॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

Phone: (02462)215541 **Academic-1 (BOS) Section** website: srtmun.ac.in

E-mail: bos@srtmun.ac.in

शैक्षणिक वर्ष २०२४–२५ पासून राष्ट्रीय शैक्षणिक धोरणानुसार लागू केलेल्या विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवीत्तर द्वितीय वर्षाच्या सुधारित (दुरूस्ती) अभ्यासक्रमा बाबत....

प रि प त्र क

संदर्भ:– १. जा.क्र.शै–१/एनईपी/विवत्रंविपदवी/२०२४–२५/१५८ दिनांक २२/०७/२०२४

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, संदर्भीय परिपत्रकान्वये दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या मा. विद्यापरिषदेच्या बैठकीतील विषय क्र. १५/५९–२०२४ अन्वये मान्यता दिल्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार पदव्युत्तर द्वितीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२४–२५ पासून लागू करण्यात आलेले आहेत. तथापी वरील संदर्भीय परिपत्रका अन्वये प्रकाशित केलेल्या अभ्यासक्रमामध्ये अभ्यासमंडळानी किरकोळ दुरूस्ती करून M. Sc. II year Geophysics (Campus) अभ्यासक्रम सादर केला असून मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा यांच्या मान्यतेने दुरूस्ती केलेला M. Sc. II year Geophysics (Campus) अभ्यासक्रम लागू करण्यात येत आहेत.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

सहाय्यक कुलसचिव
शैक्षणिक अभ्यासमंडळ विभाग

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शैक्षणिक–१/परिपत्रक/एनईपीयुजीदुरूस्ती/S&T/
२०२५–२६/ ६९
दिनांक : ०५.०५.२०२५

प्रत माहिती व पुढील कार्यवाहीस्तव.

०१. मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
०२. मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
०३. मा. संचालक, सर्व संबधित संकुले, प्रस्तुत विद्यापीठ.
०४. मा. प्राचार्य, सर्व संबधित महाविद्यालये, प्रस्तुत विद्यापीठ.
०५.सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यानां देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या संकेतस्थळावर प्रसिध्द करण्यात यावे.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science & Technology

Credit Framework for Two Year PG Program

Subject: Geophysics

Year & Level 2	Sem. 3	Major Subject (DSC) 3	Major Subject (DSE) 4	RM 5	OJT / FP 6	Research Project 7	Practicals 8	Credits 9	To Cre 1
2	3	SGPY-CT501 Magnetic Method (4 Cr) Theory SGPY –CT502 Hydrogeology (4 Cr) Theory SGPY –CT503 Seismology (4 Cr) Theory	SGPY –ET501 Remote sensing (2 Cr) Theory SGPY –EP502 Remote sensing (1 Cr) Practical **OR** SGPY –ET503 Geographical Information Systems (2 Cr) Theory SGPY –EP504 Geographical Information Systems (1 Cr) Theory	--	--	**SGPY RP501 (4Cr)** Research Project	SGPY-CP501 Magnetic Method (1 Cr) Practical SGPY –CP502 Hydrogeology (1 Cr) Practical SGPY –CP503 Seismology (1 Cr) Practical	**22**	
	4	SGPY-CT551 Well Logging (4 Cr) Theory SGPY –CT552 Seismic prospecting (4 Cr) Theory	SGPY-ET551 Electro Magnetic Methods (3 Cr) Theory SGPY-EP552 Electro Magnetic Methods (1 Cr) Practical **OR** SGPY-ET553 Radiometry and Nuclear Geophysics (3 Cr) Theory SGPY-EP554 Radiometry and Nuclear Geophysics (1 Cr) Practical	**SGPYPE551** Publication Ethics (2Cr)	--	**SGPY RP551 (6Cr)** Research Project	SGPY-CP551 Well Logging (1Cr) Practical SGPY –CP552 Seismic prospecting (1 Cr) Practical	**22**	4

M. Sc. Second Year Semester III *(Level 6.0)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SGPY CT501**	**Magnetic Method**	04	--	**04**	04	--
	SGPY CT502	**Hydrogeology**	04	--	**04**	04	--
	SGPY CT503	**Seismology**	04	--	**04**	04	--
Elective (DSE)	**SGPY ET501** / **SGPY ET503**	**Remote sensing OR Geographical Information Systems**	02	--	**02**	02	--
Research Project	**SGPYRP501**	**Research Project**	04	--	**04**	04	--
DSC Practical	**SGPY CP501**	**Magnetic Method**	--	01	**01**	--	02
	SGPY CP502	**Hydrogeology**	--	01	**01**	--	02
	SGPY CP503	**Seismology**	--	01	**01**	--	02
DSE Practical	**SGPY EP502** / **SGPY EP504**	**Remote sensing OR Geographical Information Systems**	--	01	**01**	--	02
Total Credits			**18**	**04**	**22**	**18**	**08**

M. Sc. Second Year Semester III *(Level 6.0)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	**SGPY CT501**	**Magnetic Method**	20	20	20	80	--	--	100
	SGPY CT502	**Hydrogeology**	20	20	20	80	--	--	100
	SGPY CT503	**Seismology**	20	20	20	80	--	--	100
Elective (DSE)	**SGPY ET501** / **SGPY ET503**	**Remote sensing OR Geographical Information Systems**	10	10	10	40	--	--	50
Research Project	**SGPYRP501**	**Research Project**	20	20	20	80	--	--	100
DSE Practical	**SGPY CP501**	**Magnetic Method**	--	--	--	--	05	20	25
	SGPY CP502	**Hydrogeology**	--	--	--	--	05	20	25
	SGPY CP503	**Seismology**	--	--	--	--	05	20	25
DSE Practical	**SGPY EP502** / **SGPY EP504**	**Remote sensing OR Geographical Information Systems**	--	--	--	--	05	20	25

