



**GOVERNMENT ARTS COLLEGE (AUTONOMOUS),  
KARUR – 639 005.**

(Reaccredited with A Grade status by NAAC)  
(Affiliated to Bharathidasan University, Tiruchirappalli.)

**DEPARTMENT OF GEOLOGY**

**B.SC. GEOLOGY PROGRAMME**

**PROGRAMME OUTCOME**

- To make the students understand the origin and evolution of the earth.
- To learn about the origin, occurrence and uses of the minerals, petroleum, coal and other economically viable deposits in the earth crust.
- To interpret and to adopt the precautionary measures of the natural hazards.
- To understands the adverse effect causes of the monsoon and climate changes.
- To learn about the exosphere, extra celestial bodies and their physical, chemical characters.

**PROGRAMME SPECIFIC OUT COMES**

- Being a Geology fellow, the students can become a field geologist in ONGC, GSI, AMD etc.
- A Geology student can also join as a scientist in NGRI, Hyderabad, NIO, Goa, NHPC, NTPC, N.E states, Hydrogeologist in CGWB, Scientist in ISRO etc.
- A Geology student can also be recruited in private sectors both in India and abroad like petroleum oil field in Oman, Australia, Saudi Arabia, Indonesia, Brazil, South America etc. In India Rajahmundry, Krishna Godavari Basin-Andhra Pradesh, Cauvery Basin-Tamil Nadu, Bhuj, Kutch Basin-Gujarat, Digboi Basin- Assam.
- A Geology fellow can also become an entrepreneur in establishing a geo consultancy works like water divining preparation of mining plan, advisor on climate change to Central and State Governments.
- A Geology student can also become an IT professional with a knowledge of GIS and Remote sensing techniques specifically in various software companies.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR – 639 005**  
**B.Sc. GEOLOGY COURSE STRUCTURE UNDER CBCS SYSTEM**  
(For the candidates admitted from the year 2016-2017 onwards)

SEMESTER	COURSE	SUBJECT TITLE	SUBJECT CODE	INSTR. HOURS WEEK	CREDIT	EXAM HOURS	MARKS		TOTAL	
							INT	ESE		
I	Tamil - I	Tamil – I	U16L1T1	6	3	3	25	75	100	
	English - I	English - I	U16L1E1	6	3	3	25	75	100	
	Core Course - I	Understanding The Earth	U16GL1C1	6	5	3	25	75	100	
	Core Course - II	Practical – I Structural Geology and surveying	-	3	-	-	-	-	-	
	First Allied Course – I	Allied physics-I	U16PH1A1	5	3	3	25	75	100	
	First Allied Course - II	Allied Physics -II(Practical)		2	-	-				
	Value Education	Value Education	U16VE1	2	2	3	25	75	100	
				30	16				500	
II	Tamil - II	Tamil – II	U16L2T2	6	3	3	25	75	100	
	English – II	English– II	U16L2E2	6	3	3	25	75	100	
	Core Course - II	Practical I– Structural Geology And Surveying	U16GL2C2P	3	4	3	25	75	100	
	Core Course – III	Structural Geology	U16GL2C3	6	5	3	25	75	100	
	First Allied Course – II	Allied Physics-II (Practical)	U16PH2A2P	2	4	3	25	75	100	
	First Allied Course – III	Allied Physics-III	U16PH2A3	5	3	3	25	75	100	
	Environmental Studies	Environmental Studies	U16ES2	2	2	3	25	75	100	
				30	24				700	
III	Tamil - III	Tamil – III	U16L3T3	6	3	3	25	75	100	
	English – III	English – III	U16L3E3	6	3	3	25	75	100	
	Core Course – IV	Physical Geology	U16GL3C4	6	5	3	25	75	100	
	Core Course – V	Practical – II Palaeontology and Crystallography	-	3	-	-	--	--	---	
	Second Allied Course I	Allied Mathematics – I	U16MM3A1	5	3	3	25	75	100	
	Second Allied Course II	Allied Mathematics – II	-	2	-	-	--	--	---	
	Non Core Elective I	Bio Statistics	U16ST3N1	2	2	3	25	75	100	
				30	16				500	
IV	Tamil – IV	Tamil – IV	U16L4T4	6	3	3	25	75	100	
	English – IV	English – IV	U16L4E4	6	3	3	25	75	100	
	Core Course – V	Practical – II Palaeontology and Crystallography	U16GL4C5P	5	4	3	25	75	100	
	Core Course – V I	Palaeontology and Crystallography	U16GL4C6	2	5	3	25	75	100	
	Second Allied Course II	Allied Mathematics – II	U16MM4A2	2	4	3	25	75	100	
	Second Allied Course III	Allied Mathematics – III	U16MM4A3	5	3	3	25	75	100	
	Skill Based Elective I	Descriptive and Optical Mineralogy	U16GL4S1	2	4	3	25	75	100	
	Non Core Elective II	Bio Statistics Practical	U16ST4N2P	2	2	3	25	75	100	
				30	28				800	
V	Core Course – VII	Stratigraphy	U16GL5C7	5	5	3	25	75	100	
	Core Course – VIII	Igneous and Metamorphic Petrology	U16GL5C8	5	4	3	25	75	100	
	Core Course – IX	Sedimentary Petrology	U16GL5C9	4	3	3	25	75	100	
	Core Course - X	Practical – III Rock Megascopy & Microscopy	-	3	-	-	-	-	-	
	Core Course - XI	Practical – IV Ores & Mineral Megascopy, Microscopy and Blowpipe Analysis	-	3	-	-	-	-	-	
	Elective Course - I	Remote Sensing & GIS	U16GL5E1	4	4	3	25	75	100	
	Skill Based Elective II	Economic Geology	U16GL5S2	2	4	3	25	75	100	
	Skill Based Elective III	Engineering and Environmental Geology	U16GL5S3	2	4	3	25	75	100	
	Soft Skills Development	Soft Skills Development	U16SSD3	2	2	3	25	75	100	
				30	26				700	
VI	Core Course – X	Practical – III Rock Megascopy & Microscopy	U16GL6C10P	3	4	3	25	75	100	
	Core Course – XI	Practical – IV Ores & Mineral Megascopy, Microscopy and Blowpipe Analysis	U16GL6C11P	3	5	3	25	75	100	
	Core Course – XII	Mining Geology and Geophysics	U16GL6C12	6	5	3	25	75	100	
	Core Course – XIII	Geochemistry and Gemmology	U16GL6C13	6	5	3	25	75	100	
	Elective Course - II	Hydrogeology	U16GL6E2	5	5	3	25	75	100	
	Elective Course - III	Fuel Geology	U16GL6E3	6	4	3	25	75	100	
	Extension Activities	Extension Activities		-	1	-	-	-	-	
	Gender Education	U16EA4	1	1	3	25	75	100		
				30	30				700	
TOTAL					180	140				3900

**CHAIRMAN**  
**BOARD OF STUDIES IN GEOLOGY**

**CONTROLLER OF EXAMINATIONS**

Sl. No.:

Subject Code: U16GL1C1

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR -  
B.Sc., - GEOLOGY – I SEMESTER – CORE COURSE - I**  
(For the candidates admitted from the year 2016-2017 onwards)

**UNDERSTANDING THE EARTH**

**Course outcomes**

- To be familiar with the origin of earth and earth's system science.
- Ability to understand the process and identification of age of the earth.
- Ability to understand the interior of the earth and earth's interaction components.
- Ability to understand the origin of continents and oceans.

