:3**

Unit-I		
Objective 1	**To learn the three dimensional coordinates of objects on the ground, detect and identify objects on the ground.**	
Principles of Photogrammetric, types of Aerial photographs, Properties of aerial photos, and Photographic scale. Flight planning, Parallax relief displacement and vertical exaggeration.Stereoscopy and stereoscopes.		
Outcome 1	**Learners acquire knowledge on aerial photographs and stereoscopes**	**K3**
Unit-II		
Objective 2	**Obtain information about earth objects and monitor changes to the Earth's surface over time.**	
Introduction to Remote sensing and its components– Principles of Remote sensing- Electro Magnetic Radiation and spectrum, Spectral signatures of soil, rock, water and vegetation; EMR interaction with Atmosphere and Earth objects. Visual Interpretation keys and elements.		
Outcome 2	**Acquire knowledge on EMR interact with earth features**	**K2**
Unit-III		
Objective 3	**To learn about the different satellite information, image processing and image classification**	
Satellite data acquisition, Resolution (Spectral, Spatial, Temporal and Radiometric). Platforms– Sensors– scanning and orbiting mechanics of satellite data–LANDSAT, IRS and SPOT series of satellites–Thermal, near-infrared and Microwave Remote Sensing–High-resolution satellites (IKONOS, Quick Bird) – Remote Sensing development in India		
Outcome 3	**Learners acquire knowledge on different country satellites and satellite data classifications**	**K4**
Unit-IV		
Objective 4	**To learn about Collect, store, and manage spatial data. Analyze spatial data.Display spatial data. Link spatial data to non-spatial data. Share spatial data.**	
Basic of GIS–definition, components of GIS, Data structure-Point, Line, Polygon. Data basic structures-Raster and vector data structure. Data conversion (Vector to raster; raster to vector). Sources of data, Different types of data entry methods.		
Outcome 4	**Learners acquire knowledge on Geographic Information System**	**K3**
Unit-V		
Objective 5	**Understand the concepts of DEM, DTM and GPS.**	
Data analysis–Digital Elevation Model-on tour, shaded relief map, slope, drainage analysis. GPS-Basic, control and user segments. Signal components– error in GPS observation. GPSMapping.		
Outcome 5	**Learners acquire knowledge on Digital Elevation Model, Digital Terrain Model and Global Positioning System**	**K4**

Suggested Readings

Burrough, P.A. ,Mc Donnell,R.,& Lloyd,C.D.(2015). Principles of geographical information systems(3rded.). New York: Oxford University Press.

Chandra, A.M., & Ghosh, S.K.(2015). Remote sensing and geographic information system2nded.).New Delhi: Narosa Publishing House.

Dwivedi, R.S., & Roy,P.S.(2016). Geospatial technology: For integrated natural resourcesmanagement. Chennai, Tamil Nadu, India: Yes Dee Publishing Pvt.

Elangovan, K.(2006).GIS; Fundamentals Application and Implementations. New Delhi: New IndiaPublishing Agency.

Jain, A.K.(2015). Fundamentals of digital image processing. Noida: Pearson India Education ServicesPvt

Online Resources

https://gis-lab.info/docs/books/aerial-mapping/cr1557_15.pdf
https://kanchiuniv.ac.in/coursematerials/REMOTE_SENSING_GIS.pdf
https://www.earthdata.nasa.gov/learn/backgrounders/remote-sensing
https://geol260.academic.wlu.edu/course-notes/
https://kanchiuniv.ac.in/coursematerials/Dr_K_Anitha_Course%20Material_Remote%20Sensing% 20and%20GIS.pdf

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464505 - BASICS OF REMOTESENSING AND GIS

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	L(1)	M(2)	M(2)	S(3)	S(3)	M(2)	M(2)	S(3)	L(1)	M(2)
CO-4	L(1)	L(1)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	L(1)	L(1)
CO-5	M(2)	S(3)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**1.8**	**2.2**	**2.6**	**2**	**3**	**1.4**	**1.6**	**2**	**1.8**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	M (2)	M (2)	M (2)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	L (1)	M (2)	L (1)	M (2)	M (2)
W.AV	**2.2**	**2.0**	**2.0**	**2.0**	**2.2**

S-Strong (3), M-Medium (2), L-Low (1)

SEMESTER -IV					
Core	**Course code: 464999**	**DISSERTATION OR INTERNSHIP PROGRAM**	**V**	**Credits:15**	**Hours:30**

Dissertation:

Dissertation will be carried out by the student themselves with the interest of the student as well as the interest of the faculty with mutual understanding, expertise and interest. The students continuously evaluated the work carried out day to day for further events. Finally, the faculty will be instructed on how to write the dissertation with different components, topics and the material, text, and problems to be addressed in each assignment title. The dissertation will consist of an Introduction, Materials and Methods, Results and Discussion, Summary and Conclusion, and References. Of course, appropriate statistical tools must be followed for the assessment of data. Proper preparation of graphs, diagrams and flow charts must be included in the dissertation. The appendix may also be taken into consideration if necessary.

