Learning Outcomes-based Curriculum Framework(LOCF)

For

M.Sc.,APPLIEDGEOPHYSICS(CBCS)

(With Effectivefromtheacademic year2022-2023onwards)

Submittedto

Boardof StudiesSection

ManonmaniamSundaranar
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By

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M.Sc.,APPLIEDGEOPHYSICS(CBCS)

LearningOutcomebasedCurriculum

(With Effectivefromtheacademic year2022-2023onwards)

VisionoftheUniversity

Toprovidequalityeducationtoreachtheun-reached

MissionoftheUniversity

- To conduct research, teaching and outreach programmes to improve conditions ofhuman living.
- To createanacademicenvironmentthat honourswomen and men ofallraces,caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit ofknowledge, academicfreedomand integrity.
- Toofferawidevarietyofoff-campuseducationalandtrainingprograms,includingtheuseofinformationtechnology, toindividualsand groups.
- To develop partnership with industries and government so as to improve the qualityoftheworkplace andto serveascatalyst foreconomicandculturaldevelopment.
- To provide quality / inclusive education, especially for the rural and un-reachedsegmentsofeconomicallydowntroddenstudentsincludingwomen,sociallyoppressedanddifferentlyabled.

CENTREFORGEOTECHNOLOGY

1. VisionoftheDepartment

Develop an interdisciplinary academic rigor and creativity. Deliver research basededucation,creatingnewknowledge and innovation.

2. MissionoftheDepartment

Emerge as a world class geosciences department in creating and disseminatingknowledge, andprovide learningexperience.

3. AbouttheDepartment

Thevision,missionandobjectivesofthedepartmentistostriveforexcellence,toachievesustainabledevelopment,toimparttrainingforcapacitybuilding, to tackle various environmental challenges in an eco-friendly manner, tooffer professional and job-oriented course curricula, to strengthen R&D activities andto offer consultancy and extension activities. The faculty members of departmenthaveexposureofreputednationalandinternationalorganizationsofdifferentspecialization.Thefacultymembersareengagedinextensiveresearchinthe

frontier areas of Environmental sciences. The department is providing platform invarious dimensions to the students to participate in various cultural, co-curricularactivitiesorganizedby thedepartmentanddifferentcellsoftheuniversity.Thedepartment effectively guides the students throughout the study period and Alumni ofthedepartmenthavebeenservinginvarioussectorsofenvironmentalservices.

4. LearningOutcomesbasedCurriculumFramework

TheChoiceBasedCreditSchemeevolvedintolearningoutcomes-basedcurriculumframeworkandprovidesanopportunityforthestudentstochoosecourses from the prescribed courses comprising core, elective/minor or skill-basedcourses.Thecoursescanbeevaluatedfollowingthegradingsystem,whichisconsidered tobebetterthantheconventionalmarkssystem.Gradingsystemprovides uniformity in the evaluation and computation of the Cumulative Grade PointAverage (CGPA) based on student's performance in examinations which enables thestudent to move across institutions of higher learning. The uniformity in evaluationsystem also enables the potential employers in assessing the performance of thecandidates.

5. Objectivesoftheprogramme

The prime objective of the programme is to reach the unreached and help toprovide Geophysical education at the doorstep of the learners and according to theirconvenience. Curriculums have been designed to attract young minds to choose acareerinbroadareasofGeophysicalScienceanditsapplicationswiththeknowledge of Geophysical science. And also to make the students more competentand confident, the multidisciplinary approach in subject as well as communicationskills are given importance. Finally, this programme has also been envisaged tofulfill the requirement of Geophysicist manpower in various R & D sectors includingvarious academicinstitutions.

6. Name oftheProgramme: M.Sc.AppliedGeophysics.

7. PreambleoftheProgramme: Thegeophysicalmethodsofexploration have a leading role in studying the deepstructure of the earth's crust, in prospectingfor oil and gas in regional structural studiesrelatedtotheprospectingandexploratiofMinerals.

Students who have completed thisprogramme will be employed in mineral andoil industry and other R& D institutions &HigherEducation sector.

a. Duration : Twoacademicyears(Foursemesters)

b. No.of.Seats	**:**	20Seats
c. Eligibility	**:**	B.Sc. inPhysics/Chemistry/Mathematics/Computer Science/Geology/Geophysics/Statistics/Electronicsandcommunication/Electronics/AppliedElectronics/IT,DegreeinanyBranchofEngineeringandotherequivalentcourses.
d. Examination	**:**	There will be internal assessmentscomprising of tests, Seminars andassignments and one end-semesterexamination during eachsemester. Aminimumof50%marksinacourseisprescribedforapass.Thecandidatewhohasnotsecuredaminimumof50%marksinacoursewillbedeemedtohavefailedinthat course.
e. Necessity,Objectiveand Outcomeofthe Course	**:**	Thiscourseisnecessarytounderstand thesubsurfaceoftheearthusingthevariousphysicalprinciples.Theappliedgeophysicscourse trainsthestudentsinallgeophysicalmethodslikeElectrical,GravityandMagnetic,Seismology, Seismicwelllogging,etc.,.Thestudentswillbeabletounderstandtheapplicationsofgeophysicalmethodsforexplorationofgroundwater,mineral and oil and gas sectors. Thestudentscanevaluatethedataacquisitionprocedures, process and interpret thegeophysicaldata.
f. EligibilityforTeaching Appointment	**:**	AsstipulatedinUGCnorms.

8. ProgrammeOutcomes(POs)

PO 1: Knowledge:impart knowledge in the basic and advanced fields of the coreandapplieddisciplinestoenablethestudentstohaveathoroughunderstanding oftheconcernedfieldsforfulfilmentoftheirprofessionalrequirements.

PO 2: Critical Thinking:develop the capability of critical thinking based on thecontextual knowledge of living beings/organisms, non-living components andGeosciences basis of life so as to enable the students to critically analyzeeverydayproblemsfaced bysociety.

PO 3: InterdisciplinaryApproach:makethestudentsunderstandtheinterdisciplinary approach & adaptation through MooCvalue oriented coursesofferedbyUGC, Govt.ofIndia, NewDelhi.

PO 4: Application Development: make the students understand and develop theapplications of Geophysical methods in earth and environment for sustainabledevelopmentof thesociety.

PO 5: Ethics and Leadership:make the students aware about sound professionaland character ethics as well as to inculcate the qualities of leadership andteam buildingskillsintermsof GeophysicalSociety.

PO 6: Problem Solving:train the students for developing innovative and solutioncentered approach for handling any kind of problem and to inculcate theparadigm of scientific temperament in the students by practicing the frequentfield work.

PO 7: Skills and knowledge:train the students in various core and advanced skillsto develop theoretical and practical understanding of different descriptive andinferentialGeophysical toolsandtechniques.

PO 8: Specialization and Employability:impart practical training, field's visits,project work and skill based training as well as specialization to the studentsforpreparingthemforanentrepreneurialthinkingandcareer-orientedapproachinresearchaswellasinteachingandvariousmulti-nationalindustries inOil&Petroleumandnaturalresourcerelated industries.

9. Programme Specific Outcomes (PSO)

PSO1: To provide well defined study of theoretical and experimental Geophysics to impart in depth understanding in fundamental aspects of all core areas of Geophysics.

PSO 2: To equip the student to pursue research and development in any areas of theoretical, experimental and computational Geophysics.

PSO 3: To understand the geological knowledge to understand the geophysical processes that are characteristic of a particular natural phenomenon in general.

PSO 4: To understand the theoretical concepts of Geological sciences, Physics principles and methods that required in the field of deep geophysical sciences.

PSO 5: To capable of reading maps and satellite imagery, determining map orientation in the field using GPS, compass and satellite data; and be ingable to criticize the complete operational procedures in solving the problems of geophysical technology that has been and / or is being implemented, and poured in the form of scientific papers.

PSO 6: To able to improve the performance, quality or quality of a process, measurement of objects, work, analysis, interpretation of data in accordance with geophysical exploration activities in terms of field work, etc.,

PSO 7: To introduce the student to the scientific research methodology, literature survey, technical writing, assimilation and dissemination of results, research ethics etc. through a project work.

PSO 8: To understand the factual knowledge of current principles and issues in economic, social cultural and ecological matters in general which have an influence on the field of geophysical sciences.

10. Programme Structure

M.Sc. Applied Geophysics is a four-semester postgraduate programme having 90 credits weightage consisting of Core Courses, Core Elective Courses, Supportive - Skill enhancement courses and Open Elective Courses offered by other departments of the University or from MOOCs on SWAYAM portal.

Semester	Course Code	Course	Course Nature	Credits	ContactHours perWeek	ContinuousInternal Assessment (CIA)	EndSemesterExam(ESE)
I	2534	Principles of Geophysics andElectronicinstrumentation	Core	4	4	25	75
		Seismology	Core	4	4	25	75
		GeneralGeology	Core	4	4	25	75
		The Dynamic Earth (frome-phatasala**)**	Core	4	4	25	75
		Computer Applications inGeosciences **Or**Mineral exploration**Or**Remote sensingandGIS (ElectiveMajor)	Elective	3	3	25	75
		Practical–I	Practical	2	4	50	50
II	2534	Elective-Non major-NaturalHazards-Part-1(Swayam/NPTEL – onlinecourse)	Elective	3	3	25	75
		GeophysicalSignalProcessing	Core	4	4	25	75
		ElectricalandElectromagneticprospecting	Core	4	4	25	75
		GravityandMagneticProspecting	Core	4	4	25	75
		Hydrogeology	Core	4	4	25	75
		Meteorology & Climatology(from e-phatasala) **Or**Disaster management -(ElectiveMajor)**Or** ArcheologicalGeophysics	Supportive	3	3	25	75
		Practical-II	Practical	2	4	50	50

III	2534	Elective–Non major-RemoteSensing And GIS (Swayam/NPTEL–onlinecourse)	Supportive	3	3	25	75
		BoreholeGeophysics	Core	4	4	25	75
		SeismicProspecting	Core	4	4	25	75
		MarineGeophysics	Core	4	4	25	75
		EnvironmentalGeoTechnology	Core	4	4	25	75
		Practical–III	Practical	2	4	50	50
IV	2534	DissertationandVivaVoce	Project	24	48	--	100
				90 credits	120Hrs	2000 ks	

11 SchemeofEvaluation:

(a) CIA

TheoryCourse 15
Practical* 50
Project :--
Internship* :--
Fieldvisit* :--
Seminarpresentation :05o
neAssignment 05

b **(b)ESE**

TheoryCourse 75
Practical* 50
Project 100
Internship* :--
Fieldvisit* :--

(c) ModelEndSemesterQuestionPaper

CodeNo. **SubCode**

M.Sc.DEGREEEXAMINATION
AppliedGeophysics(CBCS)

Semester
(ForthosewhojoinedinJuly2022–2023onwards)
(SUBJECT)

Time: ThreeHours **Max.75Marks**

Section –
AAnswerallquestions
All questions carry equal marks (10 X 1= **10**

Marks)**TENQUESTIONS (1-10)**

Section –
BAnswerallquestions
Allquestionscarryequalmarks(5X5=**25Marks**)

FIVEQUESTIONS(11-15)
(aOR b)

Section –

CAnswerallquestions
Allquestionscarryequalmarks(5X8=**40Marks**)

FIVEQUESTIONS(16-20)
(aOR b)

(d) PassingMinimum

CIA – No passing minimum (3 Internal Tests – Average of the best 2 will be considered)ESE– 50%,CumulativeAggregate–50%

Notes:

1. Foronecreditof theory,onehouroflecturewillbedeliveredwhileforonecreditofpractical,twohoursoflaboratorywork willbeconducted, perweek.