- Unit 1 Earth system sciences:** Definition - Branches and scope of Geology. Solar system - Origin of the solar system – Nebular hypothesis – Planetesimal hypothesis – Tidal hypothesis – Von weiszacker's hypothesis and Dust Cloud hypothesis. Big Bang Theory. Members of the solar system, Terrestrial and Jovian Planets. Planets – Satellites – Asteroids – Meteorites – Comets. Kepler's law of planetary motion – Bode's law. **The age of the earth:** Element of radio activity – Radio minerals and their decay – Isotopes – Sedimentation method – Salinity method – Kelvin's rate of cooling method. *Radiometric methods:* Uranium-Lead, Thorium-Lead and Potassium- Argon methods. Note on C<sup>14</sup> method. *Relative dating methods:* Unconformable surfaces – changes in litho units – super imposed beds and their occurrences. *Indirect methods:* A brief account of Glacial and Lacustrine Varves – Dendrochronology – Oceans salinity. Earth's dimensions, size, shape, axis of rotation, revolution – Perigee and Apogee positions.
- Unit 2 Earth and Its Interior:** Layered structure of earth - Differentiation of Earth's Core, Mantle and Crust – Seismic boundaries and discontinuities – Shadow zones. **Earth As A System of Interacting Components** - Solid earth, Atmosphere, Hydrosphere, Biosphere. History of development of Geological thoughts – Neptunism, Plutonism, contribution of Werner, Hutton, Smith and Lyell. **Earthquakes:** Definition, causes, elastic rebound theory, focus and epicentre, intensity and magnitude. Effects of Earthquakes. Seismic waves, Seismograms, Travel-time curve for seismic waves. Locating epicentre and Determining magnitude. Earthquake belts. seismic zones of India. Prediction of Earthquakes and Remedial Measures. **Tsunami and Seiche Waves:** Definition - Kinds – Generation of waves – Remedial measures. A case study on impact of Tsunami along the Indian coast during 2004.
- Unit – 3 Origin of Continents and Oceans** – Distribution and Characteristics. Continental margins and Ocean basins: Continental shelf, Continental slope, Continental rise, Abyssal plain, Oceanic trenches, Oceanic ridges and Volcanic islands. Continental Drift: Definition – Mechanisms – Wegner and Taylor hypothesis. Seafloor spreading – Definition – Mechanism – Evidences. **Mass Movements** – Definition – classification – slow movements: Soil creep, Rock creep and Solifluction. Rapid movements: Earth flows, Rock falls and Landslides. Causes and remedial measures.
- Unit – 4 Atmosphere:** Definition – Composition and Structure – Geothermal gradient – Wind systems: Planetary winds – Trade winds, westerlies and polar easterlies; Monsoon winds and Local winds. **Mountains:** Origin and classification of mountains – Life cycle of mountains. **Plate Tectonics** – Concept of plate tectonics – Different kinds of crustal plates – Plate movements and their causes. Plate boundaries: Convergent, Divergent and Transform. Features related to Plate Tectonics: Island Arc systems – Mountain chains, Subduction zones – Rift and Ramp valleys. Ring of Fire. Volcanic and earthquake belts in relation to plate tectonics. Transform faults. **Isostasy:** Pratt's and Airy's hypothesis – Causes, effects and evidences of sea level changes. Gravity anomalies of Earth, Bouger and Free-air anomalies. Concept of isostasy and compensation. **Geosynclines:** Stille's, Kay's, Strahler's and Schuchert's Classifications of Geosynclines. Characters and distribution of Geosynclines.
- Unit – 5 Plateaus and Plains:** Definition - origin, types and characteristics. Deccan plateau – origin and mode of occurrence, aerial extent and economic importance. **Weathering:** Definition – mechanism – agents of weathering. Classification of weathering – Physical, Chemical and Biological. Factors affecting weathering – products of weathering. **Rivers:** Definition – origin – three stages of river – formation and geological importance of deltas and alluvial fans. Drainage patterns and its significance. **Seas and oceans:** Definition – outlines of geological process and landforms **Lakes:** Definition – classification and geological process.

**Text Books:**

1. Press, F., Siever, R., Grotzinger, J. and Jordan, T.H., 2004, Understanding Earth, 4th Edn., W.H. Freeman, 567 p. [A later 5th Edn., will also be useful]
2. Tarbuck, E.J. and Lutgens, F.K., 2006, Earth Science, 11th Edn., Pearson Prentice Hall, New Jersey, 726 p. [Earlier editions e.g. 10th or 9th, or even earlier, will also be useful].
3. Arthur Holmes Principles of physical Geology: Thomas Nelson & sons London.
4. Philip G. Worcester A textbook of geomorphology: D. Van Nostrand co., London.
5. Radhakrishnan. V. General Geology - V.V.P. Press.
6. Mahapatra, G.B. A text book of Geology, CBS, Delhi

**Reference Books:**

1. Duff, P.McL.D., editor, 1992, Holme's Principles of Physical Geology, ELBS – Chapman Hall, 791p. [Earlier editions will also be helpful]
2. Skinner, B.J., Porter, S.C. and Park, J., 2003, The Dynamic Earth: An Introduction to Physical Geology [With CDROM], John Wiley & Sons, 631 p. [Earlier editions will also be helpful]
3. Skinner, B.J., 2010, The Blue Planet: An Introduction to Earth System Science, John Wiley & Sons, 592 p.
4. William J. Miller Principles of physical Geology : Thomas Nelson & sons , London.
5. W. D. Thornbury A text book of geomorphology : D. Van Nostrand co., London.
6. A.L. Bloom General Geology V.V.P. Press.
7. L.D. Leet & Judson Physical Geology : Prentice Hall, India

Sl. No.

