

(Affiliated Colleges)

209 - B. Sc. GEOLOGY

Programme Structure and Scheme of Examination (under TANSCHE) (Applicable to the candidates admitted in Affiliated Colleges from the academic year 2023 - 2024 onwards)

Credit Distribution for all courses with hours

First Year: Semester I

Course Code	Part	Study Components & Course Title	Credit	Hours/	Maximum Marks		
				Week	CIA	ESE	Total
		SEMESTER - I					
23UTAML11	1	Language - Tamil	3	6	25	75	100
23UENGL12	П	English	3	6	25	75	100
23UGEOC13		Core – I General Geology and Crystallography	5	5	25	75	100
23UGEOC14	III	Core – II Geo-statistics - I	5	5	25	75	100
23UMATE15 23UCHEE15		Elective – 1 Mathematics - I (Or) Chemistry for Physical Science– I	3	4	25	75	100
23UGEOS16	IV	Skill Enhancement Course – 1 (NME-I) Understanding the Earth	2	2	25	75	100
23UGEOF17	, IV	Foundation Course Rudiments of Geohazards	2	2	25	75	100
		Total	23	30			700
		SEMESTER - II					
23UTAML21	I	Language - Tamil	3	6	25	75	100
23UENGL22	П	English	3	6	25	75	100
23UGEOC23		Core – III Geo-statistics - II	5	4	25	75	100
23UGEOP24		Core – IV Crystallography and Paleontology Practical	3	4	25	75	100
23UMATE25 23UCHEE25	""	Elective – II Mathematics - II (Or) Chemistry for Physical Science– II	3	3	25	75	100
23UCHEEP1		Chemistry Practical for Physical science - I	2	3	25	75	100
23UGEOS27		Skill Enhancement Course – II (NME-II) Basics of Earth Science	2	2	25	75	100
23USECG	IV	Skill Enhancement Course – III Internet and its Applications (Common Paper)	2	2	25	75	100
		Total	23	30			800

								Ş	Marks		
Subject Code	Subject Name	Category	L	Т	P	S	Credits	Inst. Hours	CIA	External	Total
23UGEOC13	GENERAL GEOLOGY AND CRYSTALLOGRAPHY	Core	Y	-	-	-	5	5	25	75	100
	Course Obje	ctives									
CO1	The main objective of this course is to e		te th	e or	igin	of I	Earth				
CO2	To describe the concepts of Dating and i	nternal	stru	ctur	e of	the	Eart	h			
CO3	To explain various components of crysta	als and	crys	tallo	graj	ohy					
CO4	To study various class and forms of an	crystal :	syste	em.							
CO5	To determine various crystallographic p	ropertie	s of	crys	stals	wit	h sui	table	exar	nples.	
UNIT	Details							lour		Cou Objec	
I	Universe – Evolution of the Universe Milky Way Galaxy –Evolution of Galaxi Inner and outer planets – characterist Satellites – Asteroids – Meteors – movements – revolution – rotation – stime – GMT – IST. Atmosphere – Nydrosphere – lithosphere – Origin of and Planetesimal hypothesis – Tida hypothesis – merits and demerits of the	axy. So ics of so come solstice Monsoo the Earth above 1	lar S solar ets. – e n-El th – nwe hypo	Systomers System	em stem th ox no bula ker'	- n. - - - sr		12		CC) 1
II	Age of the Earth – old methods Radioactivity – Half-life period – Rad Uranium / Lead method – Rubidium / Lead / Lead method – Potassium/ method. Numerical methods in dating. – Density – Shape – Seismic waves thickness of the crust, mantle and co Conrad Discontinuity – Mohorovic Weichert-Guttenberg Discontinuity	liometri Strontiu Argon Interion – Com ore. Dis	ic m um r -Ca of of posi	ethonethor ethor ethe l tion tinu	ods nod n 1 Eart an ities	- 4 h d		12		CC)2
III	Definition of crystal – Unit cell, Bravais Lattices, Plane groups, Point groups & Space groups - Crystallographic axes – Symmetry Elements – Division of crystals into systems and Point groups – Axial Ratio – Parameters – Indices – Miller Indices – Symbol – Hermann Mauguin notations –Law of Rational Indices – Forms – simple – combination – open – closed – unit – holohedral – hemihedral – tetrahedral – hemimorphic – enantiomorphous forms – Interfacial angle and its measurement with Contact Goniometer. Types of Goniometers									CC	03
IV	Goniometers Study of common forms and combinations of the following systems and classes: Isometric System: Hexoctahedral, Diploidal, Hextetrahedral – Tetragonal System: Ditetragonal bipyramidal, Tetragonal bipyramidal, Tetragonal Pyramidal,									CC)4

	Tetragonal Sphenoidal – Hexagonal System: Dihexagonal Bipyramidal, Hexagonal Bipyramidal Trigonal System – Ditrigonal Scalenohedral - Ditrigonal pyramidal, Trirhombohedral, Trigonal trapezohedral.		
V	Study of common forms and combinations of the following systems and classes: Orthorhombic System: Rhombic Bipyramidal, Rhombic pyramidal, Rhombic Disphenoidal – Monoclinic System: Prismatic – Triclinic System: Pinacoidal – Twinning in crystals – laws of twinning – types: contact, interpenetration, polysynthetic, repeated – important examples from six systems – Irregularities of crystals-An introduction to stereographic projection.	12	CO5
	Total	60	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes.

The blooms taxonomy verbs will be given as a separate annexure for your reference.

Each course outcome should be mapped with the POs.