NON-MAJOR ELECTIVE -I					
NME - 1	**Course code: 464701**	**DISASTER MANAGEMENT AND MITIGATION**	**T**	**Credits:2**	**Hours:3**

Unit - 1		
Objective 1	**To educate the process of natural and man-made hazards.**	
Introduction to Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters– Earthquake, Landslide, Flood, Drought, Fire, etc ,Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial.		
Outcome 1	**The students evaluate the natural and manmade hazards.**	**K3**
Unit - II		
Objective 2	**To understand the mitigation and preparedness of different disasters**	
Disaster cycle-Prevention, mitigation and preparedness community-based Disaster Risk Reduction. Rolesand responsibilities of community, Panchayat Raj Institutions/Urban Local Bodies (PRIs/ULBs), States,Centre.		
Outcome 2	**Students should be able to learn the disaster mitigation and preparedness**	**K2**
Unit -III		
Objective 3	**To evaluate the recent disasters and its mitigation processes.**	
Factors affecting Vulnerabilities, differential impacts, the impact of development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.		
Outcome 3	**Students understand the recent disasters and its impact, mitigation processes.**	**K4**
Unit-IV		
Objective 4	**To understand the disaster relief**	
Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements - Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster– Disaster Damage Assessment.		
Outcome 4	**Learns acquire the knowledge of disaster relief**	**K3**
Unit-V		
Objective 5	**To learn the various disaster management organizations.**	
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Manmade disasters: Case Studies, Space - Based Inputs for Disaster Mitigation and Management and field work related to disaster management.		
Outcome 5	**Students may create the awareness about the natural hazards and its management processes.**	**K3**

Suggested Readings

Agardy, T. (Ed.). (1994). The science of conservation in the coastal zone, new insights on how to designer, implements and monitor marine protected areas (Vol.8).Switzerland: Amarine conservation and development report. IUCN, Gland.

Burby, R. J. (1999). Cooperating with nature: Confronting natural hazards with land-use planning for sustainable communities. Boulder, CO: Net Library.

Gamble, J. K. (1977). Law of the sea. Inference outcomes and problems of implementation (E. Miles,Ed.).Ballinger: Cambridge Mass.

Godschalk, D.R.(2005).Natural hazard mitigation: Recasting disaster policy and planning.Washington, DC: Island Press.

Groman,J.(2002).TheAtlasofNaturalDisasters.Friedman/FairfaPublishing.

Gubbay, S. (1995). Marine protected areas: Principles and techniques for management. London: Chapman& Hall.

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464701 - DISASTER MANAGEMENT AND MITIGATION										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	S(3)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	M(2)	L(1)	M(2)	S(3)	M(2)	S(3)	M(2)	S(3)	L(1)	M(2)
CO-4	S(3)	L(1)	S(3)	M(2)	S(3)	M(2)	L(1)	M(2)	M(2)	L(1)
CO-5	L(1)	M(2)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**2.2**	**1.8**	**2.6**	**2.2**	**2.4**	**1.8**	**1.8**	**2**	**2.2**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	L (1)	M (2)	L (1)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO5	M (2)	L (1)	S (3)	L (1)	M (2)
W.AV	**2**	**1.8**	**2**	**1.8**	**2**

S-Strong (3), M-Medium (2), L-Low (1)

NONMAJOR ELECTIVE -II					
NME - 2	**Course code: 464702**	**REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS**	**T**	**Credits:2**	**Hours:3**