Subject Code:

U16GL2C2P

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR

**B.SC., - GEOLOGY– II SEMESTER - CORE COURSE – II**

(For the candidates admitted from the year 2016-17onwards)

**PRACTICAL - I STRUCTURAL GEOLOGY AND SURVEYING**

**Course outcomes**

- To be familiar with topographic maps to recognize different landforms, major Structures such as folds, faults, unconformities, fracture patterns, shear zones and intrusions.
  - Ability to Use the clinometer and brunton compass . Use of Global Positioning Systems (GPS) to know the mean sea level (MSL).
  - Ability to understand the Stereographic projection of planes and lines.
  - To be familiar with Chain Surveying, Open traverse and Closed traverse. Prismatic Compass Surveying and determination of the distance between two inaccessible stations.
1. Reading and interpretation of topographic maps to recognize different landforms, major structures such as folds, faults, unconformities, fracture patterns, shear zones and intrusions.
  2. Use of clinometer and brunton compass, measurement of altitude of planar and linear structural elements. Use of Global Positioning Systems (GPS) to know the mean sea level (MSL), latitude and longitude.
  3. Problems to interpret trend of outcrop of different beds and reading of solid maps – measuring the dip and strike of a outcrop. Graphical solution of true dip and apparent dip problems. Two- and three-point problems.
  4. Stereographic projection of planes and lines: solution of simple structural problems using a stereonet. E.g. True dip – apparent dip relations, determination of axis of cylindrical folds.
  5. Construction of block diagrams of homoclinal (unfolded) beds and folded beds. Describing the fold and fault maps. Construction of vertical sections. Determination of throw and heave of vertical faults.
  6. Reading of Unconformable Solid Maps – Construction of sections in the geological maps to describe the geological history of the area – Interpretation of the structures – Determining the order of superposition of beds. Determination of vertical and true thickness by simple calculations.
  7. Understanding the Topographic Sheets Describe of features in Survey of India (SOI)'s Toposheet: Extra-marginal, Marginal, Intra-marginal information. Major conventional signs and symbols. Physical and socio-cultural features.

**SURVEYING**

Chain Surveying: Open traverse and Closed traverse.

Prismatic Compass Surveying: Determination of the distance between two inaccessible stations.

Radiation method and Intersection method.

Plane Table Surveying: Determination of the distance between two inaccessible stations. Radiation method and Intersection method.

Levelling: Dumpy level – Rise and Fall method

**FIELD TRAINING PROGRAMME:**

In partial fulfilment of B.Sc. geology degree course students should undergo local field work to study the petrology, structural geology of the area in and around karur district, for a period of 7 days. The student should submit a field report on field training programme along with specimens collected from the field. Internal assessment marks for the practicals are Practical class attendance = 5marks; Practical test=10; Field training report=25 marks; Total = 40 marks.

**TEXT BOOKS :**

1. M.P.Billings : Structural Geology: Prentice Hall, Englewood Clifts, U.S.A,
2. C.M. Novin : Principles of structural Geology John Willey, New York.
3. De Sitter : Structural geology - McGraw Hill, New York
4. Gokhale, N.W. 1996 Theory of Structural Geology. CBS Publishers.
5. Davis, G.H. and Reynolds, S.J., 1996, Structural Geology of Rocks and Regions, 2nd Edn., John Wiley & Sons, New York, 776 p.
6. Van der Pluijm B.A. and Marshak, S., 2004, Earth Structure: An Introduction to Structural Geology and Tectonics, 2nd Edn., W.W. Norton & Co., New York, 656 p.

**REFERENCE BOOKS:**

1. V.V. Belousov - Structural Geology – Moscow
2. P.C. Bedgley - Structural and Tectonic, Principles: Harper & Row, New york.
3. E.W. Spencer - An Introduction to structural Geology: Mc Graw Hill, New York
4. Twiss, R.J. and Moores, E.M., 2007, Structural Geology, 2nd Edn., W.H. Freeman, New York ,736 p. [Earlier edition (1992) of the same book will be equally useful]
5. Ghosh, S.K., 1993, Structural Geology: fundamentals and modern developments, Pergamon, Oxford,

Sl. No:

Subject Code:

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05**  
**B.SC.,-I SEMESTER – ALLIED COURSE-I**  
**(FOR CHEMISTRY, MATHEMATICS & GEOLOGY MAJOR)**  
**(For the candidates admitted from the year 2016-17 onwards)**  
**ALLIED PHYSICS – I**

**Course Outcomes (CO)**

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

1. CO1 Analyze and comprehend regarding the strength of the solid materials of different size.
2. CO2 Understand specific heat capacity of gas and the different theories on specific heat capacity.
3. CO3 Distinguish between magnetic effect of electric current and electromagnetic induction and to apply the related laws in appropriate circumstances.
4. CO4 Sound waves deals about amplitude how loud it is and its pitch.

**UNIT- I: PROPERTIES OF MATTER**

Stress – strain - Hooks law - Elastic constants - Young’s modulus by non-uniform bending - Static torsion - Rigidity modulus by torsion pendulum - I form of girder - Surface Tension: Surface tension of the liquid by drop weight method - Explanation of molecular theory - Viscosity: Newton’s formula - Poiseuille’s formula - stream line motion - Turbulent motion - Critical velocity - Co-efficient of viscosity - Co-efficient of viscosity by Poiseuille’s method - Ostwald’s viscometer.

**UNIT-II: MECHANICS**

Force - centripetal and centrifugal forces - Laws of friction - co-efficient of friction - Banking of curved tracks - Newton’s law of gravitation – Kepler’s laws of Planetary motion - Deduction of Newton’s law of gravitation from Keplers law - Centre of gravity - Centre of gravity of solid cone - Floatation laws - Stability of floating bodies.

**UNIT-III: HEAT AND THERMODYNAMICS**

Celcius – Rankine-Fahrenheit Scale - Entropy and Enthalpy definition - Thermal conductivity of a bad conductor by Lees Disc method - Newton’s law of cooling - Specific heat capacity of liquids - Liquification of gases – Linde’s process - Isothermal and adiabatic process - zeroth, first, second laws of thermodynamics - solar constant - Angstrom pyroheliometer

**UNIT-IV: MAGNETISM AND ELECTROMAGNETISM**

Magnetic materials - Properties of dia, para, ferro and anti ferro magnetic materials - Permeability and susceptibility - Laws of electromagnetic Induction - Biot and Savarts law - Force acting on a conductor carrying current in magnetic field – Moving coil galvanometer - Eddy currents – applications.

**UNIT-V: SOUND**

Laws of stretched strings - determination of frequency of alternating current by Sonometer - characteristics of musical sound - Acoustics of buildings – Decibel - Reverberation time - Sabine’s formula for reverberation time - Condition for good acoustics - Ultrasonics: Piezo-electric effect - piezo-electric oscillator - Properties of ultrasonic waves and its applications.