2.Besides credits from above courses, students will need to earn 6 credits fromSupportivecoursesofferedbyotherdepartmentsoftheUniversityorfromMOOCsonSWAYAMportal.Studentsarefreetoget enrolledforthiscategorycourses.

3.Studentswillneedtosubmitacertificatedeclaringtheirsuccessfulcompletionof‘Project/skill development/ In summer training/Industrial training’ for the desirednumberofhours.

4. RulespertainingtoProject:

i. Allotmentof studentsfortheProjectwillbedoneinthebeginningoffourthsemester.

ii. Theworkwillcommencewithfourthsemesterandwillcontinuetillthelastdayofteachingtermof fourth semester(asnotified inAcademicCalendar).

iii. Thelastdayoffourthsemester(asnotifiedinAcademicCalendar),willbethelastdateforsubmission of project report.

iv. TheProjectReportwillbecompiledinthefollowingformat:Acknowledgement
CertificateofSupervisorIntroduction
Review of LiteratureMaterials and MethodsResults and DiscussionSummary
Bibliography/References

PrinciplesofGeophysicsandElectronicInstrumentation

L T P
C40 04

a. Course Objectives: This paper focuses an understanding of the principles of Geophysics andElectronicinstrumentationandlearnersareexpectedtoknowthedifferenttypesofelectronicinstrumentation and itsprinciple.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Students can understand the principles of Geophysics and Electronicinstrumentation.
CO -2	Studentsareabletoexplainandapplythelaws,basictheoremsof Electronics.
CO -3	Students can expose with workings of electronic components to solve theproblem ofelectroniccircuits.
CO -4	Studentsarestudiedtoknowthedifferenttypesofelectronicinstrumentation anditsprinciple.

C.CourseOutline

Unit I: Concepts of fields; scalar, vector, raster; conservation laws; mass, momentum, energy andcharge; constitutive relations; and dynamical equations; elastic, viscous,electro-magnetic and thermal.Lawsofthermodynamicsandentropy–partialdifferentialequationofphysics-wavediffusion,potentialandschrodinger.

(12L)

Unit II: Linear stability theory and onset convection, critical points limit cycles and bifurcation ofnonlinear systems. Electric and magnetic potentials and fields, static charge distributions, Newtonianpotential;Laplace and Poisson'sequations;Green'sTheorem; Gauss' law;Continuation integral;equivalentstratum;Maxwell'sequationsandelectromagnetictheory;Displacementpotential,Helmholtz's theoremandseismicwavepropagation.

(12L)

Unit III: Op-Amp: Characteristic – Common Mode Rejection Ratio (CMRR) – Slew rate - blockdiagram representation of a typical Op-Amp – adder subtractor, integrator, and differentiator Op-Amp -Differential amplifier,DC and ACanalysis ofdifferential amplifiers,constantcurrentbias,currentmirror,cascadeddifferentialamplifierstages.

(12L)

Unit IV: Amplifiers built with Op-Amp:Inverting, non-inverting – offset null - Input impedance, outputimpedance, closed-loop gain and bandwidth calculation for the amplifiers built with Op-Amps.Otherapplications of Op-Amps:Instrumentation amplifier, voltage to current and current to voltage converts,activefilters,oscillators,comparators. **(12L)**

Unit V: Digital Electronics:Basic logic gates and truth-tables, Karnaugh map, implementing arbitrarytruth-tables, sequential logic – flip flops, registers, multiplexers and de-multiplexers, Transducers andits types.

(12L)
(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1toPO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4 –Analyze,K_5–Evaluate,K_6– Create)

e.ReferenceBooks:

1. *Achenbach, J. D. (2016).* Wave propagation in elastic solids: North-Holland series in appliedmathematicsandmechanics.*Elsevier.*
2. *Auld,B. A.(1990).* AcousticFieldsandWavesinsolids*.*
3. *Bolton,W.(2015).*Instrumentationandcontrolsystems.*Newnes.*
4. *Foulger,G.R., &Peirce,C.(2005).*Geophysicalmethodsingeology*.*
5. *Fowler, C. M., & Fowler, C. M. (2005).* The Solid Earth, An introduction to Global Geophysics.*CambridgeUniversityPress.*
6. *Gayakwad,R.A.(2000).*Op-ampsandlinearintegratedcircuits.*PearsonCollegeDivision.*
7. *Horowitz, P.,&Hill,W.(2021).*Theartofelectronics*.*
8. *JanValenta.(2015).*Introductiontogeophysics*.*
9. *Kaul,I.K.,Bhattacharyya, A.K.,&Sengupta,S.(1990).*Generalandappliedgeophysics*.*
10. *Mathur,A.P.(1989).*Introductiontomicroprocessors.*TataMcGraw-HillEducation.*
11. *Stacey,F.D., &Davis,P.M.(2008).*Physicsof theearth.*CambridgeUniversityPress.*
12. *Geophysicalmethodscommonlyemployedforgeotechnicalsitecharacterization*.(2008).

Seismology

LT P
C4 00
4

a. CourseObjectives: Thispaperexplainsandelaboratestheconceptofseismology.Thisisverymuch helpfultoidentifythe earthquakeintensity.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Students can understand phenomena related to earthquake vibration andabletoexplaintheconceptofearthwavepropagation
CO -2	Studentsareabletodeterminethelocationofearthquakesource,typeofearthquake type,andanalyzethemechanismofearthquakeoccurrence.
CO -3	Students can understand the principles and application of earthquakemonitoringtools.
CO -4	Students can understand the basic foundations of seismological conceptsusedin exploration.

C.CourseOutline

UnitI:Introductiontoseismology:

Introductiontoseismology,Introductiontoearthquakephenomena,conceptoffocus,focaldepth,epicenter,foreshocksandaftershocks,elasticreboundtheory,seismicityofIndia,Himalayasandglobalseismicity,seismiczoningofIndia,greatIndianearthquakes. **(12L)**

UnitII:Wavemotion

Fundamentals of wave motion. Bulk and rigidity modulus, Lame's Parameter, Seismic wavestypes and their propagation characteristics, absorption, attenuation and dispersion.Huygen's principleand Fermat's principle. Free oscillations of the Earth, the internal Structure of the Earth. Types ofEarthquakes -Tectonic, Volcanic, Collapse and explosion,Micro earthquakes. Reservoirinducedearthquakes. **(10L)**

UnitIII:**Seismometry:**

Introduction, Principle of Seismometer, Historical seismographs. Long period seismometers andShort period seismometers. Vertical motion seismometer and Horizontal motion seismometer. BroadBand seismometer, Analog recorders. Digital recorders. Selection of seismograph stations. Globalseismicnetwork.SeismicTomographyandreceiverfunctionanalysis,Velocitystructure,Vp/Vsstudies,Seismicnetworkandarrays,telemetrysystems. **(13L)**

UnitIV:SeismogramInterpretation:

Introduction of earthquake focal mechanism. Earthquake intensity Magnitude, Frequency, Energyreleasedinanearthquake.Epicenterdetermination.AnalysisofearthquakefocalMechanism.Earthquake location- Graphical method oflocating local earthquakes and Location of earthquake byGeigermethod. **(12L)**

Unit V:Earthquakeprediction:

Earthquake prediction; dilatancy theory, short-, medium- and long- term predictions, Seismicmicrozonations,Applicationsforengineeringproblems. **(13L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	H	PSO1 toPSO8	H	K1-K5

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.ReferenceBooks:

1. Aki,K.,&Richards,P.G.(2002).*Quantitativeseismology*.SterlingPublishingCompany.
2. Fossen,H.(2016).*Structuralgeology*.CambridgeUniversityPress.
3. Lowrie,W.,&Fichtner,A.(2020).*Fundamentalsofgeophysics*.CambridgeUniversityPress.
4. Shearer,P.M.(2009).*Introductiontoseismology*.CambridgeUniversityPress.
5. Scholz,C.H.(2002).*Themechanicsofearthquakesandfaulting*.CambridgeUniversityPress.
6. Stein, S., &Wysession, M. (2013). *An introduction to seismology, earthquakes, and earthstructure*.JohnWiley&Sons.
7. Pollard,P.D.,Pollard,V.D.,Pollard,D.D.,Fletcher,R.C.,&Fletcher, R.C.(2005). *FundamentalsOfstructuralgeology*.CambridgeUniversityPress.
8. Telford, W. M., Geldart, L. P., & Sheriff, R. E. (1990). *Applied geophysics*. CambridgeUniversityPress.

GeneralGeology

LT P
C4004

a. CourseObjectives: Thispaperexplainsaboutgeologyanditsfundamentals.Andalsodescribeaboutsedimentsand various typesofrocks.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletorecognizegeologicalobjectsanddescribethem.
CO -2	Explainthegeologicalphenomenafoundinthefieldandexplaintheprocessofoccurrence.
CO -3	Understandthebasicknowledgethatincludesmechanicalandchemical processesonEarth.
CO -4	Candescribeaboutsedimentsandvarioustypesofrocksonearth.

C.CourseOutline

UnitI:Crystalandminerals:

Crystal systems, Chemistry of minerals, atomic bonding. Structural classification of Silicatemineralsandtheircompositionalvariations,rock-formingandeconomicminerals-Majorsilicatemineral groups (quartz, feldspar, pyroxene, amphibole, mica, olivine and garnet) and their diagnosticproperties-Basicopticalmineralogy. **(12L)**

UnitII:Igneousrocks:

Introduction – Types of Rocks – Igneous Rocks: forms ofIntrusive and extrusive igneousbodies – structures and textures – its classification – Properties of magma. Bowen's reaction series-Magmatisminrelationtotectonicsettings,radioactivity&datingofrocks. **(10L)**

UnitIII:Metamorphic&Sedimentaryrocks:

Metamorphism, agents of metamorphism, types of metamorphism, metamorphic reactions,metamorphictexturesandstructures.Classificationofmetamorphicrocksbasedonchemicalcomposition and mineralogy. Grades and zones of metamorphism. Metamorphic facies. Formation ofsediments & sedimentary rocks: their compositions, textures &structures; origin & classification ofconglomerate, sandstone, shale & limestone; sedimentary environments &facies; characteristics ofnon-marine,transitional&marineenvironments. **(14L)**

UnitIV:**Folds, FaultsandJoints:**

Folds **-** parts of a folds, nomenclature of folds: Anticline, syncline, symmetrical fold, asymmetricalfold, overturned fold, recumbent fold, isoclinal fold. Faults - Terminology of fault plane; nature ofmovementalongfaults:Translationalandrotationalmovements,relativemovements,Effectsofdisturbed strata. Throw and heave; Classification: Geometrical classification, Genetic classification.Classificationbasedonabsolutemovements.Joints-Definition,geometricandgeneticclassification.

