॥ 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

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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

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Phone: (02462)215542 | E-mail: bos@srtmun.ac.in

विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत प्रस्तुत विद्यापीठाच्या भूशास्त्र सकुंलातील M. Sc. Geophysics प्रथम वर्ष अभ्यासक्रम शैक्षणिक वर्ष २०२३–२४ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक १६ जून २०२३ रोजी संपन्न झालेल्या मा. विद्यापरिषदेच्या बैठकीतील ऐनवेळचा विषय क्र. ०५/५६–२०२३ अन्वये मान्यता दिल्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार खालील अभ्यासक्रम शैक्षणिक वर्ष २०२३–२४ पासून लागू करण्यात येत आहे.

1. M. Sc. Geophysics I year (Campus School)

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.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शैक्षणिक–१/परिपत्रक/एनईपीपीजी/संकुल/
२०२३–२४/181
दिनांक : ३१.०७.२०२३.

आपली विश्वासू
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) मा. संचालक, भूशास्त्र संकुल, प्रस्तुत विद्यापीठ.
७) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यानां देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या संकेतस्थळावर प्रसिध्द करण्यात यावे.

SWAMI RAMANAND TEERTH

MARATHWADA UNIVERSITY, NANDED - 431 606

(Structure and Syllabus of Four Years Multidisciplinary Degree Program with Multiple Entry and Exit Option)

TWO YEAR MASTERS PROGRAMME IN

Geophysics

Under the Faculty of
Science and Technology

Effective from Academic year 2023 – 2024
(As per NEP-2020)

Forward by the Dean, Faculty of Science and Technology

SAMPLE COPY (Need to be Modified)

From the Desk of the Dean:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needsto be addressed, debated and taken forward in a systematic manner. Accreditation is the principalmeans of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) and give freedom to affiliated Institutes to add few (PEO's) and course objectives and course outcomes tobe clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading systemis also introduced to ensure quality of engineering education.

Semester based Credit and Grading system enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner's performance. Credit assignment for courses is based on 15 weeks teaching learning process, however content of courses is to be taught in 12-13 weeks and remaining 3-2 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc.

Credit and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

Dr. L. M. Waghmare, Dean, Faculty of Science and Technology,
Dr. M. K. Patil, Associate Dean, Faculty of Science and Technology,
Swami Ramanand Teerth Marathwada University, Nanded

NOTE: - ***Need to be modified following guidelines of NEP-2020 and its outcome and Overall improvement in Education system***

From Desk of Chairman, Board of Studies of the Subject Geophysics

Preamble:

Syllabus of M.Sc. Geophysics program offered by the School of Earth Sciences has been prepared as per the Credit Framework guidelines of National Education Policy (NEP) 2020 and considering the syllabi of the UPSC examination, MPSC examination, CSIR-NET examination and the requirements of the industry. The M.Sc. program in Geophysics is imparted to the students for two academic years consisting of four semesters. Candidates will be examined and evaluated on grade basis at the end of each semester in different theory and practical papers as per the credits offered by each course.

The M.Sc. Geophysics program consists of Core Courses, Electives Courses, Research Methodology, Publication Ethics and On Job Training. This two year program is of total 88 credits, with 22 credits for each semester. The program includes Core and Elective Courses. Students can choose one Elective Course per semester from the list of Elective Courses provided. Students are also encouraged to select Open Elective courses from National Educational Platforms such as MOOCS/NPTL/SWAYAM. If a student wishes, he/she can take a few extra courses, which will be considered as add-on credits.

In addition to class-room teaching and laboratory, the M.Sc. Geophysics program offers geophysical field training to the students. After completion of field training, students have to submit a filed report to the School. Intensive On Job Training /Internships in the nationally reputed institutes shall also be provided to the M.Sc. Geophysics students. The semester breaks can also be utilized for the geophysical field training and internships.

Students will be assessed through Continuous Assessment (CA) and End Semester Assessment (ESA). Mode of Continuous Assessment (CA) 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. The End Semester Assessment (ESA) (80% of the Maximum Marks) will be based on paper-pen pattern and laboratory experiments/calculations.

Every M.Sc. Geophysics student has to mandatorily submit dissertation thesis. The Research Project/Dissertation is of 10 Credits, 4 Credits are in third semester and 6 credits are in fourth semester. 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. Through dissertation work the student should be well-versed with the literature on the chosen topic, independently define a scientific problem, carry out focused study on a research topic, analyze and interpret large data sets, independently write thesis / project proposal and present and defend the dissertation work. The Dissertation must be submitted by the end of fourth Semester with a Seminar presentation in the presence of faculty members, students and external examiners for the purpose of evaluation. The School of Earth Sciences strongly encourages the M.Sc. Geophysics students to publish their dissertation work in SCI journals.

Prof. Dr. Dipak Baburao Panaskar

Chairman, Board of Studies of the Geology, Swami Ramanand Teerth Marathwada University, Nanded

Details of the Board of Studies Members in the subject …….. under the faculty of Science & Technology of S.R.T.M. University, Nanded