**BOOKS FOR STUDY:**

*Unit-I*

1. Brijlal subramaniam, *Properties of matter and sound.*
2. R. Murugesan *Properties of matter and sound.*

*Unit-II*

1. R. Murugesan *Allied Physics I & II.*
2. A. Sundaravelusamy *Allied Physics.*

*Unit-III*

1. Heat and Thermodynamics - Brijlal subramaniam
2. Heat and Thermodynamics - Narayanamurthi and Nagarathinam

*Unit-IV*

1. Electricity and magnetism — R. Murugesan
2. Electricity and magnetism — Narayanamurthi and Nagarathinam
3. Electricity and magnetism - Brijlal subramaniam

*Unit-V*

1. Sound -- Brijlal subramaniam
2. Sound – R.L. Seihgal

Sl. No.:

Subject Code:

U16GL2C3

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR**

**B.Sc., - GEOLOGY - II SEMESTER- CORE COURSE - III**

(For the candidates admitted from the year 2016-17 onwards)

### **STRUCTURAL GEOLOGY**

#### **Course outcomes**

- Ability to understand different kinds of structures exhibited in rock surface formed by Various forces
- Ability to understand Primary and secondary planar and linear structural elements,
- Strike and dip, pitch and plunge.
- Ability to understand the classification of folds, faults and joints.
- Ability to understand the kinds of foliation and their geometrical relation to folds. Morphological features of cleavage and schistosity

#### **Unit – 1**

Introduction of structural geology: Definition – geometric, kinematic and dynamic analysis of structures. Penetrative and non-penetrative structural elements: Primary and secondary planar and linear structural elements, strike and dip, pitch and plunge. Representation of planes and lines in stereographic and equal area projection diagrams. Outcrops of planes on horizontal and uneven surfaces: Outlier and inlier. Scales of observation of structures. Scope of structural geology.

#### **Unit – 2**

Folds: Definition – parts of fold, antiform, synform, normal fold, anticline. Nomenclature of folds based on fold shape and orientation of axis and axial plane. Ramsay's classification of folds. Variation of thickness of folded layers, isogons. Relation between major and minor folds. Foliation: Definition – kinds of foliation and their geometrical relation to folds. Morphological features of cleavage and schistosity, Morphological classification of rock cleavage. Relation of cleavage and schistosity to major folds. Lineation: Definition – types of lineation and their geometrical relation to folds.

#### **Unit – 3**

Stress and strain: Concept of stress – normal stress - shear stress – principal axes of stress – plane of maximum shear stress. Displacement and strain longitudinal and shear strain – principal axes of strain, homogeneous and heterogeneous strain – rotational and irrotational strain. Pure shear and simple shear. Strain ellipse and strain ellipsoid. Brittle and ductile deformation. Creep of rocks - elastic, viscous and plastic behaviour.

#### **Unit – 4**

Deformation: basic concepts of superimposed deformation, interference patterns in superimposed folding, deformation of older planar and linear structures, geometry of new structures. Concept of buckle (flexure), flexure slip, bending and slip(shear) folds, geometrical characteristics of folds formed by buckling and heterogeneous simple shear. Fracturing of rocks: Tension and shear fractures. Joint – definition, mechanisms, joint and joint systems, relation of joints to folds.

#### **Unit -5**

Definition, mechanisms – Translational and rotational movements, slip and separation. Nomenclature of faults based on geometrical relation of faults to beds. Effects of faults on outcrop of strata. Horst and Graben, Autochthon, Allochthon, Nappe, Window and Kippe. Criteria for recognition of faults in the field. Fold and thrust belt, Imbricate structure, Fault related folding, Duplex structure. Shear zone – basic concepts, shear zone rocks, common structures in shear zones. Shear zones in Tamil nadu, geologic and economic importance of shear zones. Unconformity: definition, mechanism, types of unconformity, criteria for distinguishing unconformity from faults and intrusive contacts. Significance of unconformity in various geological studies, type

#### **TEXT BOOKS :**

- 1.M.P.Billings : Structural Geology: Prentice Hall, Englewood Cliffs, U.S.A,
2. C.M. Novin : Principles of structural Geology John Willey, New York.
3. De Sitter : Structural geology - McGraw Hill, New York
4. Gokhale, N.W. 1996 Theory of Structural Geology. CBS Publishers.
5. Davis, G.H. and Reynolds, S.J., 1996, Structural Geology of Rocks and Regions, 2nd Edn., John Wiley & Sons, New York, 776 p.
6. Van der Pluijm B.A. and Marshak, S., 2004, Earth Structure: An Introduction to Structural Geology and Tectonics, 2nd Edn., W.W. Norton & Co., New York.

#### **REFERENCE BOOKS:**

1. V.V. Belousov - Structural Geology – Moscow
2. P.C. Bedgley - Structural and Tectonic, Principles: Harper & Row, New York.
3. E.W. Spencer - An Introduction to structural Geology: Mc Graw Hill, New York
4. Twiss, R.J. and Moores, E.M., 2007, Structural Geology, 2nd Edn., W.H. Freeman, New York, 736 p. [Earlier edition (1992) of the same book will be equally useful]
5. Ghosh, S.K., 1993, Structural Geology: fundamentals and modern developments, Pergamon, Oxford

**CHAIRMAN – BOS**

**COE**

Sl. No:

Subject Code:

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05**  
**B.Sc., –II - SEMESTER – FIRST ALLIED COURSE – II**  
**(FOR CHEMISTRY & MATHEMATICS MAJOR)**  
**(For the candidates admitted from the year 2016-17 onwards)**

**ALLIED PHYSICS – II – LAB**  
**(Any fifteen experiments)**

**Course Outcomes (Co)**

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

1. CO1 Conduct experiments on stretching wires and to identify it's the strength.
  2. CO2 Analyze the effects of refractive index of a medium using optical instruments.
  3. CO3 Integrated chips are verified by using gate.
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1. Young's Modulus – Non Uniform Bending – Pin and Microscope.
  2. Torsional Pendulum – Rigidity Modulus.
  3. Surface tension and Interfacial Surface tension – Drop weight method.
  4. Coefficient of Viscosity of liquid using graduated burette.
  5. Specific heat capacity of liquid by cooling method.
  6. Lee's Disc – Thermal Conductivity of a bad conductor.
  7. Focal length of a concave lens.
  8. Spectrometer – Grating – Normal incidence method.
  9. Spectrometer – refractive index of solid prism ( $A, D$  and  $\mu$ ).
  10. Newton's Rings – Radius of curvature of a convex lens.
  11. Sonometer – Verification of transverse laws.
  12. Carey Foster's bridge – specific resistance.
  13. Meter bridge – Determination of specific resistance.
  14. Potentiometer – Low range voltmeter calibration.
  15. Potentiometer – Calibration of ammeter.
  16. Table galvanometer – Figure of merit.
  17. EMF of thermocouple – Direct deflection method.
  18. Characteristics of a junction diode.
  19. Construction of full wave rectifiers.
  20. AND, OR and NOT Logic gates - Verification of truth table using discrete Components.