M. Sc. Second Year Semester IV *(Level 6.0)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SGPY CT551**	**Well Logging**	04	--	**04**	04	--
	SGPY CT552	**Seismic prospecting**	04	--	**04**	04	--
Elective (DSE)	**SGPY ET551**	**Electro Magnetic Methods** **OR** **Radiometry and Nuclear Geophysics**	03	--	**03**	03	--
	SGPY ET553						
Research Methodology	**SGPYPE551**	Publication Ethics	02	--	**02**	02	--
Research Project	**SGPYRP551**	**Research Project**	06	--	**06**	06*	--
DSC Practical	**SGPY P551**	**Well Logging**	--	01	**01**	--	02
	SGPY P552	**Seismic prospecting**	--	01	**01**	--	02
DSE Practical	**SGPY EP552**	**Electro Magnetic Methods** **OR** **Radiometry and Nuclear Geophysics**	--	01	**01**	--	02
	SGPY EP554						
Total Credits			**19**	**03**	**22**	**19**	**06**

* See note at the end

M. Sc. First Year Semester IV *(Level 6.0)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)	Total (7)	CA (8)	ESA (9)	
Major	SGPY CT551	Well Logging	20	20	20	80	--	--	100
	SGPY CT552	Seismic prospecting	20	20	20	80	--	--	100
Elective (DSE)	SGPY ET551 OR SGPY ET553	Electro Magnetic Methods OR Radiometry and Nuclear Geophysics	15	15	15	60	--	--	75
Research Methodology	SGPYPE551	Publication Ethics	10	10	10	40	--	--	50
Research Project	SGPYRP551	Research Project	--	--	--	150	--	--	150
DSE Practical	SGPY CP551	Well Logging	--	--	--	--	05	20	25
	SGPY CP552	Seismic prospecting	--	--	--	--	05	20	25
DSE Practical	SGPY EP452 OR SGPY EP454	Electro Magnetic Methods OR Radiometry and Nuclear Geophysics	--	--	--	--	05	20	25

Course Structure: *Major 1 - Teaching Scheme*

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY CT501	Magnetic Method	04	--	04	--	04

Major 1 - Assessment Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)		CA (8)	ESA (9)	
SGPY CT501	Magnetic Method	20	20	20	80	--	--	100

SGPY CT501: Magnetic Method *(Major 1) (Theory: 4 credits)*

Curriculum Details

Course pre-requisite:

- Basic Physical concepts of magnetism and geomagnetism

Course objectives:

- This course is intended to discuss about the magnetic field of the Earth, potentials and its applications in Geophysics. Magnetic field variations of Earth and its materials, concepts of magnetic methods, instrumentation, data acquisition, data processing, data analysis and interpretation of magnetic data and its applications. Concepts of palaeomagnetism and rock magnetism.

Course outcomes:

- At the end of the course the student will get knowledge about geomagnetism, magnetic field and its applications. The student will be adept to use magnetic methods in the geoexploration, resource evaluation, evolution of the Earth and geological mapping.

Curriculum Details: *(There shall be FOUR Modules in each course)*

SGPY CT501 : Magnetic Methods Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Concepts of Earth's Magnetic field**	**15**
	1.1	**Earth's main magnetic field, origin and distribution, Elements Geomagnetic field Coulombs law of magnetic force and fields, magnetic moments.**	
	1.2	**Intensity of magnetization, magnetic potential, Units of measurement, Laboratory determination of susceptibility**	
	1.3	**Origin and concept of magnetic anomalies, concepts of Induced and Remnant magnetism. Concepts of Palaeomagnetism, NRM, magnetic reversals**	
	1.4	**Introduction to geological time scale, applications of Paleomagnetism-Anisotropic Magnetic Susceptibility (AMS), concepts and definitions. IGRF**	
2.0		**Instrumentation**	**15**
	2.1	**Principle of magnetic prospecting, Magnetic prospecting Instruments: Flux gate magnetometers, vertical and total field magnetometers, Proton- precision magnetometers.**	
	2.2	**Ground magnetic survey procedure**	
	2.3	**Air borne and ship borne magnetic surveys**	
	2.4	**Magnetic data collection process and its corrections**	
3.0		**Data interpretation**	**15**
	3.1	**Regional & residual separation**	
	3.2	**Upward and downward continuation techniques**	
	3.3	**Qualitative and quantitative Interpretation of magnetic data, Magnetic anomalies over simple geometric bodies and irregular bodies, depth rule.**	
	3.4	**Poissons relation gravity and magnetic potential field**	
4.0		**Inversion and Applications**	**15**
	4.1	**Principles of Inversion and Modeling.**	
	4.2	**Inversion of magnetic anomalies of simple geometric bodies**	
	4.3	**Inversion of 2D polygonal bodies, magnetic interfaces, time domain and frequency domain techniques**	
	4.4	**Applications of magnetic method for geological mapping and exploration**	
		Total	**60**

Text Books and Reference Books:

1. Applied Geophysics, W.W.Telford, et. al.
2. Introduction to Geophysical prospecting, M.B.Dobrin and Savit.
3. Gravity and magnetics in oil prospecting, L.L.Nettleton
4. Gravity and magnetic methods, Rao, B.S.R and Murthy, I.V.R
5. Gravity and magnetic Interpretation in Exploration Geophysics, I.V.RadhakrishnaMurthy
6. Interpretation theory in Applied Geophysics, F.S.Grant and West
7. Environmental Magnetism By Roy Thompson and Frank Oldfield
8. Anisotropic Magnetic Susceptibility By Tarling and Hrouda
9. Principles and Appliatins of Paleomagnetism By D.H. Traling
10. Online material

Practicals : SGPY CP501: Magnetic Methods (1 Credit)

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY CP501	Magnetic Method	--	02	00	01	01

Problems based on Geomagnetism, Paleomagnetism and Polar wandering curve will be addressed under this course and also to model magnetic response due to different subsurface bodies.

Text books and reference Books

1. Applied Geophysics, W.W.Telford et. Al
2. Introduction to Geophysical prospecting, M.B.Dobrin

Course Structure: *Major 1 - Teaching Scheme*

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY CT502	Hydrogeology	04	--	04	--	04

Major 1 - Assessment Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)		CA (8)	ESA (9)	
SGPY CT502	Hydrogeology	20	20	20	80	--	--	100

SGPY CT502: Hydrogeology *(Major 2) (Theory: 4 credits)*

Curriculum Details

Course pre-requisite:

- Basic (10+2) knowledge of chemistry and physics and must have completed basic courses on geology and rock properties.