Sr No	*Name of the Member*	*Designation*	*Address*	*Contact No.*
1	*Dr. Dipak Baburao Panaskar*	*Senior Professor*	*School of Earth Sciences, S. R. T. M. University, Nanded*	*9403227259*
2	*Dr. Hari Shankarrao Patode,*	*Associate Professor*	*School of Earth Sciences, S. R. T. M. University, Nanded*	**9850209045**
3	*Dr. Shaikh MD Babar,*	*Professor*	**DSM 's College of Arts, Commerce and Science College, Parbhani**	**9890184699**
4	*Dr. Bhagwan Balasaheb Ghute,*	*Assistant Professor*	**Toshniwal Arts, Commerce & Science College, Sengaon, Tq. Sengaon, Dist Hingoli.**	**9130006333**
5	*Dr. Udaykumar Laxmikant Sahu,*	*Assistant Professor*	**Toshniwal Arts, Commerce & Science College, Sengaon, Tq. Sengaon, Dist Hingoli.**	**9860406757**
6	*Prof. D. C. Meshram*	*Professor*	**Department of Geology, S. P. Pune University, Pune**	**8275697166**
7	*Dr. A. N. Dongre*	*Associate Professor*	**Department of Geology, S. P. Pune University, Pune**	**9922410132**
8	*Dr. Sukanta Roy*	*Principal Scientist (F) & Project Director*	**BGRL, Ministry of Earth Sciences, Karad**	**9490469980**
9	*Prof. A. R. Kulkarni*	*Professor*	**SIBER, Kolhapur**	**7588470146**
10	*Dr. T.Vijay Kumar Invitee member*	*Professor*	**SES, SRTMU**	**7972643417**

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science & Technology

Credit Framework for Two Year PG Program

Subject: Geophysics

Year & Level 1	Sem. 2	Major Subject (DSC) 3	Major Subject (DSE) 4	RM 5	OJT / FP 6	Research Project 7	Practicals 8	Credits 9	Total Credits 10
1	1	SGPY-C401 Mathematics (4 Cr) Theory SGPY –C402 Numerical methods and computer Programming (4 Cr) Theory SGPY –C403 Physics of the Earth (4 Cr) Theory	SGPY –E401 Basic Geology (3 Cr) Theory SGPY –E402 Basic Geology (1 Cr) Practical **OR** SGPY –E403 Earth System Science (3 Cr) Theory SGPY –E404 Earth System Science (1 Cr) Theory	**SVCRM 401** *Research Methodology* **(3 Cr)**	--		SGPY-P401 Mathematics (1 Cr) Practical SGPY –P402 Numerical methods and computer Programming (1 Cr) Practical SGPY –P403 Physics of the Earth (1 Cr) Practical	**22**	**44**
	2	SGPY-C451 Gravity Method (4 Cr) Theory SGPY –C452 Signal Processing (4 Cr) Theory SGPY –C453 Electrical Methods (4 Cr) Theory	SGPY-E451 Applied Geology (3 Cr) Theory SGPY-E452 Applied Geology (1 Cr) Practical **OR** SGPY-E453 Geodynamics (3 Cr) Theory SGPY-E454 Geodynamics (1 Cr) Practical	---	**SDSCOJ 451** **(3 Cr)**	--	SGPY-P451 Gravity Method (1Cr) Practical SGPY –P452 Signal Processing (1 Cr) Practical SGPY –P453 Electrical Methods (1 Cr) Practical	**22**	
Exit option: Exit Option with PG Diploma *(after 2024-25)*									

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

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SGPY C401**	Mathematics	04	--	**04**	04	--
	SGPY C402	Numerical Methods & Computer Programming	04	--	**04**	04	--
	SGPY C403	Physics of the Earth	04	--	**04**	04	--
Elective (DSE)	**SGPY E401**	**Basic Geology OR Earth SystemSciences**	03	--	**03**	03	--
	SGPY E403						
Research Methodology	**SVCRM 401**	Research Methodology	03	--	**03**	03	--
DSC Practical	**SGPY P401**	**Mathematics**	--	01	**01**	--	02
	SGPY P402	Numerical Methods & Computer Programming	--	01	**01**	--	02
	SGPY P403	Physics of the Earth	--	01	**01**	--	02
DSE Practical	**SGPY E402**	**Basic Geology OR Earth SystemSciences**	--	01	**01**	--	02
	SGPY E404						
Total Credits			**18**	**04**	**22**	**18**	**08**

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

Examination Scheme

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

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

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 C401	Mathematics	20	20	20	80	--	--	100
	SGPY C402	Numerical Methods & Computer Programming	20	20	20	80	--	--	100
	SGPY C403	Physics of the Earth	20	20	20	80	--	--	100
Elective (DSE)	SGPY E401 / SGPY E403	Basic Geology OR Earth SystemSciences	15	15	15	60	--	--	75
Research Methodology	SVCRM 401	Research Methodology	15	15	15	60	--	--	75
DSE Practical	SGPY P401	Mathematics	--	--	--	--	05	20	25
	SGPY P402	Numerical Methods & Computer Programming	--	--	--	--	05	20	25
	SGPY P403	Physics of the Earth	--	--	--	--	05	20	25
DSE Practical	SGPY E402 / SGPY E404	Basic Geology OR Earth SystemSciences	--	--	--	--	05	20	25

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

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SGPY C451**	**Gravity methods**	04	--	**04**	04	--
	SGPY C452	**Signal processing**	04	--	**04**	04	--
	SGPY C453	**Electrical Methods**	04	--	**04**	04	--
Elective (DSE)	**SGPY E451**	**Applied Geology OR Geodynamics**	03	--	**03**	03	--
	SGPY E453						
On Job Training	**SGPY OJ451**	ON Job Training	--	--	**03**	--	--
DSC Practical	**SGPY P451**	**Gravity methods**	--	01	**01**	--	02
	SGPY P452	**Signal processing**	--	01	**01**	--	02
	SGPY P453	**Electrical Methods**	--	01	**01**	--	02
DSE Practical	**SGPY E452**	**Applied Geology OR Geodynamics**	--	01	**01**	--	02
	SGPY E454						
Total Credits			**18**	**04**	**22**	**15**	**08**

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

Examination Scheme

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

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits of individual paper)