(12L)

UnitV:Principlesofstratigraphy:

Law of order of superposition. Law of uniformitarianism and law of faunal succession. Standardstratigraphic scale and Indian Geologic Timescale. Imperfections in Geological record. Geologicaldivisions.PrecambrianStratigraphy:MineralWealthofCuddapahs,Vindhyans,Kurnoolgroup.

PaleozoicStratigraphy:PaleozoicrocksofPeninsularIndia,MesozoicStratigraphy:economicimportanceof GondwanaformationsofIndia,CoastalGondwanaofIndia,GondwanaformationsofTamilnadu-CretaceousofTiruchirapalli-Deccantraps;CenozoicStratigraphy.

(12L)
(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	H	PSO1 toPSO8	H	K1-K5

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.ReferenceBooks:

1. Best,M. G.(2003).*Igneousandmetamorphicpetrology*.JohnWiley&Sons.
2. Billings,M.P.(1954).*Structuralgeology*.
3. Krishnan,M.S.(1943).*GeologyofIndiaandBurma*.
4. Kumar,R.(2010).*Fundamentalsofhistoricalgeologyandstratigraphyof India*.
5. Mahapatra,G.B.(1987).*Atextbookofgeology*.CBSPublishers&DistributorsPvt,India.
6. Rutley,F.,&Read,H.H.(2017).*Elementsofmineralogy*.FranklinClassics.
7. Sengupta,S.M.(2007).*Introductiontosedimentology,2e(PB)*.
8. Stow,D.A.(2005).*SedimentaryrocksintheField:Acolorguide*.Gulf ProfessionalPublishing.
9. Tyrrell, G. (1978). *The principles of petrology: An introduction to the science of rocks*. SpringerScience&BusinessMedia.

TheDynamicEarth(Electivemajor)

LTPC
4004

a. CourseObjectives: ThispaperdescribesaboutvariousprocessesofthedynamicearthlikeGlaciers,weathering,MassWasting,FluvialandAeloian andlandforms.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletoexplainthedynamicsofthelandformsthatincludescoastalprocesses.
CO -2	Studentscanunderstandthevarioustypesofweatheringanditsprocess.
CO -3	Students are able to understand a basic of the mass wasting andprocesses.
CO -4	Understand therelationship of processes that occur with theappearanceofthefield
CO -5	AnalyzetheFluvialandAeolianProcessesanditsLandformswithvariousgeologicalprocesses.

C.CourseOutline

UnitI:Coastal ProcessesandLandforms

IntroductionCoastalZones;WavesandTides;GeomorphologyofCoasts;DivisionsofCoastal Zones; Five Major Zones; Features of Shoreline; Beach cycles; Features of a coastline;Forcesactingonshorelines,SeaWaves-Classification;Processesofcoastalerosion,Mechanismsof Erosion, Depositional Landforms, Depositional Beaches, Spits and bars, Tombolo, Barrier Islands,Barrierspits,Capes,Mudflats,Deltas. **(12L)**

UnitII:WeatheringProcess

Introduction:Geomorphicprocesses, Weathering,Factorsinfluencingweathering,ImpactsandTypesofweathering,Topographyandclimate,RockType,RockStructure,Erosion,Time,Physicalweatheringprocesses,MechanismsofPhysicalweathering, Spheroidalweathering,Chemicalweatheringprocesses-Effectiveness,RateandImpactsofchemicalweathering,Processesofchemicalweathering,Biologicalweatheringprocesses,Ratesofweathering,BehaviorofGeologicmaterials,Temperatureandrainfall,Unloading. **(13L)**

UnitIII:MassWastingProcesses

Mass-wastinganditscauses,Typesofmass-movements,Triggersofmass-wasting,Factorsinfluencingmass-wasting,Importanceofmass-movements. **(12L)**

UnitIV:FluvialandAeolianProcessesandLandforms

Fluvial**-**Introduction,StreamsandDrainages,StreamValleys,Valley-Development,Deepening, Widening, Lengthening; River and its stages, River course, Process of Lower, Middle andUpper Courses; Erosional work of streams, Rate of erosion and types of erosion; Transportation workof streams; Erosional landforms and Depositional landforms; Aeolian - Introduction – Geologicalagents; Wind and its characteristics, Geological process, Erosional landforms, transportation effectanddepositionallandforms. **(13L)**

UnitV:Glaciers

Introduction,Sphereofice&snow–CryosphereandGlaciology,GlaciersandGlacialsystems –Snow line, Parts, Characteristics and Classification of glaciers, Mountain or Valley Glaciers,Continental Glaciers, Distribution of Glaciers, Formation of Glaciers, Movement of glaciers, Featuresof Glaciers, Geological action of Glaciers, Ice ages, Glacial Budget, Glaciers and Global climate,ImportanceofGlaciers. **(10L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K5
CO5	PO1to PO8	H	PSO1 toPSO8	H	K1-K5

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. e-PGphatasalawebsite(epgp.inflibnet.ac.in).

ComputerApplicationsinGeosciences-(Electivemajor)

LT P
C3003

a. CourseObjectives: ThispaperfocusesonComputer programmingandsoftwareapplicationsingeosciences.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	StudentsareabletoexplainthefundamentalsofOperatingsystemsandLanguage.
CO -2	StudentsareabletounderstandtheCandC++programmingandits applicationinGeosciences.
CO -3	Studentscanunderstandabasicof theMATLABanditscommands.
CO -4	Students are able to apply the basics of programming with MATLAB,conceptsand applications.

C.CourseOutline

UnitI:FundamentalsofOperatingsystemsandIntroductiontoLanguage:

Operating system (DOS, Windows, LAN, WAN, Linux, Unix) – Languages. Computer andProgramming concepts: Algorithms and Flow charts – Programming fundamentals – (Constantsvariables,OperatorsandExpressions) **(8L)**

UnitII:Cprogramming:

Introduction to C; Programming statements – (Branching and Looping, Arrays, Functions andProcedures)–FileHandling;ProblemssolvingwithcomputersusingC;ApplicationofCinGeosciences. **(9L)**

UnitIII:C++programming:

Introduction to C++; Programming statements – (Branching and Looping, Arrays, Functionsand Procedures) – File Handling; Problems solving with computers using C++;Application of C++ inGeosciences. **(9L)**

UnitIV:MATLAB andCommands:

Introduction to MATLAB – Commands – Vectors, Matrices and Arrays, Basic arithmeticoperations,Basicconceptofnumericalanalysis;M-fileintroduction;ProgramminginMATLAB;Floatingpointarithmeticanderrorfinding;DifferentMATLABtoolboxesanditsapplicationforGeosciences. Data format handling; Data import and export in MATLAB; Saving and exporting thefiles. **(9L)**

UnitV:ProgrammingwithMATLAB:

Program to Plot-subplot- double axis plot – Axis command- tick marks and labels; Curveplottingusingbasic2Dand3DprogramasatoolinEarthscience;TypesofplotinMATLAB–

Parametricplot,Contourplot,Fieldplot,polarplot;Curvesandsurfacesinthreedimension;Programming in MATLAB using Loops; Basics of using the Fourier transform; Power spectrum; TimefrequencyanalysisinMATLAB. **(10L)**

(Total:45L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	H	PSO1 toPSO8	H	K1-K5

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Gilat, A. (2017). Matlab: An introduction with applications (6th ed.). Create space IndependentPublishingPlatform.
2. Hunt, B. R., Lipsman, R. L., Rosenberg, J. M., Coombes, K. R., Osborn, J. E., & Stuck, G. J. (2006). AguidetoMATLAB:Forbeginnersandexperiencedusers.CambridgeUniversityPress.
3. III,W.J.(2010).IntroductiontoMATLABforengineers.McGraw-HillEducation.
4. Tanenbaum,A.S.,&Bos, H.(2016).Modernoperatingsystems(4thed.).Pearson.
5. MikeMeyers&ScottJernigan,(2004),OperatingSystemsTataMcgraw-Hilledition,
6. Andrew.S.Tanenbaum.,2010,ModernOperatingsystem,PHTlearningPrivateLimited,NewDelhi.

MineralExploration(ElectiveMajor)

LT
PC300
3

a. CourseObjectives: Thispaperdescribesaboutmineralexploration.Andalsoexplainsthevariousgeophysicaltechniquesusedinmineralexploration.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	StudentscanunderstandthePrinciplesofmineralprospectingandexploration
CO -2	Studentsareabletofindoutthelocationfororedepositsinvariousexplorationactivities.
CO -3	Students can apply the various applications of Geophysical techniquesinmineralexploration.
CO -4	Students can understand the various mining methods and mineraleconomics ofIndia.

C.CourseOutline

UnitI:Principlesofmineral prospectingandexploration:

A brief overview of classification of mineral deposits with respect to processes of formation inrelation to exploration strategies Principles of mineral prospecting and exploration-conceptualization,methodology and stages; sampling, subsurface sampling including pitting, trenching and drilling, coreand non-core drilling, sampling and assaying. Gravity, electrical, magnetic, airborne and seismicmethodsofexploration,planningofboreholesandlocationofboreholesonground. **(11L)**

UnitII:Guidesforlocatingoredeposits:

Structural,lithological,stratigraphicandphysiographicguides.SurfaceandSub-surfaceexploration: use of diamond drilling in exploration; Resource, reserve definitions; mineral resource inindustries - historical perspective and present. methods ofore reserve estimations; recoverablereservesandanticipatedlifeof thedeposits. **(9L)**

UnitIII:ApplicationofGeophysicaltechniques:

GeomorphologicalandremotesensingtechniquesandGeobotanicalandgeochemicalmethods.Applicationofgeostatisticaltechniquesin MineralExploration. **(8L)**

UnitIV:Miningmethods:

Surface and underground mining methods; factors in selection of open cast and under groundmining methods. coal mining methods: room and pillar method, long wall method. Environmentalaspects of Mining activities. Petroleum exploration; geological, reservoir rocks, geochemical andgeophysicalmethodsofexploration. **(9L)**

UnitV:Principlesofmineraleconomics: Strategic,criticalandessentialminerals.MineralproductioninIndia.Changingpatternofmineralconsumption.Nationalmineralpolicy.Mineralconcession,rules,marineminer alresourcesandLawofSea. **(8L)**

(Total:45L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Haldar,S.K.(2018).*Mineralexploration:Principlesandapplications*.Elsevier.
2. Marjoribanks, R. (2010). *Geological methods in mineral exploration and mining* (2nd ed.).SpringerScience &Business Media.
3. Park,J.(1906).*Atext-bookofmininggeology*.Griffin'sStandardPublication.
4. Turaga,S.P.,(2006). Drilling Fluids, their composition, function and properties, Centre for RuralDevelopmentandEnvironmentalStudies(Pub.),Secunderabad.