Unit-I		
Objective 1	**To learn the three dimensional coordinates of objects on the ground, detect and identify objects on the ground.**	
Principles of Photogrammetric, types of Aerial photographs, Properties of aerial photos, and Photographic scale. Flight planning, Parallax relief displacement and vertical exaggeration.Stereoscopy and stereoscopes.		
Outcome 1	**Learners acquire knowledge on aerial photographs and stereoscopes**	**K3**
Unit-II		
Objective 2	**Obtain information about earth objects and monitor changes to the Earth's surface over time.**	
Introduction to Remote sensing and its components– Principles of Remote sensing- Electro Magnetic Radiation and spectrum, Spectral signatures of soil, rock, water and vegetation; EMRinteraction with Atmosphere and Earth objects. Visual Interpretation keys and elements.		
Outcome 2	**Acquire knowledge on EMR interact with earth features**	**K4**
Unit-III		
Objective 3	**To learn about the different satellite information, image processing and image classification**	
Satellite data acquisition, Resolution (Spectral, Spatial, Temporal and Radiometric). Platforms- Sensors–scanning and orbiting mechanics of satellite data–LANDSAT, IRS and SPOT series of satellites–Thermal, near-infrared and Microwave Remote Sensing–High-resolution satellites (IKONOS, Quick Bird) – Remote Sensing development in India		
Outcome 3	**Learners acquire knowledge on different country satellites and satellite data classifications**	**K3**
Unit-IV		
Objective 4	**To learn about Collect, store, and manage spatial data. Analyze spatial Data. Display spatial data. Link spatial data to non-spatial data. Share spatial data.**	
Basic of GIS–definition, components of GIS, Data structure-Point, Line, Polygon. Data basic structures-Raster and vector data structure. Data conversion (Vector to raster; raster to vector). Sources of data, Different types of data entry methods.		
Outcome 4	**Learners acquire knowledge on Geographic Information System**	**K2**
Unit-V		
Objective 5	**Understand the concepts of DEM, DTM and GPS.**	
Data analysis–Digital Elevation Model-on tour, shaded relief map, slope, drainage analysis. GPS-Basic, control and user segments. Signal components– error in GPS observation. GPS Mapping.		
Outcome 5	**Learners acquire knowledge on Digital Elevation Model, Digital Terrain Model and Global Positioning System**	**K3**

Suggested Readings

Burrough, P.A. ,Mc Donnell,R.,& Lloyd,C.D.(2015). Principles of geographical information systems(3rded.). New York: Oxford University Press.

Chandra, A.M., & Ghosh, S.K.(2015). Remote sensing and geographic information system(2nded.).New Delhi: Narosa Publishing House.

Dwivedi, R.S., &Roy,P.S.(2016). Geospatial technology: For integrated natural resources management.Chennai, Tamil Nadu, India: Yes Dee Publishing Pvt.

Elangovan, K.(2006).GIS; Fundamentals Application and Implementations. New Delhi: New IndiaPublishing Agency.

Jain, A.K.(2015). Fundamentals of digital image processing. Noida: Pearson India EducationServicesPvt

Online Resources

https://gis-lab.info/docs/books/aerial-mapping/cr1557_15.pdf
https://kanchiuniv.ac.in/coursematerials/REMOTE_SENSING_GIS.pdf
https://www.earthdata.nasa.gov/learn/backgrounders/remote-sensing
https://geol260.academic.wlu.edu/course-notes/
https://kanchiuniv.ac.in/coursematerials/Dr_K_Anitha_Course%20Material_Remote%20Sensing%20and%20GIS.pdf

K1-Remember	*K2-Understand*	*K3- Apply*	*K4-Analyze*	*K5-Evaluate*	*K6-Create*

Course designed by: Dr. K. Prabakaran

Course Outcome VS Programme Outcomes

464702 - REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	S(3)	M(2)	S(3)	M(2)	S(3)	M(2)	M(2)	M(2)	M(2)	M(2)
CO-2	M(2)	S(3)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	M(2)	L(1)
CO-3	L(1)	M(2)	M(2)	S(3)	S(3)	M(2)	M(2)	S(3)	L(1)	M(2)
CO-4	L(1)	L(1)	S(3)	M(2)	S(3)	L(1)	L(1)	M(2)	L(1)	L(1)
CO-5	M(2)	S(3)	M(2)	L(1)	S(3)	L(1)	M(2)	L(1)	S(3)	L(1)
W.AV	**1.8**	**2.2**	**2.6**	**2**	**3**	**1.4**	**1.6**	**2**	**1.8**	**1.4**

S-Strong (3), M-Medium (2), L-Low (1)

Course Outcome VS Programme Specific Outcomes

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S (3)	S (3)	L (1)	S (3)	L (1)
CO2	M (2)	M (2)	M (2)	M (2)	M (2)
CO3	M (2)	L (1)	M (2)	L (1)	M (2)
CO4	M (2)	M (2)	S (3)	M (2)	S (3)
CO-5	H(3)	S(1)	M(2)	H(3)	H(3)
W.AV	**2.8**	**1.8**	**2.4**	**3**	**1.8**

S-Strong (3), M-Medium (2), L-Low (1)