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 C451**	**Gravity method**	20	20	20	80	--	--	100
	SGPY C452	**Signal processing**	20	20	20	80	--	--	100
	SGPY C453	**Electrical Methods**	20	20	20	80	--	--	100
Elective (DSE)	**SGPY E451** / **SGPY E453**	**Applied Geology OR Geodynamics**	15	15	15	60	--	--	75
On Job Training	**SGPY OJ451**	ON Job Training	15	15	15	60	--	--	75
DSE Practical	**SGPY P451**	**Gravity method**	--	--	--	--	05	20	25
	SGPY P452	**Signal processing**	--	--	--	--	05	20	25
	SGPY P453	**Electrical Methods**	--	--	--	--	05	20	25
DSE Practical	**SGPY P452** / **SGPY E454**	**Applied Geology OR Geodynamics**	--	--	--	--	05	20	25

Course Structure: *Major 1 - Teaching Scheme*

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 C401	Mathematics	20	20	20	80	--	--	100

Course Code	Course Name (Paper Title)	Teaching Scheme (Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SGPY C401	Mathematics	04	--	04	--	04

SGPY C401: Mathematics *(Major 1) (Theory: 4 credits) Curriculum Details*

Course pre-requisite:

- Must have studied Mathematics courses at his under graduate level

Course objectives:

This course objective is to enable the students to gain an understanding of the applications of mathematics to solve the geophysical problems

Course outcomes:

- At the end of the course the student would be able to Solve the Geophysical Problems and will be prepared for signal processing of Geophysical data.

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

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Vector Spaces and Matrices**	**15**
	1.1	**Linear dependence and independence of vectors, Inner product, Schmidt's orthogonalization method.**	
	1.2	**Matrices – Inverse, Orthogonal, Hermitian and unitary matrices, Transformation of vectors and matrices**	
	1.3	**System of linear equations, eigenvalues and eigenvectors of square matrix, diagonalization of a matrix, rotation matrix**	
2.0		**Vector Calculus**	**15**
	2.1	**Differentiation of vectors, curves in space, velocity and acceleration, Tangential and normal acceleration, Relative velocity and acceleration, scalar vector point function.**	
	2.2	**Vector operator Del. Del applied to scalar point function-Gradient ,Del applied to vector point function, Divergence & Curl, Physical interpretation of div F and curl F, Laplacian Operator, Polar coordinate system, Divergence and curl in polar coordinate system. Laplacian in Polar coordinates**	
	2.3	**Integration of vector , Line integral circulation work , Surface integral Flux, Partial differential equations, Green's theorem in the plane, Stroke's theorem , volume integral Divergence theorem, Green's theorem, Irrotational and Solenoidal fields ,orthogonal curvilinear coordinates Del applied to function in orthogonal curvilinear coordinates.**	
3.0		**Fourier Series and Integral Transform**	**15**
	3.1	**Fourier series: General properties of Fourier series, Simple applications, properties of Fourier series, convergence, integration, differentiation.**	
	3.2	**Fourier Transform, Laplace Transforms, Properties of Fourier and Laplace transforms (Linearity, first shifting and second shifting property), Fourier sine and cosine transforms, Fourier and Laplace transform of derivatives,**	
	3.3	**Elementary Laplace transform, Inverse Fourier and Laplace transforms, shifting theorem, step function, Solution of simple differential equation using Laplace Transform technique.**	
4.0		**Complex function and Calculus of Complex function**	**15**
	4.1	**Definition of complex function, exponential function and properties, circular function and properties, hyperbolic function and properties, Inverse hyperbolic function, logarithmic function**	
	4.2	**Limit of a complex function, continuity, derivative (theorem), analytic functions, harmonic functions**	
	4.3	**Complex integration, Cauchy's theorem, Cauchy's integral formula, Series of complex term-Taylor's series, Laurentz series. Zeros of an analytical function**	
	4.4	**Singularities of an analytical function (isolated, removable, poles and essential singularity), Residue Theorem-Calculus of residues.**	
		Total	**60**

Text Books:

1. Higher Engineering Mathematics, By B. S. Grewal.
2. Mathematical Physics, S. Chandra.

Reference Books:

1. **A. W. Joshi, Matrices and Tensors in Physics,**
2. **Mathematical Physics, B. S. Rajput**
3. **Mathematical Physics, S. L. Kakani.**
4. **Online material**

Practicals : SGPY P401: Mathematics (1 Credit)

1. **Time Series Analysis**
2. **Numerical Linear Algebra**
3. **Fourier Analysis**
4. **Complex Analysis:**
5. **Discrete Mathematics**
6. **Linear Algebra Applications**
7. **Partial Differential Equations**

Text books and reference Books

1. **Higher Engineering Mathematics, By B. S. Grewal**
2. **Fourier Series and Transform by R N Bracewell**

SGPY C402: *Numerical Methods & Computer Programming*

Theory: 4 credits (Major 2) Curriculum Details

Course pre-requisite:

- Must have studied Mathematics courses at his Bachelors level and basic knowledge of computer programming

Course objectives:

- This course objective is to enable the students to gain an understanding of the Numerical Methods to solve the geophysical problems and to learn the programming skills

Course outcomes:

- At the end of the course the student will get knowledge of numerical techniques to solve geophysical problems, the student also acquire skills in developing computer programs in geophysical applications. The knowledge acquired in this course will be useful for application computer programming skills in geophysics.