RemoteSensingandGIS-(Electivemajor)

LT
PC300
3

a. CourseObjectives: ThispaperdescribesaboutremotesensingandGISapplicationsinGeosciences.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	StudentscanremembertheElectromagneticenergyresources, electromagnetic radiation (EMR) spectrum and Wavelengthrelationship.
CO -2	Students can understand the Characteristics of aerial photographsandsatellite imagery.
CO -3	Students can understand the Digital image processing, Classificationofsatelliteimageandvarioustypesofremotesensingtechniques.
CO -4	StudentsareabletoapplyGISconceptsandapplications,abletoperformGISdevelopmentandmanagespatialdatabyutilizingGIStechnology.

C.CourseOutline

UnitI: Electromagneticenergyresources,electromagneticradiation(EMR)spectrum,EMRenergy–frequency–wavelengthrelationship,Boltzmanlaw,WienLaw. **(8L)**

Unit II : Characteristics of aerial photographs and satellite imagery – false colour composites, photo-elemental characters, reflectance and emittance- Geosynchronous and sun synchronous orbits, locationofasatelliteinspace,worldreferencingsystem. **(8L)**

Unit III: Remote sensing plate forms - Characteristics of different remote sensing satellites and sensors,resolution, parallex, vertical exaggeration, relief displacement, mosaic, analysis and interpretations ofaerial photographs and satellites imagery.Satellite remote sensing digital data products, data formatand storage, preprocessing – atmospheric, geometric and radiometric correction, image rectification andregistration. **(9L)**

UnitIV: Digitalimageprocessing–contrastenhancement,imagearithmetic,filtering,imagetransformation, classification of satellite image – supervised and unsupervised classification techniques,visible, thermal infra-red, microwave and hyper-spectral remote sensing principles and techniques.Advantagesanddisadvantagesof RemoteSensing–Variousapplicationof remotesensing.**(10L)**

Unit V: Definition of GIS – components of GIS – Geographical concepts – Input data for GIS – Types ofoutput products – GIS Data types – Data representation – Data sources – Data acquisition – Georeferencing of GIS data – Spatial data errors – Spatial data structures.database management – hierarchical, network, relational, object oriented databases, data stream – data encoding and editing,dataanalysis- ApplicationofGIS. **(10L)**

(Total:45L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Gonzalaz,F.E.,Ruiz,M.J.,&Acosta,F.M(2013). *Remotesensingtutorial.*
2. Clark,P.E.,&RileeM.L.(2004).*RemoteSensingToolsforExploration.*
3. Lillesand,T.M.,Kiefer,R.W&Chipman,J.W(2004).*RemotesensingandImageinterpretation.*
4. Bakker, H.B., Janssen, L.L.F., Reeves, C.V., Gorte, B.G.H., Pohl, C., Weir, M.J.C.,Horn, J.A.,Prakash,A.,&Woldai,T.(2001).*Principleof RemoteSensing*.
5. Guha,P.K.,(2003).*RemotesensingforBeginner–EWP*,NewDelhi.
6. Arnold, R.H.,(1997).*Interpretation of air-photo and Remotely sensed imagery*,Printice-Hall, NewJersey.
7. Drury,S.A.(1993).*ImageInterpretationinGeology*–ChapmanHall,London,1993.

Practical -I

LT
PC004
2

a. CourseObjectives: Thispracticalpapergivestheknowledgeabout Geologicalandmineralexplora tion,seismologyand computerapplication ingeosciences.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudent willbeableto

	CourseOutcome
CO -1	Studentscanunderstandthemegascopicidentificationofrocksandminerals aswells asmicroscopic identificationofminerals
CO -2	StudentscanidentifytheRichermagnitude.
CO -3	StudentscanevaluatetheEpicenterdetermination.
CO -4	Studentsareabletoapplyincomputerapplicationingeosciences.

C.CourseOutline

Practical'sareselectedfromthefollowinglist

1) Megascopicandmicroscopicidentificationofcommonsilicateandoreminerals
2) Megascopicidentificationofcommonrocks
3) ThemodifiedMercalliscale
4) TheRichtermagnitudescaleisdeterminedbytheamplitudesof theP-andS-waves
5) Epicenterdetermination
6) Graphicalmethodoflocatinglocalearthquakes
7) Computerapplicationingeosciences
8) Anyotherrelatedpractical's

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

IISemester

NaturalHazards -Part-1-Elective(NonMajor)-MOOCCourse

LT P
C3003

a. Course Objectives: This paper describes about the various types of natural hazards and thispaper isofferedthroughonline program.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletoexplainaboutgeologicalhazardssuchasearthquakes,tsunamis,storms,eruptingvolcano,mudvolcano,lava flood,erosion,landslide,rockslides,subsidence,flashfloods,sedimentation andothernaturalhazards.
CO -2	Describetherelationshipofeachthreatinaregion.Studentsareabletoapplyinmulti-threatmitigation(multi-hazards)inanarea.
CO -3	Describe the relationship of each threat in a region. Students are abletounderstandmulti-threatmitigation(multi-hazards) inanarea.
CO -4	Studentsareabletounderstandmappingof disasterproneareas

CIVIL ENGINEERING

PROF. JAVED MALIK
Department of Earth Sciences
IIT Kanpur

TYPE OF COURSE : New| Elective | UG/PG **COURSE DURATION** : 8 weeks (28 Jan'19 - 22 Mar'19)
INTENDED AUDIENCE : UG/PG students of Science/Engg **EXAM DATE** : 31 Mar 2019

PRE-REQUISITES : Basic knowledge of Earth Science or Natural Disasters is recommended.

COURSE OUTLINE :

The course introduces students to natural disasters and their phenomenon, ground deformations, land-level changes, event recurrence intervals, associated environmental and depositional changes, sedimentation patterns, and all the related hazards. Some of the well-known natural disasters are earthquakes, landslides, floods, tsunamis, volcanic eruptions, storms, and cydones etc. which cause different types of natural hazards in the associated environment and landscape. This course will emphasize their mechanism, origin, and impacts in the associated regions such as mainland, hilly terrain, floodplain/alluvial plain, and coastal regions etc., and also focus on the approaches for mitigating and minimizing hazards along with related hazard assessment.

ABOUT INSTRUCTOR :

Prof. Javed Malik earned his Ph.D in 1998 from M.S. University Baroda, Vadodara, Gujarat (Geology), did Post-Doctorate (Japan Society for Promotion of Science) from (1999-2001) Hiroshima University, JAPAN. He joined IIT Kanpur in 2001 and his areas of Specialization are Active Tectonics, Paleoseismology and Paleo-tsunami

COURSE PLAN :

Week 01 : Natural Hazards and Disasters ,Natural Hazards and Disaster,Human Impact on Natural Disaster,Predicting Catastrophe,Mitigating Hazards
Week 02 : Mitigating Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards,Earthquakes and their causes
Week 03 : Earthquakes and their causes,Earthquakes and their causes,Ground Motion and Failures,Ground Motion and Failures,Ground Motion and Failures
Week 04 : Tsunami: Gaint Tsunamis,Tsunami: Gaint Tsunamis,Tsunami: Generation and Movement,Tsunami: Generation and Movement,Tsunami: Generation and Movement
Week 05 : Tsunami Hazard Assessment,Tsunami Hazard Assessment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment,Volcanic Hazard: Eruption-Type of Volcanoes and Tectonic environment
Week 06 : Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes, Type of downslope movement, associated hazard,Land Subsidence and associated hazard,Land Subsidence and associated hazard
Week 07 : Floods and Human Interaction,Flood Frequency and Recurrence Interval,Flood Frequency and Recurrence Interval,Human intervention and mitigation,Human intervention and mitigation
Week 08 : Storms: Tropical Cyclone,Storms: Tropical Cyclone,Hurricane, Tornado, Storm damage and safety, Wildfires: Fire Process and Secondary effects,Wildfires: Fire Process and Secondary effects

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.Reference:

1. Swayam/ NPTELonlinecourse

GeophysicalSignalProcessing

LT P
C4004

a. Course Objectives: This paper describes about Geophysical Signal

Processing.Thispaperis verymuchusefulforstudentstointerpretthegeophysicaldata.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletounderstandthefundamentalconceptsofsignalprocessing.
CO -2	Beingabletoapplythebasicconceptsofsignaldataingeophysicalproblems.
CO -3	Studentscanunderstandtheconvolutionanditsmethods.
CO -4	Studentscanunderstandthefiltersandwindowstointerpretthegeophysicaldata.

C.CourseOutline

UnitI:Fundamentalconcepts:

Continuous and discrete signals, Classification of discrete signals, operation on signals, linearand time invariant systems, Dirac delta function and impulse response of a linear system, wavelets,minimumdelay,maximumdelayandmixeddelaywavelets. **(12L)**

UnitII:Fourierseries:

Fourier series, Orthogonal function and Dirichlet conditions, Fourier transform, properties andapplications of FT, Fourier transform of asymmetrical rectangular pulse, reciprocity, Interpretation ofgeophysicaldatausingFouriertransform.Powerspectrum,SamplingtheoremZ-transform,propertiesofZ-transform **(12L)**

UnitIII:Introductiontoconvolution:

Convolution, methods for convolution, properties of convolution, convolution theorem, autocorrelation, cross correlation and their applications, relation between correlation functions and theircorresponding powerspectra,timedomainandfrequencydomainconcepts.Deconvolution.**(12L)**

UnitIV:Filters:

Butterworth, chebyshev and elliptic, Low-pass, high-pass and band-pass digital filter, Gibb'sphenomenon, Recursive filters. Wiener inverse filtering and its mathematical details, homomorphicapplicationsof deconvolutionfiltering. **(12L)**

UnitV:WindowFunctions:

Windowing-Triangular,HanningandHammingwindow,Bortlettwindow,Parzenwindow,Daniellwindow,practicalapplicationsofwindows.ConceptsofInversion. **(12L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Gubbins, D. (2004). Time series analysis and inverse theory for geophysicists. CambridgeUniversityPress.
2. Kanasewich,E.R.(1981).*Timesequenceanalysisingeophysics*(3rded.).UniversityofAlberta.
3. Koopmans,L.H.(2014).*Thespectralanalysisoftimeseries:Probabilityandmathematicalstatistics*.AcademicPress.
4. MarkusBath(1974).SpectralanalysisinGeophysics.
5..Menke,W.(1989).*Geophysicaldataanalysis:Discreteinversetheory*.Elsevier.
6. RamachadraRao,M.B.(1975).OutlinesofGeophysicalprospecting:AmanualforGeologists.EBDE ducational PrivateLtd.
7. Serov, V. (2017). *Fourier series, fourier transform and their applications to mathematical physics*.Springer.
8. Silvia,M.T.,&Robinson,E.A.(1979).Deconvolutionofgeophysicaltimeseriesintheexplorationforoilandnaturalgas.
9. Oppenheim,A.V.,Schafer,A.V.,&Buck,J.R.(1999).Discrete–TimeSignalProcessing.

ElectricalandElectromagneticProspecting

L T P
C400 4

a. Course Objectives: This paper focuses an understanding of the Electrical and Electromagneticprospectingandstudentsareexpectedtoknowtheelectricalandelectromagneticprospecting influencein variousfieldslikeoil,minerals,etc.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	StudentsareabletorembertheElectricalpropertiesofrocksandminerals.
CO -2	BeingabletoapplytheResistivitydataanalysisandInterpretation
CO -3	Students are able to master the concept, principles and techniques ofsystemdesign,processorapplicationcomponentofElectromagnetic Method(GPR,VLF,andMT)
CO -4	Students can analyze the modeling to resolve deep-seated geophysicalengineeringissuesdeeplyinmine,hydrogeological,geotechnic alandenvironmentalexploration.