**BOOKS FOR REFERENCE:**

1. M.N. Srinivasan and others, *A Text book of Practical Physics* - Sultan Chand & Son, New Delhi.
2. A. Dhanalakshmi and K.R. Paramasivam, *Practical Physics* - Apsara publication, Trichy.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05**  
**B.SC.,-II- SEMESTER – FIRST ALLIED COURSE-III**  
**(FOR CHEMISTRY & MATHEMATICS MAJOR)**  
**(For the candidates admitted from the year 2016-17 onwards)**

**ALLIED PHYSICS – III**

**Course Outcomes (Co)**

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

- CO1 Predict the curvature of a transparent medium.
- CO2 Understand the laser action phenomena, properties and applications of laser.
- CO3 To discuss the elementary particles.
- CO4 Have a basic knowledge of semiconductor diodes.
- CO5 Conversion between various number systems.

**UNIT- I: OPTICS**

Laws of Reflection and Refraction - Refractive index of prism using spectrometer - Interference - Newton's rings - Applications - Fresnel's explanation of rectilinear propagation of light - Fiber optics: Numerical aperture, acceptance angle - Fiber optics communication system - Temperature sensor.

**UNIT-II: LASER PHYSICS**

Einstein's co-efficients - Spontaneous and stimulated emission - Population inversion - Optical pumping - Condition for Laser action - Semiconductor laser - CO<sub>2</sub> laser - Nd-YAG laser - Applications of laser - Holography - Construction and Reconstruction.

**UNIT-III: ATOMIC & NUCLEAR PHYSICS**

Atomic physics: Photo electric effect - Einstein photoelectric equation - Coupling schemes - LS & JJ couplings - Zeeman effect - Experiment - Stark effect (definition only) - Nuclear Physics: Detection of nuclear radiation - Geiger Muller counter - Particle accelerators: Betatron - Elementary particles: Leptons, Mesons, and Baryons.

**UNIT IV: SEMICONDUCTORS AND OPTOELECTRONICS**

Volt - Ampere Characteristics of P-N junction Diode - Zener diode - Applications of Zener diodes - Zener voltage regulator - Optoelectronic devices: Photovoltaic cell - Photoconductive cell - Solar cell - Phototransistor - LED and LCD - Construction and working.

**UNIT-V: NUMBER SYSTEM AND DIGITAL ELECTRONICS**

Binary, Octal, Hexadecimal - Interconversion - AND, OR, NAND, NOR, XOR, XNOR gates - DeMorgan's theorem - Laws of Boolean algebra - Operation Amplifiers: Ideal characteristics - Inverting - Non inverting op-amp - CMRR - Adder - Subtractor.

**BOOKS FOR STUDY:**

*Unit-I*

1. R. Murugesan, *Modern Physics*.
2. R. Murugesan, *Optics and Spectroscopy*.

*Unit-II*

1. Gaur and Gupta, *Engineering physics*.
2. M. Arumugam, *Engineering physics*.
3. Thiagarajan, *Laser Physics*.

*Unit-III*

1. R.Murugesan, *Modern Physics*.

*Unit-IV*

1. V.K. Metha, *Principles of Electronics*.
2. B.L. Theraja, *Basic Electronics*.

*Unit-V*

1. Morris Mano, *Digital Logic and Computer Design*.
2. Malvino & Leech, *Digital principles and Applications*.

**Books for References:**

1. R.Murugesan, *Allied Physics I&II*.
2. Dr.R.Sabesan & Dr.Mrs. Dhanalakshmi *Allied Physics*.



**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - III SEMESTER – CORE COURSE - IV**  
 (For the candidates admitted from the year 2016-17 onwards)

**PHYSICAL GEOLOGY**

**Course outcomes**

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

- Ability to understand the continental drift, Sea floor spreading and the theory of plate tectonics - Types of plates - Causes and rate of plate movement
- Ability to understand the Difference between Weathering and Erosion – Mechanism of Weathering - Products of Weathering - economic significance of Weathering and Types of Weathering
- Ability to understand the Earthquakes - causes, elastic rebound theory, focus and epicentre, intensity and magnitude.
- Ability to understand the Geological Work of Ocean; Physical features of Oceans, Coasts, Deep Sea trench, mid oceanic Ridges.
- Ability to understand the Atmospheric circulation, weather and climate changes, Land-Air-Sea interaction, Earth's heat budget and global climatic changes.

**UNIT – I**

**Elementary Ideas of Continental Drift** - Sea floor spreading and the theory of plate tectonics - Types of plates - Causes and rate of plate movement, plate boundaries, present day configuration of plates - Application of theory of plate tectonics in Geology to explain origin of mineral deposits - Mountains - Earthquake belts - Island arcs and various Petro-genesis.

**UNIT – II**

**Rock Weathering** - Difference between Weathering and Erosion - Mechanism of Weathering - Products of Weathering - economic significance of Weathering - Types of Weathering, Soil formation - Soil profile and soil types - Geological works of River, Glacier, Wind, Ocean and Groundwater and resulting land forms.

**UNIT – III**

**Earthquakes:** Their causes - effects and distribution - Earthquake wave - Measurement of Earthquakes - Earthquakes - causes, elastic rebound theory, focus and epicentre, intensity and magnitude - Seismic waves, Seismogram - travel - time curves for seismic waves, seismic discontinuities, locating epicentre, and determining magnitude - Earthquake belts - Effects of Earthquakes, seismic zones of India - *Volcanoes:* Types, products and recent volcanism in India.

**UNIT – IV**

**Oceanography:** Geological Work of Ocean; Physical features of Oceans, Coasts, Deep Sea trench - Mid oceanic Ridges and Abyssal plain - Generations of Oceanic currents, surface currents and global ocean Conveyor system; wave erosion and beach processes; ocean as a thermostat for the earth's surface heat balance.

**UNIT – V**

**Climatology:** Atmospheric circulation, weather and climate changes, Land-Air- Sea interaction, Earth's heat budget and global climatic changes - Glacial - Interglacial periods and ice ages evidence & cause.

**Suggested Readings:**

**Text Books:**

1. **Philip G.Worcester:** A text book of Geomorphology – D. Nostrandcomp Inc. New York.
2. **Radhakrishnan. V, (1996)** General Geology, VVP, Tuticorin.
3. **Mahapatra, G.B.** A Text Book of Geology, CBS, Delhi.
4. **Chakranarayanan, A.B. et.al:** Concepts of Geology, Scientifica Publication.