Course objectives:

1. To understood the hydro-geological cycle.
2. Occurrence of groundwater on the planet earth.
3. To study the groundwater aquifers, hydro geological properties, and movement of groundwater.
4. Exploration of groundwater occurrence in different geological formations.
5. To develop the writing skills based on research pattern/report writing which is useful in research institutes/govt. organizations/Pvt. organizations
6. To develop the skills of individual student so that he/she will be competent enough to get job in this field of specialization.

Course outcomes:

1. At the completion of the course student would be able to
2. Understand Water-bearing formations.
3. Understand and model the flow of groundwater.
4. Explain chemistry of groundwater as controlled by natural and anthropogenic processes.
5. Detect groundwater potential and understand its management.
6. Analyze water for different chemical components.
7. Graphically represent variations groundwater chemistry.

SGPY CT502 Hydrogeology Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Concepts of Hydrogeology**	**15**
	1.1	**Hydrological cycle; Occurrence and distribution of groundwater**	
	1.2	**Aquifer classification and characteristics of aquifers**	
	1.3	**Hydrological properties of rocks-Porosity, permeability**	
	1.4	**hydraulic conductivity, specific yield, storage coefficient, transmissibility, hydraulic resistivity, hydraulic diffusivity.**	
2.0		**Aquifer characteristics**	**15**
	2.1	**Classification of rocks from hydrological view- Properties**	
	2.2	**groundwater conditions in different geological formations**	
	2.3	**Aquifer parameter analysis; Darcy's Law in homogenous and heterogenous media; Bernoulli equation; Reynold's number**	
	2.4	**pumping test and aquifer evaluations; Coastal conditions- seawater intrusion and its control**	
3.0		**Ground water management**	**15**
	3.1	**Groundwater management; methods of recharge; artificial recharge; water budgeting and evaluation of perennial yield**	
	3.2	**Urbanization and demands on water**	
	3.3	**Water logging and conjunctive use; excessive use and alkalinity-saltation; Methods of water conservation; sustainable watershed development**	
	3.4	**groundwater level fluctuations; land subsidence; impact of global climate change on groundwater**	
4.0		**Analysis of groundwater**	**15**
	4.1	**Chemical characteristics of groundwater in relation to various uses – domestic, industrial and irrigation; Radioisotopes in hydro-geological studies**	
	4.2	**Groundwater contamination and problems of arsenic, fluoride and nitrates.**	
	4.3	**Groundwater exploration: Surface investigation of groundwater - geologic, remote sensing, electrical resistivity, seismic, gravity and magnetic methods**	
	4.4	**sub-surface investigation of groundwater - test drilling, resistivity logging, spontaneous potential logging, radiation logging**	
		Total	**60**

Text Books:

1. Geochemistry, Groundwater and Pollution by C.A.J. Appelo
2. Geophysical Prospecting For Groundwater by Sankar Kumar Nath
3. Ground Water and Wells by F.G. Driscoll
4. Ground Water by H.M. Raghunath
5. Ground Water Hydrology by D.K. Todd
6. Groundwater Geochemistry by J. Merkel Broder
7. Groundwater Geophysics in Hard Rock by Prabhat C. Chandra
8. Groundwater Prospecting and Management by H. P. Patra, Shyamal Kumar Adhikari, and Subrata Kunar
9. Hydrogeology by S.N. Davies and R.J.N. Dc-West
10. Modern Groundwater Exploration: Discovering New Water Resources in consolidated Rocks Using Innovative Hydrogeologic Concepts, Exploration, Drilling, Aquifer Testing and Management Methods by Jay H. Lehr and Robert A. Bisson

Practicals : SGPY CP502: Hydrogeology (1 Credit)

In Laboratory: Megascopic identification and description of hydrological properties of rocks. Hydrological problems, hydrochemical analysis of water, plotting the Gibb's diagrams, Piper Tri-linear diagrams etc.

In Field: Study of weathering pattern with respect to percolation of surface water in to the ground water, study of primary and secondary porosity of rock formation; Well inventory etc.

Text books and reference Books

1. Ground Water by H.M. Raghunath
2. Ground Water Hydrology by D.K. Todd

Course Structure: *Major 1 - Teaching Scheme*

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)		CA (8)	ESA (9)	
SGPY CT503	Seismology	20	20	20	80	--	--	100

Major 1 - Assessment Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY CT503	Seismology	04	--	04	--	04

SGPY CT503: Seismology *(Major 1) (Theory: 4 credits)*

Curriculum Details

Course pre-requisite:

Basic Physical concepts of elastic properties of different materials, internal structure of the Earth

Course objectives:

- The objective is to provide knowledge about earthquakes; mechanisms-interpretation, seismology imparts solid foundation in principles of seismic wave generation and propagation through theory and applications of modern analysis techniques, seismic data acquisition techniques and Data interpretation techniques.

Course outcomes:

- At the end of the course, students will be able to derive fundamental seismological equations from first principles, model earthquake sources using seismic waveforms and identification of different phases and modelling Earth structure with multiple techniques and acquire skills in seismological data acquisition.

Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Principles of wave Propagation**	**18**
	1.1	**Elasticity, Stress-strain relation, Principal and deviatoric stress**	
	1.2	**Waves on a string, SHM, seismic wave, Snells Law, Fermats Principle, Huygens Principle, Seismic wave equation**	
	1.3	**Reflection and Transmission coefficients, Introduction to different wave patterns- body**	
	1.4	**surface and related waves, phase and group velocity, dispersion**	
2.0		**Earthquakes and Seismicity**	**12**
	2.1	**Introduction to earthquake phenomena, concept of focus, focal depth, epicentre, intensity and magnitude scales and energy of earthquakes**	
	2.2	**foreshocks and aftershocks, elastic rebound theory**	
	2.3	**seismicity of India, global seismicity, seismic zoning of India**	
	2.4	**concept of inhomogeneity and anisotropy, types and causes of earthquakes**	
3.0		**Propagation Characteristics**	**15**
	3.1	**Seismic ray theory for spherically stratified earth and velocity structure from travel time data, propagation and characteristics of body waves, , different phases of body waves and their applications,**	
	3.2	**surface waves, group and phase velocities**	
	3.3	**Structural aspects like faulting, fracture and their effects on wave propagation, reflection of body waves**	
	3.4	**focal mechanism solutions and tectonic implications**	
4.0		**Instrumentation**	**15**
	4.1	**Instruments- Principle of electromagnetic seismograph, displacement meters, velocity meter, WWSSN stations, seismic arrays for detection of nuclear explosions, wide band seismometry, strong motion seismograph.**	
	4.2	**Broad band seismometers and sensors, Short period seismometers and related analysis of seismograms**	
	4.3	**analog and digital**	
	4.4	**Seismic data recorders**	
		Total	**60**

Text Books and Reference Books:

1. Introduction to seismology by Seth and Stein
2. Fundamentals of Geophysics, William Lowrie
3. An Introduction to Seismology, Earthquakes and Earth structure By Stein & Wysession
4. Engineering Seismology By Agarwal
5. Modem Global Seismology, Thorne Lay and Wallace
6. Internal Constitution of the Earth By Gutenberg
7. Introduction to Seismology by Bath
8. The Earth, Jeffreys.S.H.
9. Elementary Seismology, Charles.F. Richter
10. An introduction to the theory of seismology, Bullen. K.E. and Bolt
11. Quantitative seismology: theory & methods, Aki. K. and Richards
12. An introduction to the theory of seismology P Shearer
13. Online material

Practicals : SGPY CP503: Seismology (1 Credit)

Problems based on

1. **Acoustic impedance**
2. **Reflection coefficient**
3. **Transmission coefficient**
4. **stress tensor**
5. **strain tensor**
6. **Modelling of travel time of Seismic phases**
7. **Poisson's ratio,**
8. **Wave velocities, frequency and wavelength**
9. **Geometric Attenuation**

Text books and reference Books

1. An introduction to the theory of seismology P Shearer
2. Introduction to seismology by Seth and Stein

Course Structure: *Major 1 - Teaching Scheme*

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)		CA (8)	ESA (9)	
SGPY ET501	Remote sensing	10	10	10	40	--	--	50

Major 1 - Assessment Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY ET501	Remote sensing	02	--	02	--	02

SGPY ET501: Remote Sensing *(DSE)(Major 1) (Theory: 2 credits) Curriculum Details*

Course pre-requisite:

Basic (10+2) understanding of science

Course objectives:

- To attain fundamental knowledge of basics of Remote Sensing.
- To identify different features with the help of Photo-interpretation Elements.
- To apply Remote Sensing knowledge for different applications in Earth Sciences.

Course outcomes:

- After the completion of the course student would be able to

- Explain the Fundamental principles of Remote Sensing.
- Explain basic properties of Remote Sensing, Data acquisition, Storage and Processing.
- Identify different features with the help of Photo interpretation Elements.
- Apply the knowledge of Remote Sensing for applications in different fields.
-

Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introductuon to Arieal Photography**	**7**
	1.1	**Introduction to Remote Sensing, Definition, Characteristics of EMR, Platforms**	
	1.2	**Fundamentals of Aerial Photography**	
	1.3	**History of Aerial Photographs**	
	1.4	**Types of Aerial Photographs- Vertical and Oblique Photographs**	
2.0		**Instrumentation**	**8**
	2.1	**Aerial Cameras, Flying Plan, Photogrammetry -- Basic Geometric Characteristics- Scale, Overlap, Tilt, Distortion and Displacement of Aerial Photographs,**	
	2.2	**Advantages and Disadvantages of Aerial Photographs**	
	2.3	**EMR and its interaction with matter, Reflection, Absorption, Transmission, Scattering**	
	2.4	**Concept of Signatures- Photo Interpretation Elements.**	
3.0		**Remote Sensing - 1**	**7**
	3.1	**Principles of Remote Sensing, Process of Remote Sensing**	
	3.2	**Indian Remote Sensing Programme**	
	3.3	**Types of Satellites- Sun-synchronous and Geostationary Satellites,**	
	3.4	**Launch Vehicles- PSLV, GSLV, Payloads, Active and Passive Remote Sensing**	
4.0		**Remote Sensing - 2**	**8**
	4.1	**Classification of Remote Sensors**	
	4.2	**Resolution- Spatial, Spectral, Radiometric, Temporal, Microwave Sensors, SLAR**	
	4.3	**Digital Image Processing- Image Classification, Supervised and Unsupervised Classification, Image Enhancement, Filtering, PCA etc.**	
	4.4	**Interpretation of Visual and Digital data, Applications in Geology**	
		Total	**30**

Text Books and Reference books:

1. Image Interpretation in Geology by Drury
2. Introduction to Remote Sensing by J. B. Campbell
3. Photogrammetry by Miller and Miller
4. Principles & Applications of Photogeology by S. N. Pande
5. Remote Sensing & Image Interpretation by T. M. Lillesand and W. K Ralph

6. Remote Sensing in Geology by Siegal
7. Remote Sensing: Principles and Interpretation by F. F. Sabins

Practicals : SGPY EP502 Remote sensing (1 Credit)

1. Toposheet Reading
2. Calculation of the Scale of Aerial photograph and Satellite Imagery.
3. Identification of different features from the Aerial photograph with the help of Photo-interpretation Elements.
4. Identification of different features from Satellite Imagery with the help of Photointerpretation Elements.
5. Study of Drainage patterns from Aerial Photograph/Satellite Imagery.
6. Preparation of Land use/Land cover Map from Aerial Photograph/Satellite Imagery.
7. Calculation of Land use/Land cover percentage from Aerial Photograph/ Satellite Imagery

Text books and reference Books

1. Image Interpretation in Geology by Drury
2. Principles & Applications of Photogeology by S. N. Pande

Course Structure: *Major 1 - Teaching Scheme*

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)		CA (8)	ESA (9)	
SGPY ET503	Geographical Information system	10	10	10	40	--	--	50

Major 1 - Assessment Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY ET503	Geographical Information system	02	--	02	--	02

SGPY ET503: Geographical Information system *(DSE)*

(Major 1) (Theory: 2 credits) Curriculum Details

Course pre-requisite:

- Basic understanding Geology, Geography and Physics (10 / 10+2 level)

Course objectives:

1. Introduce the students to the fundamental concepts of GIS and GPS technologies
2. It will make them familiar with the most essential GIS techniques with hands on practical experience.
3. Students will learn about creation and organization of spatial and non-spatial data.
4. Learn and use different GIS based techniques to identify and solve the natural, environmental and community problems.
5. Learn application of GIS and GPS in geology.