The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;						
CO1	Understand the origin of Galaxy, Our Solar System and Crystal Science	PO1					
CO2	Knowledge on Dating of Earth Age	PO1, PO2					
CO3	Correlate various Hypothesis on Origin of Earth	PO4, PO6					
CO4	Analyze the importance of Crystallography Studies	PO4, PO5, PO6					
CO5	Various Type minerals and their respective crystal system	PO3, PO8					
	Text Books (Latest Editions)						
1.	Mineralogy – Dexter Perkins (2014), 3rd edition, Pea Edition.	rson New International					
2.	Principles of Geomorphology; William D. Thornbury, (20 Distributors, New Delhi.	04) CBS Publishers and					
3.	3. Patwardhan, A.M., Dynamic Earth System, PrenticeHall, New Delhi(1999)						
4.	Mukherjee A.K, Principles of Geology, EW Press, KoIkata(1	990)					
5.	Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005						

References Books								
(Lat	(Latest editions, and the style as given below must be strictly adhered to)							
1.	Introduction to Mineralogy – William D. Nesse (2000), Oxford University press,							
1.	New York. USA.							
2.	Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers &							
۷.	Distributers, New Delhi.							
3.	Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons,							
٥.	England.							
4.	Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns							
4.	(1967), 2nd edition, Springer							
5.	Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)							
	Web Resources							
	"Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23							
1.	December 2005. Retrieved 2006-01-10.							
2	Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem							
2.	(mostly) solved". Special Publications, Geological Society of London.							
3.	Geo.libretexts.org							
4.	www.nationalgeographic.org							
5.	Solarsysytem.nasa.gov							

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding Lower level
- Apply and Analyze Medium Level
- Evaluate and Create Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	3	3	3	3	2	2	2	3

							Ş		Mark	KS .	
Subject Code	Subject Name	Cat		Т	P	s	Credits	Inst. Hours	CIA	External	Total
23UGEOC14	Geo-Statistics - I	Core	Y	-	-	-	5	5	25	75	100
	Course Obje	ctives									
CO1	The main objective of this course is to in	mportan	ce o	f sta	atist	ics i	n sci	ence.			
CO2	To describe the concepts of basic statist	ics									
CO3	To explain various components of adva	nced sta	itisti	cal	met	hod	S				
CO4	To study various graphical methods and										
CO5	To determine various correlation and reg Geology	gression	stu	dies	anc	l its	impo	rtanc	e in	the fiel	d of
UNIT	Details							lo. of lours		Cou Objec	
I	Definition and scope of statistics. Formation of Frequency Distrepresentation of data-Bar diagrams, Representation of data-Histogram, Ogives.	ribution Pie dia	-Dia gran	agra ns-(mm Grap	atic ohic		12		CC)1
II	Measures of Central Tendency-Arith Mode, Combined arithmetic mean-meri					ian,		12		CC)2
III	Measures of Dispersion- Absolute and Relative measures Range, Quartile deviation, Mean deviation, Standard deviation							12		CC)3
IV	Cure filling by the Method of Least square-Fitting straight line of the form $Y=ax+b$ and parabola $Y=ax^2+bx+c$ (Simple problems)							12		CC	04
V	Correlation-Karl person's coefficient of correlation, Rank correlation- Spearman's Rank correlation coefficient. Reregression-regression equation and their properties.							12		CC)5
	Total							60			

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The mapping of each CO can be done with any number of POs.

	Course Outcomes					
Course Outcomes	On completion of this course, students will;					
CO1	To describe the definition, scope, classification, tabulation, drawing diagrams and plotting graphs of Statistics through Geological information.	PO1				
CO2	To measure and interpret the various measures of averages using Geological data.	PO1, PO2				
CO3	To measure and interpret the various measures of dispersions using Geological data.	PO4, PO6				
CO4	To measure and interpret the relationship among the geological variables and to estimate and predict the unknown and future value through the regression lines using geological data.	PO4, PO5, PO6				
CO5	To fit the curve using geological data.	PO3, PO8				
	Text Books					
	(Latest Editions)	Gl. 1				
1.	Statistics – R.S.N. Pillai and V. Bhagavathi, Publications S. Chand.					
2.	Statistical Methods, Gupta, S.P. (2007): Sultan Chand & Sons Pvt Ltd, New Delhi, 35 th Revised Edition.					
3.	Statistics for Geoscientists - Marsal, D. Pergamon press, New York.					
4.	<i>Cline, Graysen (2019).</i> Nonparametric Statistical Methods Using 1-83947-325-8. OCLC 1132348139. Archived <i>from the original</i> Retrieved 2021-09-16.	g R. <i>EDTECH</i> . ISBN 978-				
5.	Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) In Concepts and Applications, pp. 5–9. West Group. ISBN 978-0-3					
	References Books					
•	test editions, and the style as given below must be strictly					
1. 2.	Statistics for Geoscientists - Marsal, D. Pergamon press, No Statistics - R.S.N. Pillai and V. Bhagavathi, Publications S					
3.	Statistical Methods, Gupta, S.P. (2007): Sultan Chand & Sons Revised Edition.					
4.	<i>Cline, Graysen (2019).</i> Nonparametric Statistical Methods Using 1-83947-325-8. OCLC 1132348139. Archived <i>from the original</i> Retrieved 2021-09-16.					
5.	5. Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. ISBN 978-0-314-03309-3					
	Web Resources					
1.	https://en.wikipedia.org/wiki/Statistics					
2.	http://onlinestatbook.com/2/introduction/descriptive.html					
3.	https://socialresearchmethods.net/kb/statdesc.php					
4.	https://en.wikipedia.org/wiki/Descriptive_statistics					
5.	Philosophy of Statistics from the Stanford Encyclopedia of Philo	osophy				

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- Remember and Understanding Lower level
- Apply and Analyze Medium Level
- Evaluate and Create Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	3	3	3	3	2	2	2	3

SEMESTER: I	23UMATE15	Credit: 3
PART: III	MATHEMATICS – I	Hours: 4

UNIT-I: SOLUTIONS OF TRANSCENDENTAL AND ALGEBRAIC EQUATIONS

Iteration method, Bisection method, Newton's method - Regula Falsi method, (without proof) (Simple problems only)

Unit-II: SOLUTIONS OF SIMULTANEOUS EQUATIONS

Gauss Elimination method- Gauss Jordan method-Gauss Seidel Iterative method-Gauss Jacobi method (Restricted to three variables only) (Simple problems only)

UNIT-III: MATRICES

Characteristic equation of a square matrix— Eigen values and eigen vectors — Cayley — Hamilton theorem [without proof] — Verification and computation of inverse matrix.