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

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Curve fitting and interpolation**	**15**
	1.1	**The Principle of Least squares, fitting a straight line, fitting a parabola, fitting an exponential curve, fitting curve of the form y=axb, fitting through a polynomial, Cubic spline fitting**	
	1.2	**Linear interpolation, difference schemes, Newton's forward and backward interpolation formula.**	
	1.3	**Roots of equation - Polynomial and transcendental equations, limits for the roots of polynomial equation. Bisectional method, false position method, Newton Raphson method, direct substitution method, synthetic division, complex roots.**	
2.0		**Numerical integration**	**15**
	2.1	**Newton cotes formula, trapezoidal rule, Simpson's one third rule, Simpson's three eight rule, Gauss quadratics method, Monte Carlo method**	
	2.2	**Solution of differential equation Taylor series method, Euler method, Runge - Kutta method, predictor-corrector method**	
3.0		**Solution of simultaneous equation**	**15**
	3.1	**Gaussian elimination method, pivotal condensation method, Gauss-Jordan elimination method, Gauss-Seidal iteration method, Gauss-Jordan matrix inversion method, Gaussian-elimination matrix inversion method**	
	3.2	**Eigen values and eigenvectors of a matrix- Computation of real Eigen values and corresponding eigenvectors of a symmetric matrix, power method and inverse power method.**	
	3.3	**Partial differential equations- Difference equation method over a rectangular domain for solving elliptic, parabolic and hyperbolic partial differential equation**	
4.0		**C- Programming**	**15**
	4.1	**Elementary information about digital computer principles, compliers, interpreters, and operating systems**	
	4.2	**C programming, flow charts, integer and floating point arithmetic, expression, build in functions, executable and non-executable statements, assignment, control and input-output elements, user defined functions, operation with files: pointers**	
	4.3	**Random numbers, Random walk, method of importance sampling.**	
		Total	**60**

Text Books:

1. **Rajaraman: Numerical analysis.**
2. **C Programming : Balagurusamy**
3. **Suresh Chandra Computer Applications in Physics with FORTRAN, BASIC and C, Narosa Publishers**

Reference Books:

1. **H. M. Antia: Numerical methods for scientists and engineers.**
2. **Vetterming, Teukolsky, press and Flannery: Numerical recipes.**
3. **Sastry: Introductory method of numerical analysis.**
4. **Numerical Computational methods, P. B. Patil and U. P. Verma.**
5. **Numerical methods and computation – B. K. Bafna.**
6. **Advanced engineering mathematics – Erwin Kreszing 5^{th} or 7^{th} edition john Willey and sons inc.**
7. **Online material**

Practical : SGPY P402: Numerical methods and Computer Programming (1 credit).

1. Root Finding Algorithms
2. Numerical Integration
3. Partial Differential Equations (PDEs)
4. Linear Algebra Computations
5. Data Fitting and Regression Analysis
6. Solving Linear Systems in Scientific Libraries:
7. Numerical Solutions for Eigen value Problems

Text books and Reference books:

1. **C Programming : Balagurusamy**
2. **Suresh Chandra Computer Applications in Physics with FORTRAN, BASIC and C, Narosa Publishers**

SGPY C403: Physics of the Earth Theory: *(Major 3) (Theory: 4 credits) Curriculum Details*

Course pre-requisite:

1. Basic knowledge about physics and chemistry of Earth material

Course objectives:

- This course's objective is to introduce the student about the basic physical process and its applications in understanding the formation of Earth and its process. This course forms as a foundation course for a student to gain overall understanding of the Geophysics subject and its approach.

Course outcomes:

- At the end of the course the student will get knowledge of physical concepts and Earth dynamics. With the knowledge acquired in this course the student gets foundations in understanding the Earth.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Solar System**	
	1.1	**History of development and scope of geophysics, hypotheses for the origin of solar system**	**15**
	1.2	**Kepler's law of planetary motion, planet and satellites of the Solar system and their characteristics**	
	1.3	**Internal constitution of the earth, Characteristics of Crust, Mantle and Core, lithosphere, and Asthenosphere**	
2.0		**Heat flow and Geochronology**	
	2.1	**Importance of heat flow, thermal history of the earth, sources of heat generation and temperature distribution inside the earth**	**15**
	2.2	**Relative age dating**	
	2.3	**Radiometric dating principles and ages of rocks and the earth.**	
3.0		**Geomagnetic Field**	
	3.1	**Origin of geomagnetic field, secular variations and westward drift, geomagnetic time scale, geomagnetic storms**	**15**
	3.2	**Earth's current, sun spot, solar flares, lunar and solar variations**	
	3.3	**Palaeomagnetic studies of rock samples and their applications in geophysics, polar wandering, reversals of geomagnetic field. Geomagnetic time scale**	
4.0		**Isostacy**	
	4.1	**Gravity and Figure of the Earth**	**15**
	4.2	**International gravity formula and rotation of the Earth**	
	4.3	**Pratts theory and Airy theory of Isostacy**	
	4.4	**Heikanens model and elastic rebound**	
		Total	**60**

Text Books:

1. **Fundamentals of Geophysics by Lowrie**
2. **Planet Earth by Press and Siever**

Reference Books:

1. **The Solid Earth by Fowler**
2. **Introduction to seismology by Peter Shearer**
3. **Introduction to Geophysics by Howell :**
4. **Physics and Geology, by Jacobs and Russel**
5. **Physics of the earth, by Stacey**
6. **The interior of the earth, by M.H.P. Bott**
7. **Topics in Geophysics, by P.J. Smit**
8. **Online material**

Practicals : SGPY P403 Physics of the Earth (1 Credit)

1. **Estimating the mass of the earth**
2. **Density of earth**
3. **Density of Core**
4. **Kepler's laws**
5. **Radio activity and dating**

Text books and Reference Books

1. **The Solid Earth by Fowler**
2. **Solved problems in Geophysics, Buforn, Carmen and Udias**

SGPY E401 Basic Geology Theory: 3 credits *(Elective 1) (Theory: 3 credits) Curriculum Details*

Course pre-requisite:

- Basic knowledge of chemistry

- **Course objectives:**

  This course objective is to introduce the student about the basics building blocks like mineral species and rocks. Basic introduction to formation of different type of rocks.This course is introduction of geology which is essential as the geophysics is applications of physics to solve geological processes.