Course outcomes:

- After the completion of the course student would be able to

1. Differentiate between different data types in GIS.
2. Georeference the spatial data and work on spatial and non-spatial database.
3. Describe various GIS tools and techniques.
4. Explain the fundamental principles behind GPS technology.
5. Visualize GIS outputs in different dimensions.
6. Create digital GIS maps.
7. Apply spatial data analysis for various applications to deal with geological problems

Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction to GIS**	
	1.1	Introduction to GIS, Definition, History of GIS	**7**
	1.2	Scope and Importance of GIS, Development of GIS	
	1.3	Components of GIS	
	1.4	Data models in GIS - Raster data model, Vector data model, basic entities of GIS: line, point and polygon,	
2.0		**GIS-1**	
	2.1	Geodatabase, Map Projection, Types and Need of projection system, Spatial and Attribute data	**8**
	2.2	Acquisition of spatial data: Scanning, Georeferencing, concept of layer	
	2.3	digitizing, error detection and correction	
	2.4	DBMS	
3.0		**GIS-2**	
	3.1	Global Positioning Systems, History and developments in GPS	**7**
	3.2	Trilateration process, types of GPS, GPS Surveys	
	3.3	Mapping and layout, Image processing	
	3.4	General processes involved in image processing, mosaic, subset, Point interpolation techniques: Krigging, IDW, , , ,	
4.0		**GIS-3**	
	4.1	Data analysis, network analysis	**8**
	4.2	DEM and DTM	
	4.3	Thematic maps	
	4.4	Geological Applications of GIS and GPS technology	
		Total	**30**

Practicals : SGPY EP504: Geographical Information System (1 Credit)

1. Geo-referencing of image.
2. Base layer preparation.
3. Error detection and correction.
4. Preparation of geodatabase and editing data.
5. Use of GPS instrument to collect way-point data
6. Map Projections.
7. Importing GPS data into the computer using software.
8. Mosaiking.
9. Subsetting.
10. Point Interpolation techniques: Krigging, IDW.
11. Preparation of DEM/DTM.
12. Preparation of thematic maps
13. Practical based on geological applications of GIS.
14. Practical based on geological applications Google Earth

Text Books and Reference books:

1. An Introduction to Geographical Information Systems by I. Heywood, S. Cornelisus and S. Carver
2. Concepts Techniques of Geographical Information Systems by C. P. Lo and A. W. Yeung
3. Geographical Information Systems and Science by P. A. Longley, M. F. Goodchild, D. J. Maguire and D. W. Rhind
4. Fundamentals of Geographic Information Systems by M. N. Demers
5. Introduction to Geographic Information Systems by K. T. Chang
6. Introduction to Global Positioning Systems by Ahmed E. L. Rabbany
7. Introductory Digital Image Processing by J. R. Jensen
8. Textbook of Remote Sensing and Geographic Information System by M. Anji Reddy
9. Principles of Geographical Information Systems by P. A. Burrough and R. A. McDonnell
10. The GIS Book by G. B. Korte

M. Sc. Second Year Semester IV *(Level 6.0)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SGPY CT551**	**Well Logging**	04	--	**04**	04	--
	SGPY CT552	**Seismic prospecting**	04	--	**04**	04	--
Elective (DSE)	**SGPY ET551** / **SGPY ET553**	**Electro Magnetic Methods** **OR** **Radiometry and Nuclear Geophysics**	03	--	**03**	03	--
Research Methodology	**SGPYPE551**	Publication Ethics	02	--	**02**	02	--
Research Project	**SGPYRP551**	**Research Project**	06	--	**06**	06*	--
DSC Practical	**SGPY P551**	**Gravity methods**	--	01	**01**	--	02
	SGPY P552	**Signal processing**	--	01	**01**	--	02
DSE Practical	**SGPY EP552** / **SGPY EP554**	**Electro Magnetic Methods** **OR** **Radiometry and Nuclear Geophysics**	--	01	**01**	--	02
Total Credits			**19**	**03**	**22**	**19**	**06**

* See note at the end

Course Structure: *Major 1 - Teaching Scheme*

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)		CA (8)	ESA (9)	
SGPY CT551	Well Logging	20	20	20	80	--	--	100

Major 1 - Assessment Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY CT551	Well Logging	04	--	04	--	04

SGPY CT551: Well Logging *(Major 1) (Theory: 4 credits)*

Curriculum Details

Course pre-requisite:

- Basics of physical properties of electricity, magnetism, sound, radio activity, of different materials

Course objectives:

- The main objectives of the course are to introduce the students to the fundamental concepts of well logging and its interpretation. To provide detail knowledge to read well-logs, apply the necessary corrections, and perform well log interpretations for hydrocarbon bearing formations.

Course outcomes:

- After completion of the course students are expected to acquire knowledge in various well logging tools and its interpretation. These skills are useful in Oil exploration and resource evaluations.

Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Basics of Well Logging**	**15**
	1.1	**Introduction: Drilling of a Well. Drilling Fluids. Mud Filtrates**	
	1.2	**Invasion Profile Logging Unit. Depth Control. Well Pressures**	
	1.3	**Bore Hole Environment, Formation Factor. Porosity & Water saturations, Occurrences of Hydrocarbons, Minerals and Water,**	
	1.4	**Tool design and Tool Principles.**	
2.0		**Eletctrical Logs**	**15**
	2.1	**Electrical logging: S.P Log: Origin, Static SP, Shale Base Line, SP in various aquifers, Determination of Rw, Conventional Resistivity Logs**	
	2.2	**Normal, Lateral Curves, Focused Logs: Latero Log - 3. Latero Log-7 DLL, SFL and Comparative study, Induction Log: DIL, HRI-High Resolution Induction Log. Micro Log, Micro & Micro Latero Log, Micro SFL**	
	2.3	**Determination of Rmf, Rxo & Rt. Dip meter. Side Wall Coring,**	
	2.4	**Logging for Ground Water, Coal & Minerals**	
3.0		**Radioactive and Sonic Logs**	**15**
	3.1	**Radioactive Logs: Principles of Radioactivity, Counters, Gamma Ray Log Statistical Variations, Neutron - Gamma,, Neutron - Neutron Logs, Thermal Decay logs, Density Log, Identification of Lithology, & Porosity**	
	3.2	**CMR Log: and identification of free fluids. MDT and introduction PLT survey**	
	3.3	**Sonic Logs: Transit Time, Sonic Velocities, Sonic Porosities Cementation. Cased Hole Logs**	
	3.4	**Identification of Water, Minerals and Hydrocarbons and fractures**	
4.0		**Interpretation and Application**	**15**
	4.1	**Interpretation of Log data: Lithology & Porosity determination from cross plots. Permeability determination, M-N Plots**	
	4.2	**Common Sedimentary rocks. Clean and Shaly formations, Cross Plots Techniques**	
	4.3	**Quick look interpretation and detailed interpretation of Clean sands and Shaly sands, Water Saturation**	
	4.4	**Application of Logging for Hydrocarbon zones, Mineral Zones, water Zones and Coal**	
		Total	**60**

Text Books &Reference Books:

1. **Fundamentals of Well log Interpretation (Vol 1 & Vol 2) by O Serra**
2. **Well logging for Earth Scientists Darwin Ellis and Julian Singer**
3. **Formation Evaluation, E J Lynch**
4. **Induction Logging, Plusynin.**
5. **Log Interpretation Principles and Charts, Schlumberger**
6. **Schlumberger Documents,**
7. **Development and Exploitation of Oils and Gas Fields, Murovyer and Andiasevrentnal**
8. **Handbook of Well Log Analysis, S J Peterson.**
9. **Online material**

Practicals : SGPY CP551: Well Logging (1 Credit)

1. Calculatin of water saturation at formation depth using Archies equation
2. Calculation of formation factor of cylindrical sandstone
3. Calculation of volume of shale of the gamma ray log
4. Calculation of volume of shale from the given log
5. Calculation of porosity of carbonate reservoir
6. Calculation of porosity of the formation having sandstone matrix
7. Identify the gas zone with proper explanation
8. Calculation of porosity using density log formula and plot the graph
9. Calculation of apparent resistivity between the layers

Text books and reference Books

1. **Fundamentals of Well log Interpretation (Vol 1 & Vol 2) by O Serra**
2. **Well logging for Earth Scientists Darwin Ellis and Julian Singer**

Course Structure: *Major 1 - Teaching Scheme*

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY CT552	Seismic Prospecting	04	--	04	--	04

Major 1 - Assessment Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2) /2 (6)		CA (8)	ESA (9)	
SGPY CT552	Seismic Prospecting	20	20	20	80	--	--	100

SGPY CT552: Seismic Prospecting *(Major 1) (Theory: 4 credits) Curriculum Details*

Course pre-requisite:

- Basic Physical concepts of elastic wave propagation and physics of the Earth

Course objectives:

- The objective is to train the student in the seismic prospecting methods using reflection and refraction techniques. The course is to provide knowledge about artificial seismic energy generation techniques, seismic wave propagation and seismic reflection/refraction prospecting methodologies. The course also aims at data acquisition, data processing, and analysis and interpretation techniques associated with different seismic prospecting methods.

Course outcomes:

- At the end of the course, students will acquire all the necessary knowledge in seismic prospecting. This knowledge will be useful in oil exploration programs and mineral exploration programs as well as estimating the depth to the bedrock

Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction**	**10**
	1.1	**Introduction to seismic prospecting, elasticity principles: Normal strains, shearing strains, Hook's law, Elastic moduli, wave equations, Huygen's & Fermat's Principles, wave characteristics- refraction, reflection, diffraction, attenuation & absorption of seismic waves**	
	1.2	**acoustic impedance, reflection and transmission coefficients**	
	1.3	**Elastic wave velocities of rocks: velocity inversion, low velocity layer**	
	1.4	**Concept of blind zone, hidden layer**	
2.0		**Sources and Receivers**	**15**
	2.1	**Electromagnetic geophone and its performance, damping coefficient, hydrophones, analog data acquisition, amplifiers, filters, gain control and recording types**	
	2.2	**Seismic energy sources for land and marine surveys. Dynamite thumper, vibrosies, land air gun, pinger, boomer, sparker, airgun, water gun. Controlled explosions,**	
	2.3	**source arrays, energy content, frequency, pulse length and resolution, penetration,**	
	2.4	**signatures of energy sources. Digital data acquisition**	
3.0		**Seismic Refraction**	**15**
	3.1	**Seismic Refraction surveys: Field procedures, fan shooting, broad side shooting, inline profiling, long refraction profiles, reversed and unreversed profiles, marine refraction surveys, sonobuoy surveys.**	
	3.2	**Reduction of refraction data, interpretation of refraction data, analysis of refraction records**	
	3.3	**interpretation of reversed and unreversed profiles, delay time methods, forward modeling, masked layers and hidden layers**	
	3.4	**crustal seismology, engineering surveys, exploration for ground water, application in mining industry**	
4.0		**Seismic Reflection**	**20**
	4.1	**Seismic Reflection surveys: Field procedures, .**	
	4.2	**Reflection data processing, static and dynamic corrections, velocity determination**	
	4.3	**Preparation of seismic sections migration, analysis of analog records, automatic processing of digital seismic data, different methods of migration, Geological interpretation**	
	4.4	**Application of reflection method for exploration for oil and gas, groundwater, coal, mineral deposits, gas hydrates, etc., engineering applications, crustal studies, structural and stratigraphic traps, identification of geological structures like anticlines, faults, salt domes etc**	
		Total	**60**