UNIT-IV: DIFFERENTIAL CALCULUS

n-th derivatives – Leibnitz theorem [without proof] and applications – Jacobians – Curvature and radius of curvature in Cartesian co-ordinates

UNIT-V: APPLICATION OF INTEGRATION

Evaluation of double – Simple applications to area,

TEXT BOOKS:

1. A.Singaravelu "Numerical Methods" Meenakshi Publications

Unit-I: Chapter 2

Unit-II: Chapter 2

2. P. Duraipandian and Dr. S. Udayabaskaran. 1997, "Allied Mathematics", Vol I & II. Chennai: Muhil Publishers.

Unit-III: Sec(4.5, 4.5.1 to 4.5.3)Vol I

Unit-IV: Sec(1.1.1, 1.1.2, 1.2, 1.4.3)vol II

Unit-V: Chap:3(3.2, 3.4, 3.4.1) vol II

REFERENCE BOOKS:

- 1. P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
- 2. S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
- 3. P. R. Vittal (2003), "Allied Mathematics", Chennai: Marghan Publications.

Course Outcomes:

On successful completion of the course, the students will be able to

CO1: Attain knowledge on finding Approximate root for polynomial equations using Numerical methods.

CO2: Develop the skills of finding solutions of Simultaneous Linear equations.

CO3: Adopt techniques in solving problems involving Matrices

CO4: Provide skills on finding curvature and radius of curvature in Cartesian and polar co-ordinates.

CO5:Understand the applications of double and Triple integration in real life situation.

Outcome Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	2	3	3	3	2

1-Low 2-Moderate 3- High

SEMESTER: I	23UCHEE15 CHEMISTRY FOR PHYSICAL SCIENCE- I	Credit: 3
Part: III		Hours: 4

Objectives of the course	 This course aim state provide knowledge on the Basics of atomic orbitals, chemical bonds, hybridization Concepts of thermodynamics and its applications. Concepts of nuclear chemistry Importance of chemical industries Qualitative and analytical methods.
Course Outline	UNIT-I Chemical Bonding and Nuclear Chemistry
	Chemical Bonding: Molecular Orbital Theory-bonding, anti – bonding
	And non-bonding orbitals. Molecular orbital diagrams for Hydrogen,
	Helium, Nitrogen; discussion of bond order and magnetic properties.
	Nuclear Chemistry: Fundamental particles - Isotopes, Isobars,
	Isotones and Isomers-Differences between chemical reactions and
	Nuclear reactions-group displacement law. Nuclear binding energy-
	Mass defect-calculations. Nuclear fission and nuclear fusion-
	differences–Stellar energy. Applications of radioisotopes–carbon
	dating, rock dating and medicinal applications.
	Unit-II
	Industrial Chemistry
	Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted
	Water gas, producer gas, CNG, LPG and oil gas (manufacturing
	Details not required). Silicones: Synthesis, properties and uses of
	silicones.
	Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK
	fertilizer, superphosphate, triple super phosphate.

UNIT-III

Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap, hybridization and geometry of CH4, C2H4, C2H2 and C6H6. Electronic effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples.

Reaction mechanisms: Types of reactions—aromaticity (Huckel'srule)

aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft'salkylationandacylation. Heterocyclic compounds: Preparation, propertie sofpyrroleandpyridine.

UNIT-IV

Thermodynamics and Phase Equilibria

Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its

significance. Free energy change and its importance (noderivation).

Conditions for spontaneity in terms of entropy and Gibbs free energy.

Relation ship between Gibbs free energy and entropy.

Phase Equilibria: Phaserule – definition of termsinit. Applicationsof Phase rule to water system. Two component system-Reduced phase Rule and its application to a simple eutectic system (Pb-Ag).

UNIT-V

Analytical Chemistry

Introductiontoqualitativeandquantitativeanalysis. Principles of volumetricanalysis . Separation and purification techniques—extraction, distillation and crystallization.

Chromatography: principle and application of column, paper and thin Layer chromatography.

Extended	Questions related to the above topics, from various competitive
Professional	Examinations UPSC/JAM/TNPSC others to be solved
Component(isa	(To be discussed during the Tutorial hours)
Part of internal	(10 be discussed daring the Tatorial House)
Component only,	
Not to be included	
In the external	
examination	
Question paper)	
Skills acquired	Knowledge, Problem solving, Analytical ability, Professional
From this course	Competency, Professional Communication and Transferable skills.
Recommended	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount
Text	publishing house, Chennai, firstedition, 2009.
	2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya
	Publications, Karur,2006.
	3. S.ArunBahl,B.S.Bahl, Advanced Organic Chemistry; S.Chandand
	Company, NewDelhi, twentythirdedition,2012.
	4. P.L.Soni,H.M.Chawla, Text Book of Organic Chemistry; Sultan
	Chand&sons,NewDelhi, twentyninth edition,2007.
Reference Books	5. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand
	and Company, NewDelhi, twentieth edition,2007.
	6. B.R.Puri,L.R.Sharma, M.S.Pathania, Text book Physical Chemistry;
	Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
	7. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut,
	sixteenth edition,2014.
Website and e-	
learning source	1. https://byjus.com/jee/chemical-bonding/
	2. https://en.wikipedia.org/wiki/Fuel
	3. https://www.brainkart.com/article/Fundamentals-of-Organic-
	Chemistry 36450/
	4. https://chem.libretexts.org/Courses/BethuneCookman_University/B-CU
	%3A CH-345 Quantitative Analysis/Book
	%3A Analytical Chemistry 2.1 (Harvey)/
	06%3A Equilibrium Chemistry/ 6.02%3A Thermodynamics and Equilibrium Chemistry
	5. https://en.wikipedia.org/wiki/Chromatography
	5. https://en.minpediatory.min/emoniatography

Course Learning Outcomes (for Mapping with Pos and PSOs) On completion of the course the students should be able to

CO1: Gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.