- **Course outcomes:**

  At the end of the course the student gains the knowledge of essentials of geology to study geophysics. The student will be able to identify the rocks and minerals in the field. The knowledge acquired in this course will be useful to understand the geophysical data.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction**	**15**
	1.1	**Introduction to geology, Geology as a fundamental science; branches of geology and relationships with other branches of science, weathering agents**	
	1.2	**Introduction to geomorphology Folds, faults, unconformities, joints and their classification, Geological time scale**	
	1.3	**Earth System: Lithosphere, Hydrosphere, Cryosphere and Atmosphere and their interactions**	
2.0		**Minerology basics**	**15**
	2.1	**Mineralogy: Mineral - its definition and mode of occurrence, physical properties of minerals like form, colour, lustre, streak, cleavage, fracture, hardness and specific gravity**	
	2.2	**Physical characters and chemical composition of different rock forming minerals.**	
3.0		**Petrology basics**	**15**
	3.1	**Petrology: Rock – its definition; classification and distinguishing characteristics of Igneous, Sedimentary and Metamorphic rocks; forms of Igneous rocks**	
	3.2	**Elementary ideas regarding formation; Texture and structure of Igneous, Sedimentary and Metamorphic rocks**	
	3.3	**Brief petrographic description and occurrences different rocks**	
		Total	**45**

Text Books:

1. A Text Book of Geology: P.K. Mukherjee
2. Rutley's element of Minerology
3. Textbook of mineralogy, Dana
4. Petrology: Igneous, Sedimentary and Metamorphic, Ehlers and Blatt

Reference Books:

1. The Earth: Press and Siever
2. Blue Planet: Skinner and Porter
3. Physical Geology: Arthur Holmes
4. Engineering Geology: Purbin Singh
5. Earth Materials: Klein and Philpotts
6. Principles of Petrology by Tyrrell
7. Online material

SGPY E402 Basic Geology Practical: 1 credit

1. **Hardness scale of minerals**
2. **Mineral properties in hand specimen**
3. **Mineral Properties in thin sections**
4. **Rock properties in hand specimen**
5. **Rock properties in thin section**

Textbook and Reference

1. **Text book of Geology, G.M.Bangar**
2. **Minerology and petrology by Dana**

SGPY E403: Earth System Sciences: *(Elective 1) (Theory: 3 credits)*

Curriculum Details

Course pre-requisite:

- Basic knowledge of geology, This course is recommended for those who already studied geology in their graduation and are confident about their concepts about geology

Course objectives:

- This course objective is to introduce the student about the understanding of the Earth System, various components and its interrelation. This helps the student to gain knowledge about the overall interaction and processes of various systems of the Earth.

Course outcomes:

- At the end of the course the student gains the knowledge of interaction of different spheres of Earth and provides relevant geological inputs to study and interpret geophysical data.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction**	**15**
	1.1	**Earth as a planet Holistic understanding of dynamic planet 'Earth' through Astronomy, Geology, Meteorology and Oceanography**	
	1.2	**Introduction to various branches of Earth Sciences. General characteristics and origin of the Universe, Solar System and its planets**	
	1.3	**Earth and Planetary system, size, shape, internal structure and composition of the earth; atmosphere and greenhouse effect**	
2.0			**15**
	2.1	**Plate Tectonics Concept of plate tectonics, sea-floor spreading and continental drift Geodynamic elements of Earth**	
	2.2	**Mid Oceanic Ridges, trenches, transform faults and island arcs Origin of oceans, continents, mountains and rift valleys**	
	2.3	**Earthquake and earthquake belts Volcanoes- types, products and their distribution**	
3.0			**15**
	3.1	**Lithosphere, Hydrosphere and Atmosphere, Internal structure of the Earth, isostasy**	
	3.2	**elements of seismology; physical properties of the interior of the earth; continents and continental processes, Introduction to Earth and formation theories**	
	3.3	**Seismicity and earth's interior.Compositional and Rheological divisions of Earth, Earth's magnetic field, paleomagnetism**	
		Total	

Text Books:

1. **Atmosphere Tarbuck and Luytgens**
2. **The Earth: Press and Seiver**
3. **Blue Planet: Skinner and Porter**
4. **Physical Geology: Arthur Holmes**
5. **A Text Book of Geology: P.K. Mukherjee**

Reference Books:

1. **Earth Materials: Klein and Philpotts**
2. **Holmes' principles of physical geology. Taylor & Francis. By Duff, P. M. D., & Duff, D. (Eds.).**
3. **Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press. by . Emiliani, C**
4. **Oceanography: A view of the earth by Gross, M. G.**
5. **Online material**

SGPY E404: Earth System Sciences : Practical (1 credit)

1. **Plate tectonics**
2. **Solar system**
3. **Composition of Earth**
4. **Mapping of volcanoes**
5. **Mapping of Earthquakes**

Text book and Reference books

1. **The Earth: Press and Seiver**
2. **The solid Earth , Fowler**
3. **The dynamic Earth system: A.M. Patvardhan**

II Semester

SGPY C451: Gravity method: *(Major 1) (Theory: 4 credits) Curriculum Details*

Course pre-requisite:

- Basic Physical concepts of gravitational field of the Earth

Course objectives:

- This course is intended to discuss about the gravitational field of the Earth and its applications in Geophysics. Density variations of Earth materials, gravity method concepts, instrumentation, data acquisition, data processing, data analysis and data interpretation of gravity data and its applications.