C.CourseOutline

UnitI:Basicprinciplesofelectricalmethodsofprospecting:

Classificationofmethods.Electricalpropertiesofrocks,minerals,influenceofmineralcomposition, moisture and salinity, Temperature on resistivity- Current flow in a homogeneous media- Currentflowacrosslayersofdifferingresistivities. **(12L)**

UnitII:Resistivitymethodsofprospecting:

Concepts of true and apparent resistivities. Field methods-Vertical Electrical Sounding (VES),Resistivity Profiling. Resistivity imaging: some fundamental concepts. Methods in resistivity imaging,field surveys and uses. Resistivity data analysis and Interpretation – Equivalence and Suppression,ApplicationsofElectricalResistivityTomography(ERT). **(12L)**

UnitIII:Electromagneticmethod:

PassiveandActivesourcemethods,Diffusionequation,waveequationanddampedwaveequation used in EM method, boundary conditions, skin depth, depth of investigation and depth ofpenetration, amplitude and phase relations, real and imaginary components, elliptical polarization,Principles of EM prospecting, various EM methods:Vertical loop (VLEM) - Horizontal loop - (HLEM)-Very Low Frequency (VLF) – AudioFrequency Magnetics (AFMAG) – TimeDomain systems - TerrainConductivity.MagnetoTelluric(MT)andTransientElectromagnetic(TEM)methodsofgeophysicalexploration. **(12L)**

UnitIV:Electrochemicalmethods:

Originandnatureofelectrochemicalprocesses(spontaneouspolarization)intheearth.Exploration of sulphide ore bodies. Typical responses of SP over sphere and rod like bodies. Inducedpolarization (IP) method: Introduction, Source of IP, membrane, and electro depolarizations, TimedomainandfrequencydomainmeasurementofIP, ApplicationofIPmethods. **(12L)**

UnitV:**Applications:**

Electromagnetic Principles of GPR - GPR Systems and Design, Data Processing, ModelingandAnalysisinEnvironmentalApplications,GPRapplicationinWaterResourcesResearch,Mineralogical,StratigraphyandArcheologicalScience. **(12L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Bhattacharya, P. K., &Patra, H. P. (1968). *Direct current Geoelectric sounding: Principles andinterpretation*.
2. Jol,H.M.(2008).*Groundpenetratingradartheoryandapplications*.Elsevier.
3. Parkhomenko,E.I.(2012).*Electricalpropertiesofrocks*.SpringerScience&BusinessMedia.
4. Reynolds, J. M. (2011). *An introduction to applied and environmental geophysics*. John WileyandSons.
5. Kanfman, A.A. (1992). *Geophysical Field Theory and method, Part A, Gravitational, Electric andMagnetic Fields*.
6. Parasnis,D.S.(1966).*MiningGeophysics*.
7. Ramachadra Rao, M.B. (1975). Outlines of Geophysical prospecting: A manual for Geologists.EBDEducational PrivateLtd.

GravityandMagneticProspecting

L T P
C400 4

a. CourseObjectives: ThispaperdescribesaboutGravityandmagneticprospectingandelaborates the Gravity prospecting instruments and interpretation of the gravity and magnetic data inoil/gas,mineralandgroundwaterexploration.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletounderstandtheconceptandtechnologyofgravityandmagneticmethods indescribingsubsurfaceconditions
CO -2	BeingabletocorrectthemagneticdataandReductionofgravitydata.
CO -3	Studentsareabletoapplytheconceptgravityandmagneticdata
CO -4	Studentsareabletodesigntheacquisitionofgravityandmagneticdata.

C.CourseOutline

UnitI:IntroductiontoGravity:

Geophysical potential fields, Inverse square law, Principles of Gravity and Magnetic methods,Global gravity anomalies, Newtonian and logarithmic potential, Laplace's equations for potential field.Green's Function, Concept of gravity anomaly, Rock densities, factors controlling rock densities,determinationof densityStableandunstablegravimeters,boreholeandairbornegravimeters. **(13L)**

UnitII:IntroductiontoMagnetic:

Earth's main magnetic field, origin, diurnal and secular variations of the field, Geomagneticelements, intensity of magnetization and induction, magnetic potential and its relation to field, units ofmeasurement, interrelationship between different components of magnetic fields, Poisson's relation,Magneticsusceptibility,factorscontrollingsusceptibility.MagneticMineralogy:Hysteresis,rockmagnetism,natural,andremnantmagnetization,demagnetizationeffects.Magneticprospectinginstruments:fluxgate,protonprecessionandRubidiumvapourmagnetometers. **(13L)**

UnitIII:Processingofgravitydata:

Reductionofgravitydata,latitudeeffect,Free-aireffect,Bougercorrection,topographiccorrectionandvarioustypesofgravityanomaly;regionalandresidualseparation,conceptofisostasy and isostatic anomaly, principle of equivalent stratum, Excess mass calculations. The gravityanomalyoversimplegeometricshapes. **(12L)**

UnitIV:Processingofmagneticfield:

Magnetic data acquisition - IGRF corrections - Magnetic data reduction. Qualitative interpretation – depth estimation - Interpretation of magnetic anomalies due to different geometry shaped bodies andmodelling. **(10L)**

UnitV:Gravityandmagneticanomaliesandapplications:

Quantitative interpretation of gravity and magnetic anomalies over simple geometric shapes.Applications of gravity and magnetic prospecting in oil/gas, mineral and groundwater exploration –Applications in geological / structural mapping. Forward modelling and inversion of arbitrary shapedbodiesand2-D,3-Dinterfaces.Interpretationsinfrequencydomain. **(12L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. B.S.R.RaoandI. V.R.Murthy.1978. Gravity and Magnetic Methods of Prospecting, Arnold-HenninmanPublishingCompany,Delhi.
2. S.H.Ward(Ed.).1967.MiningGeophysics,Vol.IandVol.II.,SEGPublication,Tulso,Oklahoma,USA.
3. D.S.Parasnis.1973.MiningGeophysics,Amsterdam,ElsevierPublishers,TheNetherlands.
4. L.L.Nettleton.1976.GravityandMagneticsinOilProspecting,McGrawHillPublication,NewYork.
5. V.L.S.BhimasankaramandV.K.Gaur.1978.LecturesandExplorationGeophysics,AEGPublications, CEG,Osmania University,Hyderabad.
6. I.V.RadhakrishnaMurthyandD.C.Mishra.1989.GravityandMagneticAnomaliesinspaceandfrequencydomain,AEGPublications.
7. Edwin S. Robinson and Cahit Coruh.1988. Basic Exploration Geophysics. John Wiley and Sons,NewYork/Toronto/Brisbane/Singapore.
8. RamachadraRao,M.B.(1975).OutlinesofGeophysicalprospecting:AmanualforGeologists.EBDEducational PrivateLtd.

Hydrogeology

LT
PC400
4

a. CourseObjectives: ThispaperdescribeaboutGroundwaterhydrogeologyandusingapplication of Geophysics. This paper elaborately discusses about type ofwater and its flow. Andalsodescribethegeologicalandhydrogeologicalmethodsingroundwaterexploration.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletounderstandthetypesofwaterdistributionofgroundwater
CO -2	Studentsareabletounderstandtheimportantgeologicalconditionsin theformationofaquifersystems.
CO -3	Students are able to apply the Geophysical methods in Groundwaterexploration.
CO -4	StudentscanunderstandtheSubsurfaceinvestigations.
CO -5	StudentscanapplytheGroundwatermappingusingvariousmodelingmetho dsbyusinggroundwaterchemistry.

C.CourseOutline

UnitI:Introduction:

Types ofwater— meteoric, juvenile, magmatic and seawater.Historical Background – Groundwater in the Hydrologic cycle – Hydrologic Budget –Origin and Age of Groundwater – RockProperties affecting groundwater – Vertical distribution of groundwater – Zone of Aeration – Zone ofSaturation–GeologicformationsasAquifers–TypesofAquifer–Springs. **(13L)**

UnitII: Theoryofgroundwaterflow:

Darcy's Law – Permeability – Hydraulic conductivity – Anisotropic aquifers – groundwater flowrates – groundwater flow directions – Dispersion – Groundwater tracers – general flow equations –unsaturatedflow–Infiltration:TheGreen-AmptMethod. **(12L)**

UnitIII:GroundwaterlevelsandQuality:

Time variations of levels– Streamflow and groundwater levels– types of fluctuations– Urbanization – effects of global climate change on groundwater. Types of water quality analysis – Waterqualitycriteria–
PollutionofgroundwaterduetoMunicipalsources,Industrialsources,Agriculturalsources– Remediationofcontaminatedgroundwater. **(13L)**

UnitIV:GroundwatermodelingandManagment:

Typeofgroundwatermodelling–Simulationoftwo-dimensionalandthree-dimensionalgroundwater systems. Basin Management – Groundwater Basin investigations– Yield – Conjunctiveuse– Waterlawsandpolicies.Artificialrechargemethods –wastewaterrechargeforreuse.**(12L)**

UnitV:GeophysicalmethodsinGroundwaterexploration:

EngineeringapplicationsinGroundwaterexplorationandmanagement-SurfaceInvestigation: Remote sensing, Electrical resistivity method, Seismic refraction method, Gravity andmagnetic methods – Subsurface investigations: Test Drilling – water level measurement – resistivitylogging– spontaneouspotentiallogging–Radiationlogging. **(10L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4
CO5	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Karamouz, M., Ahmadi, A., &Akhbari, M. (2011). Groundwater hydrology: Engineering,planning,andmanagement.CRCPress.
2. Kirsch, R. (2008). Groundwater geophysics: A tool for hydrogeology. Springer Science &Business Media.
3. Koopmans,L.H.(1995).Thespectralanalysisof timeseries.Elsevier.
4. Reddy,M.A.(2008).Textbook ofremotesensingandgeographicalinformationsystems.
5. Pratt,G.(2005). AppliedGeoPhysics.
6. Tood,D.K.,&Mays,L.W.(2005).GroundWaterHydrology.

Meteorology&Climatology-(Electivemajor)

LTPC
3003

a. Course Objectives: This paper explains about various components and concepts of MeteorologyandClimatology.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletorembertheatmosphereanditsstructure.
CO -2	Studentscanunderstandthedifferentfactorsaffectingtheatmosphere
CO -3	Students can understand the various climate components inatmosphere.
CO -4	StudentsshouldknowtheClimatologyandAtmosphericcirculationandits varioustypesandunderstandthepaleoclimatology.