Text Books & Reference Books:

1. Applied Geophysics, W.W.Telford, et. al.
2. Introduction to Geophysical prospecting, M.B.Dobrin and Savit.
3. Introduction to geophysical exploration, Keary Brooks
4. Exploration seismology, Sheriff. R.E.
5. Reflection Seismology by Kenneth Waters
6. Seismic stratigraphy-application to hydrocarbon exploration Ed. By Charles Payton.
7. Shear wave exploration, SH Danbom and SN Domenico
8. Multicomponent seismology in petroleum exploration, RH Tathamz and MD cCormack
9. Fundamentals of seismic tomography, Lo and Inderweisen
10. Reservoir studies, SEG publication.
11. Seismic exploration fundamentals, J.A.Coffeen.
12. A hand book for seismic data acquisition, Brain J Evans
13. Online material

Practicals : SGPY CP552: Seismic Prospecting (1 Credit)

1. Synthetic computation of Direct and Refracted waves for horizontal interface
2. Synthetic computation of Reflected waves horizontal interface
3. Travel time modelling of Direct and Refracted waves for horizontal interface
4. Travel time modelling of Direct and Refracted waves for Dipping interface from reverse shooting
5. Computation of depth to the interface from crossover distance
6. Computation of depth to the interface from intercept time
7. Nmo correction
8. Finding the optimum geophone spacing to cancel the ground roll
9. Estimating the stacking velocity

Text books and reference Books

1. Introduction to geophysical exploration, Keary Brooks
2. Introduction to Geophysical prospecting, M.B.Dobrin

Course Structure: *Major 1 - Teaching Scheme*

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY ET551	Electromagnetic Methods	03	--	03	--	03

Major 1 - Assessment Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)		CA (8)	ESA (9)	
SGPY ET551	Electromagnetic Methods	15	15	15	60	--	--	75

SGPY ET551: Electromagnetic Methods *(Major 1) (Theory: 3 credits) Curriculum Details*

Course pre-requisite:

Basic Physical concepts of electromagnetism, Maxwell's equations, conductivity and magnetic properties of Earth materials

Course objectives:

The objective is to train the student in the electromagnetic methods using both natural and artificial sources. The course is to provide knowledge about various methods using electromagnetic principle. The course also aims at data acquisition, data processing, and analysis and interpretation techniques associated with different Electromagnetic prospecting methods. The objective is to train the student in the electromagnetic methods using both natural and artificial sources. The course is to provide knowledge about various methods using electromagnetic principle. The course also aims at data acquisition, data processing, and analysis and interpretation techniques associated with different Electromagnetic prospecting methods.

Course outcomes:

At the end of the course, students will acquire all the necessary knowledge in electromagnetic methods used in the exploration. This knowledge will be useful in mineral exploration programs and geological Mapping

Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Natural Source EM**	**12**
	1.1	**Basic concept of Electromagnetic induction, Maxwell's equations, plane wave characteristics, wave number, impedance, skin depth**	
	1.2	**primary-secondary field relations, elliptic polarization, real and imaginary components, response function**	
	1.3	**Methods of measurement for different source-receiver configuration. Components in EM measurements**	
	1.4	**Introduction to natural source EM methods**	
2.0		**Artificial Source EM**	**13**
	2.1	**Artificial source methods, classification frequency domain EM**	
	2.2	**Turam, VLEM and Slingram methods principles, field procedures, quantitative interpretation**	
	2.3	**time domain EM**	
	2.4	**general field procedures, interpretation of surface transient method data**	
3.0		**VLF & GPR**	**15**
	3.1	**EM sounding, geometric and parametric soundings**	
	3.2	**field procedures, interpretation**	
	3.3	**VLF; ground penetrating radar**	
	3.4	**Airborne EM methods, passive airborne EM systems, AFMAG and VLF;**	
4.0		**Applications**	**5**
	4.1	**application of EM Methods in mineral,**	
	4.2	**application of EM Methods ground water exploration**	
	4.3	**application of EM Methods geological mapping**	
	4.4	**application of EM Methods engineering problems**	
		Total	**45**

Text Books and Reference books:

1. Applied Geophysics, Telford, et. al., revised edition
2. The magnetotelluric method, Theory and practice by Chave and Jones
3. Mining Geophysics, Parasnis
4. Philip Kearey and Michael Brooks, An introduction to geophysical exploration, 2000, Blackwell Science.

5. Outline of Geophysical Prospecting, M.B. Ramchandra Rao.
6. Field Geophysics, John Milsom
7. Foundation of Geophysical Electromagnetic theory and methods by Michael S Zhdanov

Practicals : SGPY EP552 Electromagnetic methods (1 Credit)

Problems based on

1. **Skin depth estimation**
2. **VLF**
3. **GPR**
4. **MT/CSAMT/AFMAG/SLINGRAM/TURAM**

Text books and reference Books

1. Applied Geophysics, Telford, et. al., revised edition
2. An introduction to geophysical exploration by Philip Kearey and Michael Brooks, 2000, Blackwell Science.

Course Structure: *Major 1 - Teaching Scheme*

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY ET553	Radiometry and Nuclear Geophysics	03	--	03	--	03

Major 1 - Assessment Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)		CA (8)	ESA (9)	
SGPY ET553	Radiometry and Nuclear Geophysics	15	15	15	60	--	--	75

SGPY ET553: Radiometry and Nuclear Geophysics *(Major 1)*

(Theory: 3 credits) Curriculum Details

Course pre-requisite:

Basic Physical concepts of Radioactivity and radioactive properties of Earth materials

Course objectives:

The objective is to train the student in the Radiometry and Nuclear Geophysics. The course is to provide knowledge about various methods using Radioactivity principles. The course also aims at data acquisition, data processing, and analysis and interpretation techniques associated with different Nuclear Geophysics methods.