CO2: Evaluate the efficiencies and uses of various fuels and fertilizers

CO3: Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

CO4: Apply various thermodynamic principles, systems and phase rule.

CO5:Explain various methods to identify anappropriate method for the separation of chemical components

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

								્		Mark	S
Subject Code	Subject Name	Category	L	Т	P	S	Credits	Inst. Hours	CIA	External	Total
23UGEOS16	Understanding the Earth	NME	Y	-	-	-	2	2	25	75	100
	Course Obj	ectives									
CO1	The main objective of this course is to					rop	erties	of E	arth.		
CO2	To describe the concepts of internal str	ructure o	f th	e Ea	ırth						
CO3	To explain various components related	l to exter	nal j	proc	esse	es of	Eart	h			
CO4	To study concepts of various currents	and atmo	sph	eric	ciro	ulat	ion.				
CO5	To understand the availability of eleme	ents in the	e Ea	rth.							
UNIT	Details							lo. o lour		Cou Objec	
I	Understanding of planet Earth: Astronomy, Geology, Meteorology and Oceanography. General characteristics and origin of the Universe, Solar System and its planets. The terrestrial and jovian planets. Meteorites and Asteroids Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters and its age.							12		CC	01
II	Internal structure: core, mantle, cru hydrosphere, atmosphere and biosph field.						1	12		CC)2
III	Plate tectonics, sea-floor spreading and continental drift; Mid Oceanic Ridges, trenches, transform faults and island arcs Origin of oceans, continents, mountains and rift valleys Earthquake and Volcanoes.							12		CC)3
IV	Concepts of eustasy; Land-air-sea interaction Oceanic current system and effect of Coriolis force; Wave erosion and beach processes Atmospheric circulation; Weather and climatic changes.							12		CC	04
V	Distribution of elements in solar system and in Earth; Chemical differentiation and composition of the Earth; General concepts about geochemical cycles and mass balance Properties of elements; Geochemical behavior of major elements; Mass conservation of elements and isotopic fractionation.								CC) 5	
	Total							60			

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes. The blooms taxonomy verbs will be given as a separate annexure for your reference.

Each course outcome should be mapped with the POs.

The mapping of each CO can be done with any number of POs.

	Course Outcomes						
Course Outcomes	On completion of this course, students will;						
CO1	Understand the properties of Earth PO1						
CO2	Knowledge on Dating of Earth Age	PO1, PO2					
CO3	Correlate various Hypothesis on Origin of Earth	PO4, PO6					
CO4	Analyze the importance of Crystallography Studies	PO4, PO5, PO6					
CO5	Various Type minerals and their respective crystal system	PO3, PO8					
	Text Books						
1.	(Latest Editions) Duff, P. M. D., & Duff, D. (Eds.). (1993). Holmes' principles of & Francis.	of physical geology. Taylor					
2.	Emiliani, C. (1992). Planet earth: cosmology, geology, and environment. Cambridge University Press.						
3.	D. II AM D. ' E. I C. D. ' H II M D II (4000)						
4.	4. Mukherjee A.K, Principles of Geology, EW Press, KoIkata(1990)						
5.	Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw	Hill., New York(2005					
(La	References Books test editions, and the style as given below must be strictly	adhered to)					
1.	Gross, M. G. (1977). Oceanography: A view of the earth.						
2.	Principles of Geomorphology; William D. Thornbury, (20 Distributors, New Delhi.	004) CBS Publishers and					
3.	Crystals and Crystal Structures – Richard J. D. Tilley(200 England.	06), John Wiley & Sons,					
4.	Introduction to Mineralogy, Crystallography & Petrolog (1967), 2nd edition, Springer	gy – Carl W. Correns					
5.	Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuti	corin (1996)					
	Web Resources						
1.	"Age of the Earth". U.S. Geological Survey. 1997. Archived December 2005. Retrieved 2006-01-10.	from the original on 23					
2.	Dalrymple, G. Brent (2001). "The age of the Earth in the two (mostly) solved". Special Publications, Geological Society of Lo						
3.	Geo.libretexts.org						
4.	www.nationalgeographic.org						
5.	Solarsysytem.nasa.gov						

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding Lower level
- Apply and Analyze Medium Level
- Evaluate and Create Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	3	3	3	3	2	2	2	3

								Ş		Mark	S
Subject Code	ct Code Subject Name L		Т	P	S	Credits	Inst. Hours	CIA	External	Total	
23UGEOF17	Rudiments of Geohazards	FC	Y	-	-	-	2	2	25	75	100
	Course Obje	ctives									
CO1	To explain students about the physical a	nd geol	ogic	al p	roce	esses	s caus	sing g	geoha	azards.	
CO2	To discuss the methods for quantifying	geohaza	ırds								
CO3	To understand the possible consequence	s as we	ll as	risk	and	d dis	saster	man	agen	nent.	
CO4	To make them aware about landslides, figeological and physical process were to	-			ano	d ea	rthqu	akes,	for	which t	he
CO5	To discuss potential inter linkages between different types of geohazards, disaster										
UNIT	Details							o. of ours			
I	Geological Hazards: Introduction Earthquakes: Causes and measurement Tsunami Hazards.							Iours veek	s /	СО	1
II	Volcanoes: Magma and lava - volcanic landforms - volcanic hazards.	c erupti	ons	- vo	olca	nic		Iours veek	5 /	CO	2
III	Landslides: Mass wasting and Mass wasting processes – Slope stability, triggering events, mass wasting hazards – subsidence.							Iours veek	s /	CO)3
IV	Storms: The Ocean - Atmosphere System – Thunderstorms & Tornadoes – Tropical Cyclones – Hurricane – Windstorms – Lightening – Drought – wildfire.							Iours veek	3/	CO)4
	River systems: Causes of flooding — river flooding — flooding hazards. Extra-terrestrial hazards. Meteorites & impacting events.					_	2 F	Iours	. /		
V	flooding hazards. Extra-terrestrial				eori	tes		veek	, ,	CO)5

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes. The blooms taxonomy verbs will be given as a separate annexure for your reference. Each course outcome should be mapped with the POs.