C.CourseOutline

UnitI:ThermalStructureoftheAtmosphere

Introduction,Historyandtrendofresearchontheexplorationofatmosphericstructure;EvolutionofAtmosphere;ThermalStructureofAtmosphere–Troposphere,Stratosphere,Mesosphere,Thermosphere,Exosphere. **(8L)**

UnitII:Differentfactors

Factors Affecting Atmospheric Temperature at Troposphere-Composition of the Atmosphere;Insolation, Humidity, Altitude, Type ofBiome, Instruments in Study ofAtmospheric Layers, HumanandNaturalInfluencesontheChangingThermalStructureoftheAtmosphere,StructuresofAtmosphereinotherPlanets **(8L)**

UnitIII:BasicsofClimatology:

Introduction –Climatology, Climatic components, Ancient Science, Chronology - Work of Indians,ClimatologyandEcology,Globalclimateandcyclicalprocesses,ClimatologyandAtmosphere,Importance of atmosphere, Study of Atmosphere, Climatology and Global Energy, Solar Radiation -factors influencing insolation, Nature of Radiation, Energy Balance, Study of Weather and Climate,Elements of Weather and Climate, Temperature, Atmospheric Temperature, Uneven Distribution ofTemperature, Processes, Climatology&GlobalPressure, Distributionof Air Pressure.

(10L)

UnitIV:TheOutlineofClimotology:

Climatology and Atmospheric circulation, Types of Circulation, Forces Controlling Circulation,AtmosphericPressureandMotion,DynamicsoftheAtmosphere,LocalandSeasonalWinds,Circulationfeatures,MoistureintheAtmosphere,AtmosphericHumidityandCondensation,Climatology Analyses Humidity, Fogs, their origin and Types of Fogs, Clouds, their origin and Types,MonsoonsandClimatology,Seasons,Precipitation&itsDistribution. **(10L)**

UnitV:ConceptsofAtmosphere:

AtmosphericDisturbances,ExtremeEventsinAtmosphere,Cyclones,Hurricanes,Thunderstorms, Tornadoes, World Climatic Types, Classification of Climates, Climatic Types andBiomes,ClimaticChange,WeatherForecast,MethodsinWeatherForecast,SatelliteClimatology, TropicalClimatology,Paleoclimatology,LeadingRoleofClimatologists,Climaticmapsandcharts

(9L)

(Total:45L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. E-phatasalawebsite(epgp.inflibnet.ac.in)

DisasterManagement-(Electivemajor)

L T P
C3003

a. Course Objectives: This paper explains about various disaster management and its conceptsand elaborately discusses the disasters and Environmental impacts on disaster. And also describestheDisasterlawand policy.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsrememberthehazardsanddisastersanditstypes.
CO -2	StudentscananalyzetheareasPronetoCyclonicandCoastalHazards with SpecialReferencetoTsunami
CO -3	Students can understand the Disaster Management Concepts andits law
CO -4	Studentscanunderstandthevariousactsandpolicieswithreferenceto Disastermanagement.

C.CourseOutline

Unit : Introduction to Disaster: Definition, Factors and Significance; Difference between Hazard andDisaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Repercussions ofDisastersandHazards:EconomicDamage,LossofHumanandAnimalLife,DestructionofEcosystem. **(8L)**

Unit II: Types of hazards and Human activity: Study of Environmental Impacts Induced by HumanActivity; History of Disasters and Types of Hazards: Earthquakes, Volcanisms, Cyclones, Tsunamis,Floods, Droughts and Famines, Landslides and Avalanches. Nuclear Reactor Meltdown, IndustrialAccidents,OilSlicksandSpills,OutbreaksofDiseaseandEpidemics,WarandConflicts. **(8L)**

UnitIII:StudyofSeismicZones: AreasProneToFloodsandDroughts,LandslidesandAvalanches;Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-DisasterDiseases and Epidemics. Types of News Media, Structure and Trends, News Media during Crisis,ImpactofMediaonPolicy. **(9L)**

UnitIV:**DisasterManagementConcepts**:Meaningofdisaster,elementsandScopeofdisastermanagement, Approaches to disaster management, Disaster Management Cycle, Disaster Law andPolicy related to disaster prevention, emergency response, compensation & insurance, human rights,and community recovery, relief policy and procedure; exploring the legal issues, Disaster Law andPolicy, features: legal analysis of issues emerging from disastrous events the causes of disasters andtheirrelationshiptolaws,designedtoprotecthealth,safety,andtheenvironment. **(10L)**

UnitV:**Actsandpolicies:**MappolicyofIndia,RemoteSensingPolicy,RTIAct,PrivacyAct,Groundwater Act, Mines & Mineral Act, Atomic Mineral Act, Oil &Natural Gas Act (including coal),Environmental Pollution and Prevention Act, Wildlife Act, Forest Act, Western Ghats Ecosystem act,National Biodiversity Act, National Marine Biodiversity act, Marine Environmental Act, Integrated CoastalZone Regulation, Offshore Mining Regulation, Law of the Sea, Maritime Law; National Data sharing &accessibilitypolicy. **(10L)**

(Total:45L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4– Analyze,K_5–Evaluate,K_6–Create)

e.References:

1. Beach,M.(2010).*Disasterpreparednessandmanagement*.F.A.Davis.
2. Bhandari, R. K. (2013). *Disaster education and management: A joyride for students, teachers anddisastermanagers*.SpringerScience &BusinessMedia.
3. Brebbia, C. A. (2013). *Disaster management and human health risk III: Reducing risk, improvingoutcomes*.WIT Press.
4. Collins,L.R.(2000).*Disastermanagementandpreparedness*.CRCPress.
5. Coppola,D.P.(2010).*Introductiontointernationaldisastermanagement*.Elsevier.
6. *NATURALDISASTERMANAGEMENT*.(1999).JonIngleton.
7. Pine,J.C.(2014).*Hazardsanalysis:Reducingtheimpactofdisasters*(2nded.).CRCPress.
8. Pinkowski,J.(2008).*Disastermanagementhandbook*.CRCPress.
9. Ranke, U. (2015). *Natural disaster risk management: Geosciences and social responsibility*.Springer.
10. Shi,P.(2019).*Disasterriskscience*.Springer.
11. Singh, A., Punia, M., Haran, N. P., & Singh, T. B. (2018). *Development and disastermanagement:Astudyofthenortheasternstatesof India*.Springer.

ArcheologicalGeophysics-(Electivemajor)

LT P
C3 00
3

a. Course Objectives: This course may be interesting not only for students-geophysicists, but also forstudentsofarchaeologicalandenvironmentalDepartments.Andalso,thispaperfocusesonGeophysicalmethodsin archaeological sitesanditsapplications.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsrememberthearchaeologyandmuseumandunderstandtherelationbetweenhistoryand archaeology
CO -2	Studentscanunderstandthevariousexplorationtechniquesinfield archaeology
CO -3	Studentsarecapableofanalyzinggeophysicalstatementsin archeology, paleodisaster, sedimentation and stratigraphy,radiocarbondating,
CO -4	Canapplyandutilizinggeophysicalmethodstodescribe subsurfaceconditionsinarchaeologicalfields.

C.CourseOutline

UNIT–I:Introductionto Archaeological aspects:
Relation between History and Archaeology, Geology and Archaeology, Anthropology and Archaeology - Contributions of Archaeological Survey of India, Archaeological sites in India and Tamilnadu. Importanceof conservation - Conservation of Organic and Inorganic materials –Legal aspects relating to conservation and preservation – Origin of Museums in India - Types of MuseumMuseum. **(6L)**

UNIT–II:Field Archaeology
Exploration techniques – Exploration tools – Excavation methods – Horizontal and Vertical Excavations – Stratigraphical Analysis - Excavation equipments - Documentation and Interpretation – Preparation ofExcavationReport–Datingmethods–RemotesensinginArchaeology–DigitalArchaeology. **(7L)**

UNIT–III:MagneticandGravitymethodsinarchaeology
Magnetic Field - Brief explanation of paleo-magnetic studying in archaeology.Techniques of magneticanomalyinterpretationunder simplifiedand complicated environments.
Gravity field - Density properties of soil, rocks and archaeological targets - Gravity field of the Earth,Gravityfieldanomalies(positiveandnegative)overtypicalarchaeologicalobjects.Examplesofquantitativeinterpretationoverarchaeologicaltargets. **(10L)**

UNIT–IV:Electrical andSelf-Potentialmethods inarchaeology
Resistivityfield:Electricpropertiesofgeologicalrocksandarchaeologicaltargets-
Quantitativeinterpretationofresistivityanomalies- Applicationofresistivitymethodinarchaeology.
Self-Potential(SP)method-Physical-geologicallimitationsofSPmethod-
QuantitativeinterpretationofSPanomaliescausedbyarchaeologicaltargets. **(10L)**

UNIT–V:OtherGeophysicalmethodsonarchaeology:

Physical principles of GPR - Methodology of field measurements - Examples of GPR application atvariousarchaeologicalsites-Globalpositionalsystemandarchaeology-MetaldetectorInducedpolarization - Near-surface seismic prospecting -Recognition of ancient earthquakepatterns - Filteringof geophysicalfields. **(12L)**

(Total:45L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Aitken,M.J.,1974.*PhysicsandArchaeology*.OxfordUniversityPress,London.
2. Conyers,L.B.(2016).*Interpretingground-penetratingradarforarchaeology*.Routledge.
3. Conyers, L. B. (2018). *Ground-penetrating radar and magnetometry for buried landscapeanalysis*.Springer.
4. David, A., English Heritage, Linford, N., & Linford, P. (2008). *Geophysical survey inarchaeologicalField evaluation*.
5. Goldberg,P.,Holliday,V.T.,&Ferring,C.R.(2001).*Earthsciencesandarchaeology*.Springer.
6. Goodman, D., &Piro, S. (2013). *GPR remote sensing in archaeology*. Springer Science &Business Media.
7. Herz, N., & Garrison, E. G. (1998). *Geological methods for archaeology*. Oxford University PressonDemand.
8. Oswin, J. (2009). *A Field guide to geophysics in archaeology*. Springer Science & BusinessMedia.
9. Telford, W.M., Geldart, L.R. and Sheriff, R.E., 2001. Applied Geophysics, Cambridge UniversityPress,Cambridge.
10. Vogell, A. and Tsokas, G.N. (Eds.), 1993. *Theory and practice of applied geophysics*, v. 7,GeophysicalExplorationofArchaeologicalSites,ViewegVerlag,Wiesbaden.

Practical-II

L T P
C0
042

a. CourseObjectives: ThispracticalpaperdescribesaboutsolvingtheproblemsanddatainterpretationaboutElectrical, Gravity,andGeophysicalsignalprocessing.

b. CourseOutcomes(CO):

Attheendof theCourse,thestudentwillbeableto

	CourseOutcome
CO -1	StudentscancomputetheResistivityprofilingcurvewithtwo,threeandfourelectrodespread over a verticalcontact.
CO -2	Studentscanbaletoconstructandinterpretthe VEScurves
CO -3	Students can analyze the construction of gravity profiles on somesimplegeometricalmodels.
CO -4	StudentscananalyzeandinterprettheS.P.anomalyoverasphere.