Course outcomes:

At the end of the course, students will acquire all the necessary knowledge in Nuclear Geophysical methods used in the exploration. This knowledge will be useful in mineral, Oil exploration programs and for geological Mapping

Curriculum Details: *(There shall be FOUR Modules in each course)*

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction**	**12**
	1.1	**Introduction to radiometric and nuclear geophysical methods**	
	1.2	**. Brief review of radioactive transformations and equilibrium.**	
	1.3	**Natural and artificial radioactive elements. Stable and radioactive isotopes in nature. Radiation Sources, Units of Radioactivity.**	
	1.4	**Isotopic neutron sources generator and nuclear reactor as a source of neutrons. Elementary concepts of safety considerations in handling of gamma and neutron sources**	
2.0		**Radiometry**	**11**
	2.1	**Radiation detectors and basic equipment's: Geiger-Muller and proportional counters, scintillation detectors-NaI (TI) gamma ray spectrometer. Outlines of semiconductor radiation detectors**	
	2.2	**Elements of neutron detectors. Principles of counting systems - total and differential counting, Basic principles of alpha, beta and gamma methods**	
	2.3	**Laboratory Radiometric analysis: Beta gamma method. Gamma spectrometric technique for U, Th, K determinations. Alpha spectral analysis, Emanation methods of analysis**	
	2.4	**Application of radiometric methods for radioactive and non-radioactive ores**	
3.0		**Gamma Rays**	**13**
	3.1	**Evaluation of anomalies, Gamma radiation techniques in Nuclear Geophysics**	
	3.2	**Gamma absorption method for determination of rock densities and estimation of total heavy elements**	
	3.3	**Gamma scatter principle for the estimation of insitu densities and ore assaying**	
	3.4	**Field applications of method in mine workings and boreholes**	
4.0		**Neutron**	**9**
	4.1	**Introduction to Neutron methods**	
	4.2	**Neutron-Neutron absorption and scatter principles**	
	4.3	**Field applications for moisture and porosity estimations**	
	4.4	**Principles of application of the n-gamma method for determinations of elements such a Fe, Cr,Ni,Cl in the laboratory and in logging investigations**	
		Total	**45**

Text Books and Reference books:

1. Applied Geophysics, Telford, et. al., revised edition
2. The magnetotelluric method, Theory and practice by Chave and Jones
3. Mining Geophysics, Parasnis
4. Philip Kearey and Michael Brooks, An introduction to geophysical exploration, 2000, Blackwell Science.
5. Outline of Geophysical Prospecting, M.B. Ramchandra Rao.
6. Field Geophysics, John Milsom
7. Foundation of Geophysical Electromagnetic theory and methods by Michael S Zhdanov

Practicals : SGPY EP554 Radiometry and Nuclear Geophysics (1 Credit)

Problems based on Radiometry and Nuclear Geophysics with different radioactivity data sets.

Text books and reference Books

1. VLS Bhimasankaram (1974) Radiometric methods of Exploration, Published by CEG.

2. VLS Bhimasankaram, EI Savenko, and N. Venkat Rao (1973) Laboratory and field Methods of radiometry and nuclear geophysics, published by CEG

3. VLS Bhimasankaram, N. VenkatRao, K. Sreeramamurti and EI Savenko (1985) Principles and Methods of Nuclear Geophysics, Published by AEG.

4. W.M. Telford, L.P. Geldart and R.E. Sheriff (1990) Applied Geophysics publishedby Cambridge University Press.

SGPYRP551: Research Project

(Dissertation Thesis: 4 credits & Presentation: 2 credits)

Major 1 - Assessment Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)		CA (8)	ESA (9)	
SGPY RP551	Research Project (Dissertation Thesis)	--	--	--	100	--	--	100

Pre-requisites:

Completed all required credits of Theory and Practicals.

Course objectives:

1. To independently work on a scientific problem.
2. To able to generate new data OR able to synthesize and analyze available large global data sets.
3. To interpret the data and derive scientifically robust conclusions.
4. To learn software required for thesis work.
5. To develop the writing skills based on research pattern/report writing which is useful in research institutes / govt. organizations / Pvt. organizations.
6. To develop the analytical and interpretative skills so that he/she will be competent enough to get job in this field of specialization.

Thesis (4 Credits):

Every Post-graduate student has to mandatorily submit dissertation thesis. The dissertation work is based on either new data generated for the proposed scientific problem OR based on available large global data sets using innovative ideas. The thesis should be based on sound methodology and well defined objectives.

SGPYRP551: Presentation based on SGPYRP551 (2 Credits)

Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
		CA			ESA (7)			
		Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)		CA (8)	ESA (9)	
SGPY RP551	Research Project (Presentation)	--	--	--	50	--	--	50

Course outcomes:

At the completion of the course students would be able to

1. Well versed with the literature on the chosen topic.
2. Independently define a scientific problem.
3. Carry out focused study on a research topic.
4. Analyze and interpret large data sets.
5. Independently write thesis / project proposal.
6. Present and defend the scientific work.

Every student has to present his/her thesis in open house and defend their work.

Note: There will be interaction hours between the concerned guide and the student towards successfully completing the Research Project as contact hours as per the requirement of the research Problem.

Guidelines for Course Assessment:

A. **Continuous Assessment (CA) (20% of the Maximum Marks): This will form 20% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting Two Tests (Test I on 40% curriculum) and Test II (remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper will make his CA score (col 6).**
B. **End Semester Assessment (80% of the Maximum Marks): 1. ESA Question paper will consists of 6 questions, each of 20 marks. 2. Students are required to solve a total of 4 Questions. 3. Question No.1 will be compulsory and shall be based on entire syllabus. 4. Students need to solve ANY THREE of the remaining Five Questions (Q.2 to Q.6) and shall be based on entire syllabus**.

*Note: Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45 lectures.

%~%~%~%~%~%~%~%~%