The mapping of each CO can be done with any number of POs.

	Course Outcomes										
Course	On completion of this course, students will;										
Outcomes	On completion of this course, students will,										
CO1	Understand different natural hazards.	PO1									
CO2	Knowledge on volcanic hazards.	PO1, PO2									
CO3	Understand mass wasting and subsidence processes	PO4, PO6									
CO4	Analyze the importance of storm studies	PO4, PO5, PO6									
CO5	Various types of river hazards	PO3, PO8									
	Text Books										
	(Latest Editions)										
1.	Montgomery, C.W. (2008), Environmental Geology, McGraw F	Hill 8thEdition.									
2.	Abbott Patrick, L. (2006), Natural Disasters, McGraw Hill, Bos	ton, MA.									
3.	Bryant, E. (2005), Natural Hazards, Cambridge University Pr	D T (2005) N. III I C I I I I I P C I I I I I I I									

SEMESTER II

								Ş		Mark	S
Subject Code	ct Code Subject Name L T P		S	Credits	Inst. Hours	CIA	External	Total			
23UGEOC23	Geo-Statistics - II	Core	Y	-	-	-	5	4	25	75	100
	Course Obje	ctives									
CO1	The main objective of this course is to in	mportan	ice c	f sta	atist	ics i	n scie	ence.			
CO2	To describe the concepts of basic statist	ics									
CO3	To explain various components of adva	nced sta	atisti	cal	met	hods	S				
CO4	To study various graphical methods and	d its app	olica	tion	S						
CO5	To determine various correlation and re- Geology	gression	stu	dies	and	lits				the fiel	d of
UNIT	Details							lo. o: lour:		Cou Objec	
I	Definition and scope of statistics-Tabulation of data- Formation of Frequency Distribution-Diagrammatic representation of data-Bar diagrams, Pie diagrams-Graphic Representation of data-Histogram, Frequency polygon- Ogives.						12		CC	01	
II	Measures of Central Tendency-Arith Mode, Combined arithmetic mean-meri					ian,		12		CC)2
III	Measures of Dispersion- Absolute and Relative measures Range, Quartile deviation, Mean deviation, Standard deviation							12		CC)3
IV	Cure filling by the Method of Least square-Fitting straight line of the form $Y=ax+b$ and parabola $Y=ax^2+bx+c$ (Simple problems)						1	12		CC	04
V	Correlation-Karl person's coefficient of correlation, Rank correlation- Spearman's Rank correlation coefficient. Reregression-regression equation and their properties.						12		CC)5	
	Total							60		-211 ka	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes. The blooms taxonomy verbs will be given as a separate annexure for your reference. Each course outcome should be mapped with the POs.

The mapping of each CO can be done with any number of POs.

	Course Outcomes						
Course Outcomes	On completion of this course, students will;						
CO1	To describe the definition, scope, classification, tabulation, drawing diagrams and plotting graphs of Statistics through Geological information.	PO1					
CO2	To measure and interpret the various measures of averages using Geological data.	PO1, PO2					
CO3	To measure and interpret the various measures of dispersions using Geological data.	PO4, PO6					
CO4	To measure and interpret the relationship among the geological variables and to estimate and predict the unknown and future value through the regression lines using geological data.	PO4, PO5, PO6					
CO5	To fit the curve using geological data.	PO3, PO8					
	Text Books						
	(Latest Editions)	Cl. 1					
1.	Statistics – R.S.N. Pillai and V. Bhagavathi, Publications s. Statistical Methods, Gupta, S.P. (2007): sultan Chand & sons						
2.	Revised Edition.	Pvt Ltu, New Dellii, 85					
3.	Statistics for Geoscientists - Marsal, D. Pergamon press, New York.						
4.	<i>Cline, Graysen (2019).</i> Nonparametric Statistical Methods Using 1-83947-325-8. OCLC 1132348139. Archived <i>from the original</i> Retrieved 2021-09-16.						
5.	Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) In Concepts and Applications, pp. 5–9. West Group. ISBN 978-0-3						
/1	References Books	11 1. \					
	Latest editions, and the style as given below must be strictly a						
1. 2.	Statistics for Geoscientists - Marsal, D. Pergamon press, No Statistics - R.S.N. Pillai and V. Bhagavathi, Publications.						
3.	Statistical Methods, Gupta, S.P. (2007): sultan Chand & sons Revised Edition.	Pvt Ltd, New Delhi, 5 th					
4.	Cline, Graysen (2019). Nonparametric Statistical Methods Using 1-83947-325-8. OCLC 1132348139. Archived from the original Retrieved 2021-09-16.	on 2022-05-15.					
5.	Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) In Concepts and Applications, pp. 5–9. West Group. ISBN 978-0-3						
	Web Resources https://en.wikipedia.org/wiki/Statistics						
1.							
2.	http://onlinestatbook.com/2/introduction/descriptive.html						
3.	https://socialresearchmethods.net/kb/statdesc.php						
4.	https://en.wikipedia.org/wiki/Descriptive_statistics						
5.	Philosophy of Statistics from the Stanford Encyclopedia of Philosophy	osophy					