**Reference Books:**

1. **Don Leet, & Sheldon Judson, (1960)** Physical Geology – Prentice Hall, Internation Inc. Englewood, Cliff, U.S.A.
2. **Arthur Holmes, (1992)** Principles physical Geology Thomos Nelson & sons, London.
3. **Miller, (1949)** An introduction to physical Geology, D. Van Nostrand Company, Inc New York.
4. **Dutta A.K.,** Physical Geology.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - IV SEMESTER – CORE COURSE - V**  
 (For the candidates admitted from the year 2016-17 onwards)  
**PRACTICAL - II PALAEOLOGY AND CRYSTALLOGRAPHY**

**Course outcomes**

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

- Ability to observe hard part morphology, identification and modes of preservation and elementary structure.
- Ability to identify hard part morphology and identification of gastropod.
- Ability to Measure of interfacial angle using Contact Goniometer, Stereographic Plotting using Symmetry elements of normal classes of the six crystals.

**UNIT – I**

Hard part morphology, identification and modes of preservation and elementary structure - function relations of Cephalopod: *Nautilus*, *Ceratites*, *Perisphinctes*, *Macrocephalites*, *Belemnites* and *Acanthoceras*. Hard part morphology and identification and inferences on modes of living of Bivalvia: *Unio*, *Ostrea*, *Pecten*, *Venus*, *Hippurites* and *Gryphaea*.

**UNIT – II**

**Hard part morphology and identification of Gastropod:** *Turritella*, *Cerithium*, *Nerita*, *Natica*, *Conus*, *Murex*, *Cypraea*, *Physa* and *Bellerophon*. Hard part Morphology, identification and modes of preservation of Gondwana flora: *Glossopteris*, *Gangamopteris*, *Vertebraria*, *Ptilophyllum*, *Schizoneura*, *Pterophyllum*, *Cladophlebis* and *Dadoxylon*. Hard part morphology and identification of Coelenterate – *Calceola*, *Zapherenits*, *Lithostratium* and *Favosites*.

**UNIT – III**

Measurements of interfacial angle using Contact Goniometer. Stereographic Plotting using symmetry elements of normal classes of the six crystal system Identification. Description of the following crystal models:- **Isometric system** - Galena, Garnet, Fluorite, Magnetite Pyrite, Tetrahedrite, Sphalerite, Cuprite, and Boracite. **Tetragonal system**- Zircon, Cassiterite, Rutile, Octahedrite, Apophyllite, Vesuvianite, Scheelite, Meonite and Chalcopyrite. **Hexagonal system** - Beryl, Zincite, Calcite, Hematite, Corundum, Dolomite, Tourmaline, Phenacite and Quartz.

**UNIT – IV**

Description of the following crystal models:- **Orthorhombic system** - Olivine, Topaz, Barite, Andalusite, Cordierite, Sulphur, Staurolite, Hypersthene, Calamine and Epsomite. **Monoclinic system** - Gypsum, Orthoclase, Augite, Amphibole, Hornblende, Epidote and Sphene. **Triclinic system** - Axinite, Albite, Anorthite, Kyanite, and Rhodinite.

**UNIT – V**

Study of twin crystal models of the following crystal system: Spinel, Iron Cross twin. Tetragonal: Rutile, Zircon and Cassiterite. Hexagonal: Brazil law – Calcite and Quartz. Orthorhombic: Cruciform, Aragonite – Staurolite. Monoclinic: Mica and Orthoclase. Carlsbad, Manebach and Baveno type, Gypsum, Triclinic: Albite - Simple twin.

**Field Training Programme: II Year of the Course.**

In partial fulfilment of the B. Sc Geology degree course, the students should be taken to areas with outcrops of fossil bearing rocks for a period of 10 days to collect and study modes of preservation of fossils. They should present the collected fossils and submit a report on the field training at the time of the main Practical Examination.

**Internal Assessment Marks for the practical are given below:**

**Attendance in Practical Classes:** 5 marks; **Practical tests:** 10 marks. **Full Attendance during field training, collection and submission of field report:** 25 marks. Total: 40 mark

**Suggested Readings Text****Books:**

1. Dana, E.S, (2006) A Text Book of Mineralogy, Wiley Eastern.
2. Berry Mason, L.G, (1985) Mineralogy, W.H. Freeman &Co.
3. Kerr B.F, (1995) Optical Mineralogy. McGraw Hill, 5<sup>th</sup> Edition, New York.

**Reference Books:**

1. Nield, E.W., and Tucker, V.C.T. (1985) Palaeontology: An Introduction, 1st Edn., Pergamon Press, 178 p.
2. Raup, D.M., and Stanley, S.M. (1985) Principles of Palaeontology, 1st Edn., CBS Publishers, 481 p.
3. Foote, M., and Miller, A.T. (2007) Principles of Palaeontology (3rd Edn. of Raup & Stanley), W.H. Freeman, 480 p.
4. Dasgupta, A. (2007) An Introduction to Palaeontology, 1st Edn., The World Press, Kolkata.
5. Moore, R.C., Lalicker, C.G., and Fischer, A.G. (1952) Invertebrate Fossils, McGraw Hill 766p.
6. Clarkson, E.N.K. (1998) Invertebrate Palaeontology and Evolution, 4th Edn., Blackwell, 468.

Sl. No.: Subject Code: **GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05**B.Sc., – I & III – SEMESTER - FIRST/SECOND ALLIED COURSE - I  
(FOR CHEMISTRY, PHYSICS AND GEOLOGY MAJOR)

(For the candidates admitted from 2016-2017 onwards)

**ALLIED MATHEMATICS-I - CALCULUS AND FOURIER SERIES****Course Outcomes**

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

- Understand the  $n^{\text{th}}$  derivative of second order differential equations by using Leibnitz theorem.
- Solve the problem by using the general properties of definite integrals.
- Acquire knowledge in solving the double and triple integrals on Cartesian Co-ordinates only.
- Understand the concept of Fourier series.

UNIT 1: Successive Differentiation –  $n^{\text{th}}$  derivative of standard functions (Derivation not needed) Simple problems only - Leibnitz theorem (proof not needed) and its applications. Curvature and radius of curvature in Cartesian Coordinates only (proof not needed) - Jacobians of two & three variables - Simple problem only.

UNIT 2: Integrating by parts – Bernoulli's formula - Evaluation of integrals of types

$$1. \int \frac{dx}{a+b \cos x} \quad 2. \int \frac{dx}{a+b \sin x} \quad 3. \int \frac{(a \cos x + b \sin x + c)}{(p \cos x + q \sin x + r)} dx$$

UNIT 3: General Properties of Definite integrals - Evaluation of Definite integrals of type

$$1. \int_a^b \sqrt{(x-a)(x-b)} dx \quad 2. \int_a^b \frac{dx}{\sqrt{(x-a)(x-b)}} \quad 3. \int_a^b \sqrt{\frac{(x-a)}{(x-b)}} dx$$

Reduction formula when n is a positive integer for 1.  $\int_a^b e^{ax} x^n dx$  2.  $\int_a^b \sin^n x dx$

$$3. \int_a^b \cos^n x dx \quad 4. \int_0^{\pi/2} \cos^n x dx \quad 5. \int_0^{\pi/2} \sin^n x dx \quad 6. \int_0^{\pi/2} \sin^m x \cos^n x dx$$

(proof not needed for 6 only).