Course outcomes:

- At the end of the course the student get knowledge about gravitational field and its applications. The student will be in a position to use gravitational methods in the geoexploration, resource evaluation, figure of the Earth and geological mapping.

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction and instrumentation**	**15**
	1.1	**Earth's Gravity Field, principle and Characteristics, Properties of Newtonian potential, - Rock densities and factors affecting density, density measurement techniques of the samples**	
	1.2	**Laplace's and Poisons'' equations, Green's theorem and Gauss law**	
	1.3	**gravity prospecting instruments, zero length spring, Worden & Lacoste gravimeters, Absolute gravimeters**	
2.0		**Gravity data processing**	**15**
	2.1	**Gravity units, concept of geod and spheroid, gravity base, collection of gravity data, drift correction, reduction of gravity, Bouguer gravity anomalies, airborne and ship borne gravimetry, Isostacy.**	
	2.2	**Plan of gravity surveys, presentation of gravity data, Concept of noise**	
	2.3	**regional and residual anomalies, methods of calculation, upward and downward continuation, derivative calculations, Fourier transformations and Harmonic analysis. Ambiguity in gravity**	
3.0		**Data interpretation**	**15**
	3.1	**Interpretation of gravity data- qualitative interpretation, identification of two and three dimensional bodies, structural features, quantitative interpretation,**	
	3.2	**conventional methods of interpretation techniques- thumb rules and methods of characteristic curves,**	
	3.3	**gravity anomalies of geophysical models- point mass, line mass, discs, cylinders, sheets, faults, slabs, irregular shaped bodies.**	
4.0		**Data Modelling**	**15**
	4.1	**Computer based techniques- Forward modeling and inversion – principles of inversion.**	
	4.2	**computer aided interpretation of gravity anomalies of different regular, irregular shaped bodies, sedimentary basins.**	
	4.3	**Application of gravity in mineral and oil exploration**	
	4.4	**Applications of gravity method in geological mapping, groundwater and geotechnical engineering – some case studies. Mass estimation in gravity.**	
		Total	

Text Books:

1. **Gravity and Magnetic methods by Rao B.S.R and Murthy I.V.R**
2. **Gravity and Magnetic interpretation in Exploration Geophysics by I.V.R. Murthy**
3. **Applied geophysics by W.W. Telford**
4. **Introduction to Geophysical prospecting by M.B. Dobrin**
5. **An Introduction to Geophysical Exploration by Philip Kearey , Michael Brooks and Ian Hill**
6. **Fundamentals of Geophysics by William Lowrie**
7. **Net Browsing**

Reference Books:

1. Gravity and Magnetic exploration: Principles. Practices and Exploration
2. Gravity and magnetic in oil prospecting L.L. Nettleton
3. The Solid Earth by Fowler
4. Introduction to Geophysics by Howell
5. Elementary gravity and magnetics for Geologists and Seismologists L.L. Nettleton
6. Online material

SGPY P451: Gravity method: *(Practical: 1 credit) Curriculum Details*

1. Gravity corrections

2. Regional and residual

3. International gravity formula

4. Bouguer gravity

5. Gravity anomaly due to regular shaped bodies

6. Isostacy

Text book and Reference books

1. **The solid Earth by Fowler**
2. **Applied Geophysics by Telford**

SGPY C452: Signal Processing: *(Major 2) (Theory: 4 credits)*

Curriculum Details

Course pre-requisite:

- Basic Physical and mathematical concepts data handling

Course objectives:

- This course is intended to discuss about the different prerequisites of data processing techniques and mathematical transforms useful in Geophysical signal Processing, Forward modeling and Inversion of geophysical data is introduced.

Course outcomes:

- At the end of the course the student get knowledge about Geophysical data Processing for various methods and physical meaning. Inversion and Modelling of geophysical data.

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction to Signals**	**15**
	1.1	**Introduction, definition of signal and noise, types of signals, Analog and Digital signals**	
	1.2	**Sampling theorem, Digitization of geophysical data, Nyquist frequency**	
	1.3	**Aliasing and Errors of digitization**	
2.0		**Applications of Transforms**	**15**
	2.1	**Applications of Fourier series and fourier transforms Gibbs phenomenon, time and frequency domain**	
	2.2	**Fourier transforms and some important functions – rectangular, periodic, exponential, singularity, Spectral analysis**	
	2.3	**Discrete Fourier Transform, Fast Fourier Transform**	
3.0		**Time series Analysis**	**15**
	3.1	**Time series analysis, correlation, convolution, impulse response and transfer function,**	
	3.2	**Z-transform and Hilbert transform**	
	3.3	**wavelets. Waveform processing, power spectrum, Wiener-Khintchin theorem**	
4.0		**Deconvolution and Inversion**	**15**
	4.1	**Windowing, Length of window and significance, Types of windows and its affects**	
	4.2	**Filtering techniques – design - digital and frequency filters; Amplitude and phase responses of filters, low pass, high pass and band pass filters, butter worth filters.**	
	4.3	**recursive and non recursive filters, Wiener filters**	
	4.4	**Deconvolution : predictive deconvolution. Generalised linear inverse theory**	
		Total	

Text Books:

1. **Marcus Bath, 1974, Spectral Analysis in Geophysics, Elsevier.**
2. **A Populis, 1962, The Fourier integral and its applications, MC Graw Hill Publishers.**
3. **J.F. Clarebout, 1976, Fundamentals of geophysical data processing.Mc. Graw Hill Publishers.**
4. **E.R. Kanasewich, 1975, Time sequence analysis in geophysics, The University of Alberta Press.**
5. **E.A. Robinson and S. Treitel, 1983, Digital Seismic inverse methods, D. Reidel Publishing Co.**
6. **R.N. Bracewell, 1986, Fourier transform and its applications, Mc Graw Hill Publishers.**
7. **Oppenheim, Willsky and Nawab, Signals and System**
8. **J.B. Thomas, 1969, An introduction to statistical communication Theory, John – Wiley Publishers,**

Reference Books:

1. A.V. Oppenheim and R. W. Schafer. Digital signal processing, Prentice hall of India.
2. Silvia, M.T. and Robinson, E.A. Deconvolution of geophysical time series in the exploration for Oil and Natural gas. Elsevier Scientific Publishing Co.
3. Tarantola A 1984, Inverse Problem Theory, Elsevier, Amsterdam.
4. Introduction to Inverse geophysical theory by Scales, Smith and Treital
5. Time series analysis by Cryer and Chan
6. Geophysical Inverse theory by Nowack, Lecture notes of Purdue University
7. Online material

SGPY P452: Signal Processing: *(Practical: 1 credit) Curriculum Details*

1. **Signal analysis**
2. **Frequency spectrum**
3. **Autocorrelation**
4. **Cross correlation**
5. **Convolution**
6. **Filtering**

Textbook and Reference

1. **Signal and systems by Rawat**
2. **Marcus Bath, 1974, Spectral Analysis in Geophysics, Elsevier.**

SGPY C453: Electrical Method: *(Major 3) (Theory: 4 credits) Curriculum Details*

Prerequisite

- Basic Physical concepts of Electricity,

Course Objective:

- This course is intended to impart knowledge about the various electrical properties of Earth materials, methods developed based on the electrical properties, instrumentation, data acquisition, data processing, data analysis and data interpretation of electrical data and its applications. .

Course outcomes:

- At the end of the course the student will get knowledge of using electrical methods for understanding the Earth materials indirectly and will be able to locate manmade and natural conducting bodies in the upper crust. The student will be able to handle the Electrical resistivity meter and its operation.

Curriculum Details:

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Basics**	
	1.1	Electrical fields in geophysics, Principles and classification of Electrical methods of prospecting	**15**
	1.2	current and potentials, electrical properties of the rocks, current flow in ground, Electric conduction in rocks, factors affecting electrical conduction in rocks, isotropy, anisotropy	
	1.3	principles of equivalence, Dar Zarrouk parameters- Longitudinal conductance and transverse resistance	
2.0		**SP and Resistivity**	
	2.1	Self potential (SP) – origin, measurement, field technique	**15**
	2.2	SP anomalies over different models, interpretation of SP anomalies, Applications of SP method.	
	2.3	Resistivity methods – concept of resistance and resistivity. Concept of true and apparent resistivity. Apparent resistivity for multi layer Earth and super position	
3.0		**Resisitivity field survey and Interpretation**	
	3.1	Different Electrode arrays – Wenner, Schlumberger, Dipole-diploe – Geometric factor. Vertical Electrical Sounding (VES), Horizontal Profiling techniques. Field procedures.	**15**
	3.2	Types of VES curves- Interpretation-Curve matching, partial curve matching techniques- direct and indirect methods of interpretation – resistivity transform functions	
	3.3	Resistivity profiling over fault, vertical contacts, buried 2-d and 3-D bodies, estimation of overburden thickness.	
	3.4	Application of resistivity methods in various applications like groundwater, mineral, geotechnical and geological mapping	
4.0		**Induced Polarisation**	
	4.1	Basic concepts, source of IP. Over voltage and Induced polarization. Membrane polarization and electrode polarization	**15**
	4.2	IP measurements- Time domain measurements – Chargeability and delay time. Frequency domain measurements – percentage frequency effect (PFE), metal conduction factor. Relation between time and frequency domain IP measurements.	
	4.3	Field procedures – collection and presentation of data – pseudo section plotting – complex resistivity. Magnetic Induced Polarization (MIP) method	
	4.4	Applications of IP in exploration and geological applications.	
		Total	**60**

Text Books:

1. **Applied geophysics by W.W. Telford**
2. **Introduction to Geophysical prospecting by M.B. Dobrin**
3. **An Introduction to Geophysical Exploration by Philip Kearey, Michael Brooks and Ian Hill**
4. **Field Geophysics, John Milsom**

Reference Books:

1. **Electrical methods of Geophysical Prospecting, Keller and Frischknecht**
2. **Mining Geophysics, Parasnis**
3. **Outline of Geophysical Prospecting, M.B. Ramchandra Rao.**
4. **Engineering geology Principles and Practice, Price**

5. **Online e books**

SGPY P453: Electrical Method: *(practical: 1 credit) Curriculum Details*

1. Resistivity curves
2. Types of standard curves
3. Apparent resistivity
4. Transverse resistivity and Longitudinal conductance

Text book and reference book

1. Applied geophysics by Telford

SGPY E451: Applied Geology: *(Elective 1) (Theory: 3 credits)*

Curriculum Details

Course pre-requisite:

- Basic knowledge of geology, of undergraduate course are must have studied Basic geology/ Earth System Studies course at first semester in this school

Course objectives:

This course objective is to introduce the student about the geology which is essential as the geophysics is applications of physics to solve geological processes.

Course outcomes:

- At the end of the course the student gains the knowledge of essentials of geology and relevant geological inputs to study geophysics.