C.CourseOutline

Practicalsareselectedfromfollowinglist

1. ComputationofResistivityprofilingcurvewithaTwoElectrodespreadoveraverticalcontact
2. ComputationofResistivityprofilingcurvewithathreeElectrodespreadoveraverticalcontact.
3. ComputationofResistivityprofilingcurvewithafourelectrodespreadoveraverticalcontact.
4. AnalyticalandGraphicalconstructionof VEScurves.
5. Applicationof curvematchingtechniquesininterpretationofVEScurves
6. Computerinterpretationof VESdata
7. ComputationandinterpretationofS.P.anomalyoverasphere.
8. Reductionoffieldgravitydata
9. Constructionofgravityprofilesonsomesimplegeometricalmodels
10. Computationspertainingtobasementdepthestimationfromgravity
11. Hilberttransform
12. Amplitudeandphasecharacteristicsofdigitalfilter
13. Ore–lodeestimationfromgravityanomalyusinggausstheorem
14. Anyotherrelatedpracticals

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1toPO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

SemesterIII

RemoteSensingandGIS–Elective(NonMajor)-MOOCCourse

L T P
C3 003

a. Course Objectives: This paper describes about fundamentals of Remote Sensing and GIS. Thispaper is very much useful to the students for using of remote sensing and GIS concept in variousfields.Itisofferedthrough online.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	StudentscanunderstandtheconceptsandpracticesofRemoteSensingand GIS.
CO -2	ComprehensiveunderstandingontheapplicationofRemoteSensingandGI S insolvingtheresearch problems.
CO -3	Students can understand the Satellite image and digital imageprocessing.
CO -4	StudentsareabletoapplyRemotesensingandGISintheirfutureresearchwork.

Instructor Name : PROF. RISHIKESH BHARTI (IIT Guwahati - Civil Engineering)

COURSE DURATION : Jul-Sep 2019 **CORE / ELECTIVE :** Core **UG / PG:** Both

PRE-REQUISITES : No

INTENDED AUDIENCE : PG Students

INDUSTRIES APPLICABLE TO : Rolta India, RMSI Private Limited, ArcGeosystems

COURSE OUTLINE : This course will introduce the students to the state-of-the-art concepts and practices of remote sensing and GIS. It starts with the fundamentals of remote sensing and GIS and subsequently advanced methods will be covered. This course is designed to give comprehensive understanding on the application of remote sensing and GIS in solving the research problems. Upon completion, the participants should be able to use remote sensing (Satellite images and Field data) and GIS in their future research work.

ABOUT INSTRUCTOR : Rishikesh Bharti is a faculty member at the Department of Civil Engineering, Indian Institute of Technology Guwahati. He has been teaching Advanced Remote Sensing, Geohazard Science and Engineering, Advanced Techniques in Geoscience, Engineering Geology to the B.Tech, M.Tech and PhD students at IIT Guwahati. Hydrogeomorphology, Geospatial modelling, Snow and Glacier Studies, Spectroscopy of natural & manmade materials and Advance remote sensing (Hyperspectral and thermal) for the earth and planetary exploration are his major research interests. He hope participants will enjoy and learn the proposed course. The details of his research can be found at Website: http://www.iitg.ac.in/rbharti/.

COURSE PLAN

Week 1: Remote Sensing Data and Corrections

Week 2: Satellite Image Corrections

Week 3: Digital Image Processing-I

Week 4: Digital Image Processing-II

Week 5: Thermal and Microwave

Week 6: Imaging Spectroscopy-I

Week 7: Imaging Spectroscopy-II & GIS-I

Week 8:GIS-II and Application

d.Mapping ofCos toPOsandPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.Reference:

1. Swayam/NPTELonlinecourse

BoreholeGeophysics

L T P
C4 00
4

a. CourseObjectives: ThispaperdescribesthevarioustypesofLoggingandits interpretationinvariousfieldlikegroundwater,mineralandoil/gas industry.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentscanmasteringthebasicconceptsofformationassessment, wellboreenvironment,principlesofwellloggingmeasurementsanditsmethods.
CO -2	Studentscanap understand the various types of logging and its plications.
CO -3	Student can understand the well logging theory and interpreting wellloggingdata.
CO -4	Studentcanapplywellloggingconceptsforformationevaluationlikeinground water,mineraland petroleumresource.

C.CourseOutline

UnitI:Introductiontowelllogging:

Porosity, permeability, fluid saturation, drilling fluids and its properties, invasion process andvarious profiles, classification of formation evaluation methods, objective of well logging methods,loggingoperationalfieldsystemanditsprocedure. **(11L)**

UnitII:ElectricalLogging:

Spontaneous Potential (SP)logging:Spontaneous potentialsin boreholes and itssources,SSPanditsmeasurements,SPcurvesanditsinterpretation,factorsaffectingtheshapeandamplitudeofSPcurve,Non-focussed,focusedandinductionlogging,principleofsonde,Interpretation of Electric Log Data : Determination of resistivity of interstitial water Rw, porosity andwater saturation Sw of clean and shaly sandstones, determination of Rw of clean sandstone from SPcurve,estimationofpermeability. **(15L)**

UnitIII:Radioactivelogging:

Gammaraylogging,detailsoftheradiationlogging,densityorgamma-gammalogging,principle of the neutron-gamma logging, neutron-epithermal-neutron logging, neutron-thermal-neutronlogging,interpretationandapplicationsofradiationloggingforevaluationofreservoircharacteristics. **(12L)**

UnitIV:Othertypesoflogging:

Acoustic velocity (Sonic) logging, Cement Bond Log (CBL), Litho-density Tool (LDT), thermallog, caliper or section gauge log, Casing Collar Locators (CCL), dip and direction logging, gravitylogging,nuclearmagneticresonancelogging. **(12L)**

UnitV:Applicationofwelllogging:

Resistivity-porosity cross plots,Porosity Cross plots:neutron– density, sonic density andsonic neutron density cross plots. Application of well logging to groundwater, mineral and petroleumresource. **(10L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Darling,T.(2005).*Wellloggingandformationevaluation*.Elsevier.
2. Edward,J.Lunch(1976).Formationevaluation.TheEnglishBookDept,Dehradun.
3. Liu,H.(2017).*Principlesandapplicationsofwelllogging*.Springer
4. Pirson. (1963). *Handbook of Well log Analysis for Oil and Gas formation Evaluation*. SpringerScience&BusinessMedia.
5. RamachadraRao,M.B.(1975).OutlinesofGeophysicalprospecting:AmanualforGeologists.EBDEducational PrivateLtd.
6. Serra,O.(2008).*Fundamentalsofwell-loginterpretation*.
7. Vaish,J.P.(1997).Geophysicalwelllogging-PrinciplesandPractices,AsianBookPrivateLtd.

SeismicProspecting

L T P
C400
4

a. CourseObjectives: ThispaperdescribeaboutSeismicprospecting.Thispaperdescribesthebasicsof Seismic dataacquisition,Seismicdataprocessingandinterpretation.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentscanunderstandthebasicsofwavepropagationandelasticconstants.
CO -2	Studentsrecognizeandunderstandseismicrefractionmethodandreflection seismicmethod,
CO -3	StudentshaveunderstandingaboutseismicdataprocessingTechniquerefractionand2Dreflection.
CO -4	Studentsareabletocreate2-dimensionaland3-dimensionalseismicacquisitiondesign,abletoperformseismicdataprocessing(basic seismicprocessing).
CO -5	DataacquisitionandprocessingconceptsofSASWandMASW.ApplicationofSeismicmethodsinHydrocarbon,Mining,Groundwater.

C.CourseOutline

UnitI:**Seismicsourcetheory:**

Waveforms and their characteristics, Elastic wave velocities in rocks. Stress, Strain, elasticconstants. Wave propagation, Historical Development and Background of Refraction and ReflectionMethods, Difference between Refraction and Reflection Surveys Propagation of Seismic waves inLinearandNonlinearmedium,NLayeredcase,continuousincreaseofvelocity. **(13L)**

UnitII:BasicsofSeismicdataAcquisitionsystems:

Energysources-explosiveandnonexplosivesources,Zoepritz'sequation-Seismicoperation on Land, Grouping of Geophones and shot points. Recording formats, Different types ofDisplayofDigitalandMagneticRecordings,WiggleTrace, CommonDepthPointtechnique.**(13L)**

UnitIII:ProcessingofSeismicdata:

Sequence of Digital Seismic data Processing, Seismic data reduction, static and dynamiccorrections Analysis of Multiples and Ghost Reflections, Processing of Seismic Data Imaging, TimeandDepthSections,SeismicInversion,MigrationTechniques–WaveVelocities. **(12L)**

UnitIV:InterpretationofSeismicdata:

Synthetic Seismograms, Processing and interpretation of Refraction Seismic data– Methodsbasedonfirstandlaterarrivals,Hiddenlayer,seismicstratigraphy,introductionto3Dseismic.**(12L)**

UnitV:ConceptsofSASWandMASW:

Data acquisition and processing concepts of SASW and MASW. Application of Seismic methodsinHydrocarbon,Mining,Groundwater. **(10L)**

(Total:60L)

d.Mapping ofCos toPOsandPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4
CO5	PO1to PO8	H	PSO1 toPSO8	H	K1-K5

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Yilmaz,O.(1991).*Seismicdataprocessing*.
2. Dobrin, M.B., &Savit, C.H. (1988). *Introduction to geophysical prospecting*. McGraw-Hill CollegeIntroductiontoGeophysicalProspecting
3. Telford, W.M., Geldart, L.P., & Sheriff, R.E. (1990). *Applied geophysics*. Cambridge UniversityPress.Applied Geophysics,SecondEdition.
4. RamachadraRao,M.B.(1975).OutlinesofGeophysicalprospecting:AmanualforGeologists.EBDE ducational PrivateLtd.
5. Sheriff,R.E.,&Geldart,L.P.(1995).*Explorationseismology*.CambridgeUniversityPress.
6. Evenden, B.S.&Stone,D.R.,1971, Seismic Prospecting Instruments, GebrudeyBorntraege,Berlin,Stuttagart.