UNIT 4: Evaluation of Double and Triple integral in simple cases – Changing the order and Evaluating the Double integration. (Cartesian Coordinates only)

UNIT 5: Definition of Fourier series - Finding Fourier Co-efficients for a given periodic function with period  $2\pi$  - Use of Odd and Even functions in evaluation of Fourier Co-efficients - Half range sine and cosine series.

**TEXT BOOKS:**

1. T. K. Manickavasagam Pillai, S. Narayanan, "Calculus Vol. I" S. Viswanathan Private Limited, 2011.
2. S. Arumugam, Issac and Somasundaram, "Trigonometry and Fourier series", New Gamma Publishers, Hosur, 1999.

CHAIRMAN - BOS

COE

Sl. No.:

Subject Code:

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 05.**

**B.Sc., - GEOLOGY - III SEMESTER – NON CORE ELECTIVE - I**

(For the candidates admitted from 2016-17 onwards)

### **BIO - STATISTICS-I**

#### **Course Outcomes:**

To imbibe statistical techniques applicable in biological sciences and to demonstrate the applications of statistical methods in real-life situations.

#### **Unit - I**

Bio-statistics and biometry - meaning - descriptive biostatistics - sample statistics history statistical terms - limitations of statistical methods - aims of biostatistics - applications of biostatistics - role of biostatistics - parametric and non-parametric.

#### **Unit -II**

Classification - Meaning of Classification - Objects of Classification - Rules of Classification - Types of Classification - Difference between classification and Tabulation - Parts of Tabulation - Structure of Tabulation - Rules of Tabulation - Types of Tabulation.

#### **Unit - III**

Diagrams and Graphs - Presentation of biometric data - graphic presentation of data - types of graphs - line -histogram- frequency polygon - kite diagram -stem and leaf displays - frequency curve or OGIVE - scatter or dot diagram -diagrammatic presentation of data - bar diagram - pie chart - pareto charts.

#### **Unit - IV**

Measures of central tendency - standard score or Z score - percentiles - Quartiles - Deciles - Measures of dispersion.

#### **Unit -V**

Correlation - Karl Pearson's Coefficient of Correlation - Spearman's Rank Correlation Coefficient. Regression - Linear Models - Properties - Problems.

(Note: All examples and problem to be related to Medical Statistical data only.)

#### **Text Book:**

1. VEER BALA RASTOGI, "FUNDAMENTALS OF BIOSTATISTICS", Anu Books Pvt. Ltd. New Delhi. 2009.

#### **Reference Books:**

1. S.PALANICHAMY, "BIO-STATISTICS", Palani Paramount Publishing Ltd. Palani.

Sl. No.:

Subject Code:

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**

**B.Sc., - GEOLOGY - IV SEMESTER – CORE COURSE - VI**

(For the candidates admitted from the year 2016-17 onwards)

**PALAEONTOLOGY AND CRYSTALLOGRAPHY**

**Course outcomes**

- Ability to understand the types of fossils and their taxonomy.
- Ability to understand the Rules and procedure for naming a new species.
- Ability to know about the Essential characteristics of crystalline and non–crystalline states of matter and 32 classes of symmetry.

**UNIT – I**

**Introduction:** Definition and types of fossils; Major disciplines in palaeontology; Brief introduction to Precambrian and Phanerozoic life forms. Fossilization: Definition, Conditions, modes and preservation of fossils, Taphonomy; imperfection of fossils record. Law of faunal succession.

**UNIT – II**

**Taxonomy:** Hierarchical nature of classification of Organism - species to kingdom; Identification and classification; species concept in Biology and binomial nomenclature; Rules and procedure for naming a new species; typomorphic and cladistic taxonomy. Index fossils – definition and their distribution in space and time.

**UNIT – III**

**Invertebrate palaeontology** - A brief study of morphology classification, evolutionary trends and distribution of bivalves, Cephalopod and Gastropod, Echinoids, Corals and Brachiopods. **Vertebrate Palaeontology** - Brief study of vertebrate life through ages. Evolution of reptiles and mammals; Siwalik vertebrate fauna; Biodiversity and mass extinction events; evidence of life in Precambrian times; Introduction to Micropaleontology; Types of microfossils; Plant fossils - Gondwana flora and their significance. Palynology: introduction and applications.

**UNIT – IV**

**Definition of Crystal** - Essential characteristics of crystalline and non–crystalline states of matter. Crystal measurements-interfacial angle, zone - law of constancy of interfacial angles - Principles of Stereographic projection - notation of crystal faces, edges and corners - crystallographic axes - Miller indices - Law of rational indices - general zonal relations of faces.

**UNIT – V**

**Crystal symmetry:** elements of symmetry -32 classes of symmetry - Hermann - Mauguin symmetry notation - Crystal forms - classification and nomenclature. Classification of crystals into systems and classes. Crystal habit - types of crystal aggregates, general twin laws - Space lattice - unit cell.

**Suggested Readings:**

**Text Books:**

1. **Woods, H. (1985)** ‘Invertebrate Palaeontology’ CBS Publishers and Distributions. New Delhi.
2. **Black, R.M. (1989)** Elements of Palaeontology, 2<sup>nd</sup> Edn., Cambridge University Press, 420 p.
3. **Doyle, P., Doyle, M. and Florence, M.L. (1996)** Understanding Fossils: An Introduction to Invertebrate Palaeontology, John Wiley & Sons, 426 p.
4. **Ray, A.K. (2008)** Fossils in Earth Sciences, 1st Edn., Prentice Hall, India, 444 p.

**Reference Books:**

1. **Nield, E.W., and Tucker, V.C.T. (1985)** Palaeontology: An Introduction, 1<sup>st</sup> Edn., Pergamon Press, 78 p.
  2. **Raup, D.M., and Stanley, S.M. (1985)** Principles of Palaeontology, 1<sup>st</sup> Edn., CBS Publishers.481 p.
  3. **Foote, M., and Miller, A.T. (2007)** Principles of Palaeontology (3<sup>rd</sup> Edn., of Raup & Stanley), W.H. Freeman, 480 p.
  4. **Dasgupta, A. (2007)** An Introduction to Palaeontology, 1<sup>st</sup> Edn., The World Press, Kolkata.
  5. **Moore, R.C., Lalicker, C.G., and Fischer, A.G. (1952)** Invertebrate Fossils, McGraw Hill 766 p.
- Clarkson, E.N.K. (1998)** Invertebrate Palaeontology and Evolution, 4th Edn., Blackwell, 468 p.