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding Lower level
- Apply and Analyze Medium Level
- Evaluate and Create Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	3	3	3	3	2	2	2	3

								\hat{\dots}		Mark	KS .
Subject Code	Subject Name	Category	L	Т	P	S	Credits	Inst. Hours	CIA	External	Total
23UGEOP24	CRYSTALLOGRAPHY AND PALEONTOLOGY PRACTICAL	Core	Y	-	-	-	3	4	25	75	100
	Course Obje	ectives								!	ļ.
CO1 The main objective of this course is to enumerate the origin of Earth.											
CO2	To describe the concepts of Dating and	internal	stru	ctur	e of	the	Eart	h			
CO3	To explain various components of cryst	tals and	crys	stallo	ogra	phy					
CO4	To study various class and forms of an	crystal :	syste	em.							
CO5	To determine various crystallographic p	ropertie	s of	crys	stals	wit	h sui	table	exar	nples.	
UNIT	Details							lo. o:		Cou Objec	
I	Isometric System: Normal Class – Galena, Fluorite, Magnetite, Garnet, and Leucite, Copper- Pyritohedral class – Pyrite, Tetrahedral Class – Tetrahedrite. Tetragonal System: Normal Class – Zircon, Vesuvianite, Cassiterite, and Rutile. Tripyramidal – Scheelite, MeioniteSphenidal Class – Chalcopyrite. Hexagonal System: Normal Class – Beryl, Tripyramidal – Apatite, Hemimorphic – Zincite, Rhombohedral Normal – Calcite, Trapezohedral Class – Quartz.						12		CO1		
II	Orthorhombic System: Normal – Barite, Sulphur, Stibnite, Topaz, Staurolite, and Aragonite. Hemimorphic – Calymene, Sphenoidal Class – Epsomite. Monoclinic System: Normal – Gypsum, Pyroxenes and Amphiboles. Triclinic System: Normal – Axinite, Albite, and Rhodonite. Twin Crystals: Contact and Penetration twins of Fluorite, Iron Cross Twin of Pyrite, Knee type twin of Cassiterite, Polysynthetic twin of Aragonite, Cyclic twin of Cerussite, Swallow Tail of Gypsum, Twins of Carlsbad, Baveno, Manebach, Albite law of Albite.					12		CC)2		
III	Identification and description of the following fossils: Lamellibranchs: Arca, Meretrix, Pecten, Cardita, Lima, Allectronia, Inoceramus, Gryphaea, Exogyra, Radiolites, Ostrea, Unio, Trigonia. Gastropods: Turritella, Turbo, Cerithium, Trochus, Physa, Murex, Voluta, Helix, Euomphalus, Cyprea.							12		CC)3
IV	Cephalopods: Nautilus, Orthoceras,	Cerat	ite,	Go	nia	tite,		12		CC)4

	Belemnites, Baculites, and Perisphinctes. Echinodermata: Cidaris, Holaster, Hemiaster, Stigmatophygus, Apiocrinus. Trilobites: Paradoxides, Olenus, Olenellus, Phacops,		
	Calymene.		
	Corals: Calceola, Zaphrentis, Lithostrotion, Omphyma,		
V	Thecosmelia. Brachiopoda: Terebratula, Spirifer, Productus,		CO5
	Monograptus, Tetragraptus, Diplograptus.		
	Total	60	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes. The blooms taxonomy verbs will be given as a separate annexure for your reference. Each course outcome should be mapped with the POs.

The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes On completion of this course, students will; The main objective of this course is to enumerate the fundamental aspects of Mineralogy in such a way as to stimulate the minds of the post-graduate students. CO2 To describe the concepts of Mineralogy is essential to comprehend the concepts of Petrology. CO3 To explain the importance of instrumentation techniques for better analysis To compare and contrast between the fascinating plethora of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject CO5 Can evaluate the accuracy and summaries the methods adapted for certain practical activities. Text Books (Latest Editions) 1. Mineralogy — Dexter Perkins (2014), 3rd edition, Pearson New International Edition. 2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. 3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) 4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) Introduction to Mineralogy — William D. Nesse (2000), Oxford University press, New York. USA. Textbook of Mineralogy — E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi. 3. Crystals and Crystal Structures — Richard J. D. Tilley(2006), John Wiley & Sons,		Course Outcomes							
CO1 fundamental aspects of Mineralogy in such a way as to stimulate the minds of the post-graduate students. CO2 To describe the concepts of Mineralogy is essential to comprehend the concepts of Mineralogy is essential to better analysis CO3 To explain the importance of instrumentation techniques for better analysis To compare and contrast between the fascinating plethora of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject CO5 Can evaluate the accuracy and summaries the methods adapted for certain practical activities. Text Books (Latest Editions) 1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. 2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. 3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) 4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils, CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York, USA. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.		On completion of this course, students will;							
CO3	CO1	fundamental aspects of Mineralogy in such a way as to	PO1						
CO4 better analysis To compare and contrast between the fascinating plethora of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject CO5 Can evaluate the accuracy and summaries the methods adapted for certain practical activities. Text Books (Latest Editions) 1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. 2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. 3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) 4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) 1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	CO2								
of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject CO5 Can evaluate the accuracy and summaries the methods adapted for certain practical activities. Text Books (Latest Editions) 1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. 2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. 3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) 4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) 1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	CO3		PO4, PO6						
Text Books (Latest Editions) 1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. 2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. 3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) 4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) 1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	CO4	of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this	PO4, PO5, PO6						
1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. 2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. 3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) 4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) 1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	CO5		PO3, PO8						
1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition. 2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi. 3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) 4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) 1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.		Text Books							
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Distributors, New Delhi. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995) Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	1.	_ == · · · · · · · · · · · · · · · · · ·	rson New International						
4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D 2005) 5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) 1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	2.	1 95	04) CBS Publishers and						
5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952). References Books (Latest editions, and the style as given below must be strictly adhered to) 1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	3.	Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995)							
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1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. 2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	5.	Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952).							
 Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi. 		References Books							
New York. USA. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.	(Latest editions, and the style as given below must be strictly adhered to)								
Distributers, New Delhi.	1.	New York. USA.	7 1						
3. Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons,	2.		ion, CBS Publishers &						
	3.	Crystals and Crystal Structures – Richard J. D. Tilley(200	6), John Wiley & Sons,						