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		**Introduction**	**15**
	1.1	**Different kinds of rocks – igneous, sedimentary and metamorphic rocks**	
	1.2	**physical properties and its variations of Igneous, Sedimentary and Metamorphic rocks, factors affecting the physical properties of different rocks**	
	1.3	**Nomenclature of folds, Types of folds, origin of folds, identification of folds in the field**	
2.0		**Structural geology**	**15**
	2.1	**Faults, folds and joints: Nomenclature, types, mechanisms, identification in the fields of Faults**	
	2.2	**Types of Faults, Fault Mechanism, Identification of Faults in the field**	
	2.3	**Geological structures and associated physical processes**	
3.0		**Geotectonics**	**15**
	3.1	**Convection currents, Plate, types of plates, plate boundaries, causes of plate movement**	
	3.2	**Rifting of continent, Subduction zone, island arcs, mid oceanic ridges**	
	3.3	**Hot Spot, Formation of Deccan Shield, Collision and its types**	
		Total	

Text Books:

6. **Fundamentals of Structural Geology: Pollard & Fletcher**
7. **Foundations of Structural Geology: R. G. Park**
8. **Structural Geology: Marland Pratt Billings**
9. **Plate Tectonics: Kent. C. Condie**
10. **The Techniques of Modern Structural Geology: John G. Ramsay**
11. **Introduction to the Structure of the Earth: Edgar Winston Spencer**
12. **Flow Processes in Faults and Shear Zones: G. Ian Alsop**

Reference Books:

1. **Plate Tectonics: Continental Drift and Mountain Building: Wolfgang Frisch, Martin MesChede, Ronald C. Blakey**
2. **Plate Tectonics: A. Cox and R.B. Hart**
3. **Mantle convection: Plate Tectonics and Global Dynamics: W.R. Peltier**
4. **When Did Plate Tectonics Begin on Planet Earth: Kent. C. Condie and Victoria Pease**
5. **Online material**

SGPY E452: Applied Geology: *(Elective 1) (Practical: 1 credit) Curriculum Details*

1. **Study of different rock types**
2. **Study of folds**
3. **Study of Faults**

Text book and Reference books:

1. **Foundations of Structural Geology: R. G. Park**
2. **Structural Geology: Marland Pratt Billings**

SGPY E453: Geodynamics: *(Elective 2) (Theory: 3 credits) Curriculum Details*

Course pre-requisite:

Basic knowledge of geology, of undergraduate course are must have studied Basic geology/ Earth System Studies course at first semester in this school

Course objectives:

- This course objective is to introduce the student about the dynamic processes associated with the Earth. The objective is to teach both exogenic and endogenic processes in relation to the understanding of geophysics..

Course outcomes:

- At the end of the course the student gains the knowledge of dynamics of Earth and provides relevant geological inputs to study and interpret geophysical data.

Module No.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0		Introduction	15
	1.1	Geology and geodynamics, Lithosphere, hydrosphere and atmosphere	
	1.2	Endogenic and Exogenic forces, Internal constitution of the earth, Crust, mantle and core, characteristics of lithosphere and asthenosphere	
	1.3	causes of geodynamical process, geodynamic models	
2.0		Geological Process	15
	2.1	Rock forming minerals, Classification of rock formations	
	2.2	rock cycle and geodynamic processes	
	2.3	Geological action of agents like water and wind, weathering, soil formation, atmosphere and climatic changes, Geomagnetism, Paleomagnetism	
3.0			15
	3.1	continental drift, ocean floor spreading, plate tectonics and its geological implications, new global tectonics and plate margin process	
	3.2	geomagnetic time scale, Benioff zones, oceanic ridges, evolution of the triple junction, trenches and island arcs, hot (20) spots	
	3.3	geodynamics of Indian subcontinents and formation of Himalayas, 900 E ridge, concept of Isostacy, Airy, Heiskanan and Pratt-Hayford hypotheses	
		Total	45

Text Books:

1. **Fundamentals of Structural Geology: Pollard & Fletcher**
2. **Introduction to the Structure of the Earth: Edgar Winston Spencer**
3. **Flow Processes in Faults and Shear Zones: G. Ian Alsop**
4. **Plate Tectonics: Continental Drift and Mountain Building: Wolfgang Frisch, Martin MesChede, Ronald C. Blakey**
5. **Plate Tectonics: Kent. C. Condie**

Reference Books:

1. **Mantle convection: Plate Tectonics and Global Dynamics: W.R. Peltier**
2. **When Did Plate Tectonics Begin on Planet Earth: Kent. C. Condie and Victoria Pease**
3. **Geomagnetism by Jacob**
4. **The Earth: Press and Seiver**

5. **Blue Planet: Skinner and Porter**
6. **Physical Geology: Arthur Holmes**
7. **A Text Book of Geology: P.K. Mukherjee**
8. **Oceanography: A view of the earth by Gross, M. G.**
9. **Online material**

SGPY E454: Geodynamics: *(Elective 2) (Practical: 1 credit) Curriculum Details*

1. **Study of Minerals and Rocks**
2. **Geomagnetism and Paleomagnetism**
3. **Geodynamics of the world**
4. **Geodynamics of Indian subcontinent**

Text books and Reference books

1. **The solid Earth by Fowler**
2. **Applied Geophysics by Telford**

Guidelines for Course Assessment: (4Credits)

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):

(For illustration we have considered a paper of 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)

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.**

Guidelines for Course Assessment: (3 credits)

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):

(For illustration we have considered a paper of 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)

5. **ESA Question paper will consists of 5 questions, each of 20 marks.**
6. **Students are required to solve a total of 3 Questions.**
3. **Question No.1 will be compulsory and shall be based on entire syllabus.**
4. Students need to solve **ANY Two** of the remaining Four Questions (Q.2 to Q.5) 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.**

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