MarineGeophysics

LTPC4
004

a. Course Objectives: This paper describes the ocean, waves, tides and currents and also explainsthephysio-chemicalcharacteristic ofseawaterand navigationinocean.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	StudentsrememberingtheWaves,tides,currentsandwavereflection,refraction anddiffractionstudies.
CO -2	StudentscanunderstandtheLittoralprocessesEvolutionofvarious geomorphologicallandformsinaroundcoastalarea.
CO -3	Marinegravitymagneticandseismicsurveyinoffshoreexploration foroilandnaturalgas andothermineralsand seabedmapping.
CO -4	Studentsareabletointerpretthegeomorphologyoftheseafloor, anomaliesorunderwaterobjectsfromgeophysicaldata

C.CourseOutline

UnitI:IntroductiontoMarineGeology:

Waves, tides, currents, turbidity currents, long shore currents, rip currents, circulation, wavereflection,refractionanddiffraction–Seicheandtsunamis–
Causesofmarineregressionandtransgression – Description of important regressions and transgressions in the geological past–Eustacy – Abyssal plains and its various topographic features–ridges, seamounts ,guyots, mudbanks–Evolutionandclassificationof seacoastsandshorelines. **(11L)**

UnitII:Origin,morphologyanddistributionofoceanbasins:

Mid-ocean ridge systems. Littoral processes Evolution of headlands and bays – Beaches,continental shelves, continental slopes, trenches and canyons-MarineSedimentation – Sourcesanddistributionofsediments–Transportofseabottomsediment–Rateofdeposition–
Mineralresourcesoftheoceansandthefactorscontrollingtheirdistribution.Stratigraphyandgeochronometry ofdeep-seadeposits–phosphorite, glauconites,bariumsulphateconcertions,polymetallicnodules–Beachplacers. **(13L)**

UnitIII:Physio-chemicalcharacteristicofseawater:

Distribution of temperature, salinity and density for sea water –sedimentary markers of palaeoenvironmental conditions – chemistry ofoceanic rocks. Formation of subtropical gyres; westernboundary currents; equatorial current systems; El Nino; monsoonal winds and currents over the NorthIndianOcean;Somalicurrent;southernocean. **(12L)**

UnitIV:Marinegravityandmagnetic:

Techniques of echo sounding, sound ranging side scan sonar, Finger, Boomer, sparker andpneumatic pulsarprofiling.Gravity and magneticsurvey overthe oceans,Marine magneticandgravity instruments, reduction ofobservations, identification of anomalies and interpretation of thedata set. Seabed mapping, seabed sampling, dredging and coring, Navigation methods and Positionlocationmethods. **(12L)**

UnitV:MarineSeismic:

Airgun,waterguns,Seismicreflectionreceivers-geophones,hydrophones.Arrayconfiguration and advantages. Single channel and multi-channel seismic reflections, Sonobuoys,ocean bottom seismometers (OBH) – Data acquisition and quality control- Seismic data processing.Applicationofgeophysicalmethodsinoffshoreexplorationforoilandnaturalgasandothermineral s.

(12L)
(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L–Low,M–Medium,H–High;K_1–Remember,K_2–Understand,K_3–Apply,K_4–Analyze,K_5–Evaluate,K_6– Create)

e.References:

1. Reynolds,J.M.(1998).*Anintroductiontoappliedandenvironmentalgeophysics*.JohnWiley&Son.
2. Seibold, E., & Berger, W. H. (2013). *The sea floor: An introduction to marine geology*. SpringerScience&BusinessMedia.
3. Kurekian,K.K.,1990.Ocean,PrenticeHall.
4. RamachadraRao,M.B.(1975).OutlinesofGeophysicalprospecting:AmanualforGeologists.EBDEducationalPrivateLtd.
5. Seabold,E.&Berger,W.H.,1982.TheSeafloor,SpringerVerlag.
6. Jones,E.J.W.,(1994).MarineGeophysics,JohnWileyandsons.

EnvironmentalGeoTechnology

LTPC4
004

a. Course Objectives: This paper describes the environmental aspects with reference toSoil and its structure, Beach and beach erosion and Radioactive decay. This paper is verymuchhelpfultoknowtheenvironmentalconditions aroundtheworld.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Students can understand the concepts, principles andtechniquesof environmentalproblem.
CO -2	StudentscanunderstandEnvironmentalimpactofexploitation,processinga ndsmeltingofnaturalresources.
CO -3	Students can apply with Geophysical/geological as well asgeotechnicalroleinEnvironmentalproblems.
CO -4	Studentsareabletomodelingtosolvethephysicalenvironment problemsaswellastomitigatethemdeeplyandberesponsible

C.CourseOutline

UnitI:AimsofEnvironmentalGeotechnology:

EnvironmentcyclesandtheirinteractionwithGeotechnology–ManmadeEnvironment–EnvironmentalGeotechnicalproblems. **(10L)**

UnitII:Characteristicsofsoil:

Shrinkage, Swelling and Cracking characteristics of soil - Thermal conductivity andResistivity of soil – Fundamentals of Soil; Soil structure vs Structure - Soil Interactions; Soilcompaction – Dynamic consolidation – Stress-Strain-Strength characteristics of soil – Soildynamics Load, factor of safety and allowable condition –Bearing capacity of Ground Soil–UnderwaterFoundationProblems. **(14L)**

UnitIII:RadioactiveDecayProcess:

Environmental Geotechnical Aspects of Radiation – Radioactive and toxic radon gas-Nuclear waste disposal – Utilization of nuclear energy for construction applications; Solidwastedisposal–planningandsitingof land-fills;radioactivewaste management.

(13L)

UnitIV:Earth'sprocessesandgeologicalhazards:

Earth'sprocesses;Conceptofresidencetimeandratesofnaturalcycles;Catastophicgeological hazardswithaviewtoassessthemagnitudeoftheproblem,prediction and perception of the hazards; Mineral Resources and Environment - ResourceandReserves;Environmentalimpactofexploitation,processingandsmeltingofminerals.

(11L)

UnitV:Energyresourcesandenvironment:

Environmentaleffectsassociatedwithtypesofenergyresource,viz.petroleum,natural gas, hydropower, nuclear, coal, solar and wind energy; Ocean pollution by toxicwastes; HumanUseofSurfaceandGroundWaters;GroundWater Pollution.**(12L)**

(Total:60L)

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1 toPSO8	M	K1-K4

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

e.References:

1. Hasi–YangFang,(1997).IntroductiontoEnvironmentalGeotechnologyCRCpress,
2. Fang, H., & Daniels, J. (1997). *Introduction to environmental Geotechnology*. CRCPress.
3. Kesavulu,N.C.,(2016).*Textbookofengineeringgeology*.
4. FredG.Bell,(2004).*EngineeringGeologyandConstruction*,CRCPress
5. Roberts, A. (2013). *Applied Geotechnology: A text for students and engineers on rockexcavationandrelatedtopics*.Elsevier.
6. Keller,E.A.(2012).*Introductiontoenvironmentalgeology*.PearsonCollegeDivision.
7. Valdiya,K.S.,(2015).*Environmentalgeology*.TataMcGraw-HillEducation.
8. Bryant,E.(2005).*Naturalhazards*.CambridgeUniversityPress.

Practical-III

LT
PC004
2

a. Course Objectives: This practical paper describes the solving the problems and analysisin the field of seismic prospecting, Marine geology and Marine Geophysics, and boreholegeophysicalmethods.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentscanprocessandinterpretationofrefractionandreflectionseismograms.
CO -2	Studentscaninterpretofacquiredshallowdepthseismicrefractiondata
CO -3	StudentscananalyzetheBeachProfilingandSedimentBudgeting.
CO -4	Studentscananalyzeanddeterminateofresistivityusing SPlogdata.

C.CourseOutline

Practical'sareselectedfromfollowinglist

1. Construction of travel time of direct and refracted and reflected waves (Horizontallayer)
2. Construction of travel time curves of direct and refracted and reflected waves(Dippinglayer)
3. Processingandinterpretationofgivenrefractionandreflectionseismograms
4. Velocityanalysis.
5. Signalandnoisestatisticsfromseismictraces
6. Studyoftheseismicrefraction/reflectionunit
7. Processingandinterpretationofacquiredshallowdepthseismicrefractiondata
8. NoiseestimationusingAutoandcrosscorrelations
9. BeachProfilingandSedimentBudgeting.
10. Computationofwavepatternsandcurrentvelocity.
11. Sedimentlogicalanalysis–Grainsize,Clayanalysis.
12. Micropaleontologicalanalysis–Pickingandmountingofmicrofauna.
13. Compute the volumetric producible hydro carbon reserves and estimatetheformationpressureandgeothermalgradientusingwellloggingdata.
14. DeterminationofformationwaterresistivityusingSPlogdata.
15. ComputeandlocatethehydrocarbonsaturationusingRatiomethod.
16. Computeaboreholelogging datatoestimateporosityfromdensitymeasurements.
17. ComputationofM-N*crossplotusinglithologymappingtechniques.
18. Determination of water saturation, cementation factor and matrix parametersforporositylogsusingPickettcrossplotmethod.
19. Determinationofhydraulicconductivityonsoil.
20. Anyotherrelatedpracticals **(Total:60L)**

d.MappingofCos toPOs andPSOs

CourseOutcome	PO Addressed	Correlation Level	PSOAddressed	Correlation Level	Cognitive Level
CO1	PO1to PO8	L	PSO1 toPSO8	L	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO4	PO1to PO8	M	PSO1toPSO8	M	K1-K4

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

ProjectandVivaVoce

L T P
C0 02 4

a. Course Objectives: This Project and Viva-Voce gives very much exposure to studentswho are studying M.Sc Applied Geophysics. They have to do the project work either in thedepartment or in various R&D laboratories /institutions like NGRI, WIHG, ISR, IIG andONGC,etc.

b. CourseOutcomes(CO):

AttheendoftheCourse,thestudentwillbeableto

	CourseOutcome
CO -1	Studentsareabletoconductresearchongeophysicalstudiesandgeosciences
CO -2	Studentscan analyzethe Geophysical datain respectivestudiesforfield workorprojectwork.
CO -3	Studentscananalyzethedataandcreatearesearcharticle.
CO -4	Students are able to present their research article unaccompanied in anyscientificconference/seminar,etc.,

C.CourseOutline

- StudentshavetodotheprojectworkeitherinthedepartmentinvariousR&Dlaboratories/institutionslikeNGRI,WIHG,ISR,IIGandONGC,etc.ongeophysical/geological studies.

(Total:720L)

d.MappingofCos toPOs andPSOs

CourseOutcome	**PO Addressed**	**Correlation Level**	**PSOAddressed**	**Correlation Level**	**Cognitive Level**
CO1	PO1to PO8	M	PSO1 toPSO8	M	K1-K2
CO2	PO1to PO8	M	PSO1 toPSO8	M	K1-K3
CO3	PO1to PO8	H	PSO1 toPSO8	H	K1-K3
CO4	PO1to PO8	H	PSO1 toPSO8	H	K1-K4

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

Course	**Course Nature**	**Credits**	**ContactHours perWeek**
Principles of Geophysics andElectronicinstrumentation	Core	4	4
Seismology	Core	4	4
GeneralGeology	Core	4	4
The Dynamic Earth (frome-phatasala**)**	Core	4	4
Computer Applications inGeosciences **Or**Mineral exploration**Or**Remote sensingandGIS (ElectiveMajor)	Elective	3	3
Practical–I	Practical	2	4
Elective-Non major-NaturalHazards-Part-1(Swayam/NPTEL – onlinecourse)	Elective	3	3
GeophysicalSignalProcessing	Core	4	4
ElectricalandElectromagneticprospecting	Core	4	4
GravityandMagneticProspecting	Core	4	4
Hydrogeology	Core	4	4
Meteorology & Climatology(from e-phatasala) **Or**Disaster management - (ElectiveMajor)**Or** ArcheologicalGeophysics	Supportive	3	3
Practical-II	Practical	2	4
Elective–Non major-RemoteSensing And GIS (Swayam/NPTEL– onlinecourse)	Supportive	3	3
BoreholeGeophysics	Core	4	4
SeismicProspecting	Core	4	4
MarineGeophysics	Core	4	4
EnvironmentalGeoTechnology	Core	4	4
Practical–III	Practical	2	4
DissertationandVivaVoce	Project	24	48
		90 credits	120Hrs