	England.					
4.	Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer					
5.	Colbert E.H. et al., Evolution of the Vertebrates, Wiley. New Delhi 2002)					
	Web Resources					
1.	"Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005. Retrieved 2006-01-10.					
2.	Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.					
3.	Digitalatlas.cose.ISU.edu>geo>basics>fossil					
4.	www.sciencedirect.com>topic>hemichordata					
5.	w.qm.qid.au>biodiscovery>corals					

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding Lower level
- Apply and Analyze Medium Level
- Evaluate and Create Strong Level

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	3	3	3	3	2	2	2	3

SEMESTER: II		Credit: 3
PART: II	23UMATE25 MATHEMATICS – II	Hours: 3
Core IV		

UNIT-I:TRIGONOMETRY

Expansions of $\sin^n \theta$, $\cos^n \theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ – Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ in terms of θ Unit-I: Chap: 6 (6.1,6.1.1 to 6.1.3)

UNIT-II: PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations, elimentary partial differential equations- Lagranges equations.

Unit-II: Chap:6 (6.1,6.1.1, 6.4).

UNIT-III: VECTOR DIFFRENTIATION

Vector functions- Scalar and vector point functions- Directional derivatives –Unit vector normal to a surface – angle between the surfaces-divergence, Gradient of a scalar point function- Divergence and curl of a vector point function.

Unit-III Section 8.1,8.2,8.3, 8.4).

UNIT-IV: VECTOR INTEGRATION

Green's theorem in the plane-Gauss divergence theorem- [without proofs] ,Stoke's theorem (Statement only)

Unit-IV:Section(8.6.1, to 8.6.3).

UNIT-V: FINITE DIFFERENCES

Operator E, Relation between $^{\Delta,\nabla}$ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation-Lagrange's interpolation formula for unequal intervals(without proof) .

Unit-V:Sec(5.1,5.2).

TEXT BOOK:

1.P. Duraipandian and S. Udayabaskaran(1997), "Allied Mathematics", Vol I & II. Chennai:

Muhil Publishers.

Unit-I: Chap: 6 (6.1,6.1,1 to 6.1.3), Vol I,

Unit-II: Chap:6 (6.1,6.1.1,6.4), Vol II,

Unit-IIISec(8.1,8.2,8.3,8.4), Vol I,

Unit-IV:Sec(8.6.1, - 8.6.3), Vol I,

Unit-V:Sec(5.1,5.2), Vol II.

REFERENCE BOOKS:

- 1. P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
- 2. S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
- 3. P. R. Vittal (2003), "Allied Mathematics", Chennai: Marghan Publications.
- 4. P.Kandhasamy, K. Thilagavathy (2003), "Allied Mathematics" Vol I & II, New Delhi: Tata McGraw Hill.

Course Outcomes:

On successful completion of the course, the students will be able to

- **CO1:** Attain knowledge on finding the expansions of trigonometric functions and concept of hyperbolic and inverse hyperbolic functions.
- **CO2**: Provide a basic knowledge of Partial Differential equations and develops knowledge on handle practical problems.
- **CO3**: Adopt techniques in solving problems involving vector and scalar functions
- **CO4:** Provide skills on finding derivatives and gradients on vector differentiation and Integration.
- **CO5**: Understand the applications of differentiation and integration in real life situation.

Outcome Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	2	3	3	3	2

1-Low 2-Moderate 3- High

SEMESTER: II

Credit: 3

Part: III

Chemistry for Physical Science– II

23UCHEE25

Hours: 3

Objectives of the course

This course aims at providing knowledge on the

- Co-ordination Chemistry and Water Technology
- Carbohydrates and Amino acids
- basics and applications of electrochemistry
- basics and applications of kinetics and catalysis
- Various photochemical phenomenon

Course Outline

UNIT I

Co-ordination Chemistry and Water Technology

Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature -

Werner'stheory - EAN rule - Pauling's theory - Postulates -

Applications to [Ni(CO)4], [Ni(CN)4]2-,[Co(CN)6]3- Chelation -

Biological role of Haemoglobin and Chlorophyll (elementary idea) -

Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques-BOD, COD.

Unit II

Carbohydrates and Amino acids

Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose -fructose interconversion. Properties of starch and cellulose.

Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).

UNIT III

Electrochemistry

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.

UNIT IV

Kinetics and Catalysis

Order and molecularity. Integrated rate expression for I and II (2A Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction — Half-life period — Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.

UNIT V

Photochemistry

Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Extended
Professional
Component (is a part of internal component only,
Not to be included in the external examination
question paper)

Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Skills acquired	Knowledge, Problem solving, Analytical ability, Professional						
from this course	Competency, Professional Communication and Transferable skills.						
Recommended	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount						
Text	publishing house, Chennai, first edition,2009.						
	2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.						
	3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.						
	4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.						
Reference Books	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan						
	Chand and Company, New Delhi, twentieth edition, 2007.						
	2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry;						
	Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 3. B.K,Sharma, Industrial Chemistry; Meerut, sixteenth edition, 2014.						
	GOEL publishing house,						
Website and e-learning source							

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology
- **CO 2:** explain the preparation and property of carbohydrate, amino acids and nucleic acids.
- **CO 3:** apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
- **CO 4:** identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.
- **CO** 5: outline the various type of photochemical process.

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of					
Course Contribution to	3.0	3.0	3.0	3.0	3.0
PSOs					

Level of Correlation between PSO's and CO's

SEMESTER: I

Part: III

23UCHEEP1

CHEMISTRY PRACTICAL FOR PHYSICAL SCIENCE – I

Credit: 2

Hours: 3

Objectives of the	This course aims to provide knowledge on the								
course									
	 basics of preparation of solutions. 								
	 principles and practical experience of volumetric analysis 								
Course Outline	VOLUMETRIC ANALYSIS								
	Estimation of sodium hydroxide using standard sodium carbonate.								
	2. Estimation of hydrochloric acid using standard oxalic acid.								
	3. Estimation of ferrous sulphate using standard Mohr's salt.								
	4. Estimation of oxalic acid using standard ferrous sulphate.								
	5. Estimation of potassium permanganate using standard sodium hydroxide.								
	6. Estimation of magnesium using EDTA.								
	7. Estimation of ferrous ion using diphenyl amine as indicator.								
Reference Books	V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles								
	ofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.								
Website and E-	1)http://www.federica.unina.it/agraria/analytical-chemistry/								
Learning Sources	volumetricanalysis								
	2)https://chemdictionary.org/titration-indicator/								

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration.

CO 3: apply their skill in the analysis of water/hardness.

CO4: analyze the chemical constituents in allied chemical products

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of					
Course Contribution to	3.0	3.0	3.0	3.0	3.0
PSOs					

Level of Correlation between PSO's and CO's

Note: Scheme for Practical Evaluation.

Volumetric Estimation - 75

Record - 10 marks

Procedure - 15marks

Results

< 2% - 50 marks

2-3% - 40 marks

3-4% - 30 marks

> 4% - 20 marks

		Category		Т	P	S	Credits	Inst. Hours		Marks	
Subject Code	Subject Name								CIA	External	Total
23UGEOS27	Basics of Earth Science	NME	Y	-	-	-	2	2	25	75	100
	Course Obj	ectives	•			•				'	
CO1									arth.		
CO2	To describe the concepts of internal structure of the Earth										
CO3	To explain various components related	d to exter	nal j	proc	esse	es of	Eart	:h			
CO4											
CO5	To understand the availability of eleme	ents in the	e Ea	rth.							
UNIT	Details								f s	Course Objectives	
I	Universe – Evolution of the Universe. Solar System – Inner and outer planets – characteristics of solar system. Satellites – Asteroids – Meteors – comets. Earth – movements – revolution – rotation – solstice – equinox. Atmosphere – El Nino – hydrosphere – lithosphere-Origin of the Earth.							2 hours / week		CO1	
II	Age of the Earth - old methods - new methods - Radioactivity - Half-life period - Radiometric methods. Interior of the Earth - Density - Shape - Seismic waves - Composition and thickness of the crust, mantle and core. Discontinuities: Conrad Discontinuity - Mohorovicic Discontinuity.							nours week		CC)2
III	Introduction to Geomorphology: Geological action of wind, water, glaciers and ground water. Volcanoes and earthquakes. Rock deformation: Folds, Faults, Joints, Cleavage, Unconformities, Concepts of plate tectonics, sea floor spreading and geosynclines.							nours week		CC)3
IV	Study of Fossils- Introduction, Geological Record and its nature. Geological Time Scale. Introduction, Definition of Paleontology, Classification of Plants, Invertebrate and Vertebrate fossils. Fossils -Tophonomy (Burial Law), Types of Fossilization, Mode of preservation- Applications of Fossils – National fossil parks across India.								s /	CC)4

V	Applications of Geology: Environmental impacts due to mining and mineral process, Engineering Geology: Dams, Reservoirs and Tunnels, strategic, critical and essential mineral –Mineral resources of India. Fossil Fuels and Groundwater.	2 hours / week	CO5
	Total	60	

The course outcome is based on the course objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Course objectives and Course outcomes. The blooms taxonomy verbs will be given as a separate annexure for your reference. Each course outcome should be mapped with the POs.

The mapping of each CO can be done with any number of POs.

	<u> </u>
(niirse	Outcomes

Course Outcomes								
Course Outcomes	On completion of this course, students will;							
CO1	Gather basic information on Earth Sciences	PO1						
CO2	Understand the importance of various components of Earth							
CO3	Process of Geomorphological features	PO4, PO6						
CO4	Understand, predict and analyze the fossil and dating PO4, PO5, I							
CO5	Apply the geological knowledge in various civil structures	PO3, PO8						
	Text Books							
	(Latest Editions)							
1.	1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition.							
2.	2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.							
3.	3. Patwardhan, A.M., Dynamic Earth System, PrenticeHall, New Delhi(1999)							
4.	4. Mukherjee A.K, Principles of Geology, EW Press, KoIkata(1990)							
5.	5. Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005							
	References Books							
(Lat	test editions, and the style as given below must be strictly	adhered to)						
1.	1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA.							
2.	2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.							
3.	Crystals and Crystal Structures - Richard I D Tilley (2006) John Wiley & Sons							
4.	Introduction to Mineralogy, Crystallography & Petrolog (1967), 2nd edition, Springer	y – Carl W. Correns						
5.	Radhakrishnan, V, General Geology, V.V.P. Publishers, Tutio	corin (1996)						

	Web Resources						
1.	"Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005. Retrieved 2006-01-10.						
2.	Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.						
3.	Geo.libretexts.org						
4.	www.nationalgeographic.org						
5.	Solarsysytem.nasa.gov						

The S, M, L is based on the course outcome. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your course outcome.

- Remember and Understanding Lower level
- Apply and Analyze Medium Level
- Evaluate and Create Strong Level

Mapping with Programme Outcomes:

	DO 4	DO D	500	DO 4	50 -	50.0	50 -	700
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	3	3	3	2	2
CO 2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO 4	3	3	3	3	3	2	1	1
CO 5	3	3	3	3	2	2	2	3