Sl. No.:

Subject Code:

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05**

**B.Sc., – II & IV – SEMESTER – FIRST / SECOND ALLIED COURSE - II**

**(FOR CHEMISTRY, PHYSICS AND GEOLOGY MAJOR)**

(For the candidates admitted from 2016-17 onwards)

**ALLIED MATHEMATICS –II**

**ALGEBRA, 3D AND TRIGNOMETRY**

**Course Outcomes:**

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

- Demonstrate algebraic facility with algebraic topics including linear, exponential, logarithmic and trigonometric functions.
- Ability to work solving the system of linear equations and compute the eigen values and eigen vectors.
- Ability to work some trigonometric expansions, hyperbolic and inverse hyperbolic functions.

UNIT 1: Binomial, Exponential and Logarithmic series (Formulae only) - Summation and approximation related problems.

UNIT 2: Symmetric, Skew symmetric, Orthogonal, Hermitian, Skew Hermitian and Unitary matrices - Characteristic equation, Eigen values, Eigen vectors - Cayley Hamilton's theorem(proof not needed)  
- Simple problems only.

UNIT 3: Equation of a Sphere -Tangent plane - Plane section of a sphere - Finding the center and radius of the circle of intersection (simple problems only).

UNIT 4: Expansion of  $\sin n\theta$ ,  $\cos n\theta$ ,  $\tan n\theta$  ( $n$  being a positive integer) - Expansion of  $\sin^n \theta$ ,  $\cos^n \theta$ ,  $\sin^n \theta \cos^n \theta$  in a series of sines and cosines of multiples of  $\theta$  ( $\theta$  - gives in radians) - Expansion of  $\sin \theta$ ,  $\cos \theta$  and  $\tan \theta$  in terms of powers (only problems in all the above)

UNIT 5: Euler's formula for  $e^{i\theta}$  - Definition of Hyperbolic functions – Formulae involving Hyperbolic functions - Relation between Hyperbolic and circular functions - Expansion of  $\sinh x$ ,  $\cosh x$ ,  $\tanh x$  in powers of  $x$  – Separation of real and imaginary part of  $\sin(x+iy)$ ,  $\cos(x+iy)$ ,  $\tan(x+iy)$ ,  $\sinh(x+iy)$ ,  $\cosh(x+iy)$ ,  $\tanh(x+iy)$ ,  $\sinh^{-1}(x+iy)$ ,  $\cosh^{-1}(x+iy)$ ,  $\tanh^{-1}(x+iy)$ .

**TEXT BOOKS:**

1. T. K. Manickavasagam Pillai, T. Natarajan, K. S. Ganapathy, "Algebra Vol. I" S. Viswanathan Private Limited, Chennai-2010.
2. S. Narayanan, T. K. Manickavasagam Pillai, "Trigonometry" S. Viswanathan Private Limited and Vijay Nicole Imprints Pvt. Ltd.2010.
3. T. K. Manickavasagam Pillai, "Analytical Geometry of 3D and Vector Calculus", New Gamma Publishing House, 2010.

**REFERENCE BOOKS:**

1. Arumugam & Isaac, "Analytical geometry of 3D and Integral calculus", New Gamma Publications, 2011.
2. Arumugam & Isaac, "Trigonometry and Fourier series", New Gamma Publications.

CHAIRMAN

COE

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05**

**B. Sc.,-II & IV SEMESTER – FIRST/SECOND ALLIED COURSE - III  
(FOR CHEMISTRY, PHYSICS AND GEOLOGY MAJOR)  
(For the candidates admitted from 2016-17 onwards)**

**ALLIED MATHEMATICS – III  
DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS  
AND VECTOR CALCULUS**

**Course Outcomes:**

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

- Solving the ODE of first order and higher degree by using various methods
- Forming the PDE by using different approach and also solving the PDE by various methods
- Solving the second order ODE with constant coefficient using Laplace transform
- Knowing the concept of vector differentiation and integration

UNIT 1: Ordinary Differential Equations of first Order but of Higher Degree – Equation solvable for x, solvable for y, solvable for  $dy/dx$ , Clairaut's form (Simple case Only) – Linear Equations with constant coefficients – Finding Particular Integral in the case of  $e^{kx} \sin(kx)$ ,  $\cos(kx)$  (Where k is constant),  $X^k$  Where k is a positive integer, and  $e^{kx} f(x)$  Where f(x) is any function of x (only problems in all the above – no proof needed for any formula)

UNIT 2: Formation of Partial Differential Equations by Eliminating arbitrary constants and by Elimination of arbitrary functions – Definition of general, particular and complete solutions – singular integrals (geometrical meaning not required) – Solution of First Order Equations in standard forms:  $f(p, q) = 0$ ,  $f(y, p, q) = 0$ ,  $f(z, p, q) = 0$ ,  $f_1(x, p) = f_2(y, q)$ ,  $z = xp + yq + f(p, q)$  – (only problems in all the above – Proof not needed for any formula)

UNIT 3: Laplace Transforms: Definition –  $L f(t)$ ,  $L(\cos at)$ ,  $L(\sin at)$ ,  $L(\sin t^n)$  Where n is a positive integer, Basic theorems in Laplace Transforms (Formula only) –  $[e^{at} f(t)]$ ,  $L[e^{at} \cos bt]$ ,  $L[e^{at} \sin bt]$  – Inverse Laplace Transforms related to the above standard forms solving second order ODE with constant co-efficient using Laplace transforms.

UNIT 4: Vector Differentiation – Velocity and Acceleration vectors- Gradient of the vectors – Directional derivatives – Unit normal Vector – Tangent plane – Divergence – Curl – Solenoidal and irrotational vectors – Double operators – Properties connecting grad., div and curl of a vector.

UNIT 5: Vector Integration – Line Integral – Conservative force field - Scalar potential field – Work done by a force – Surface integral – (Statement, Application and verification only) - Gauss Divergence theorem, Stoke's theorem, Green's theorem.

**TEXT BOOKS:**

1. S. Narayanan, "Differential Equation", S. Viswanathan Publishers, 1996.
2. S. Narayanan, T. K. Manickavasagam Pillai, "Calculus Vol. II", S. Viswanathan Pvt. Limited, 2003.
3. M. L. Khanna, "Differential Calculus", Jaiprakashnath and Co., Meerut -2004.

**REFERENCE BOOK:**

1. Kandasamy, Thilagavathy, Gunavathy, "Allied Mathematics Vol. II", S. Chand & Company Limited, New Delhi 2010.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - IV SEMESTER – SKILL BASED ELECTIVE – I**  
 (For the candidates admitted from the year 2016-17 onwards)

**DESCRIPTIVE AND OPTICAL MINERALOGY**

**Course outcomes**

- Ability to understand the Physical properties of Important Silicate and economic Minerals
- Ability to understand the Petrological microscope and its construction; principles of optics as applied to Orthoscopic and Conoscopic study of minerals
- Ability to understand the Optical behaviour of crystals, Propagation of light. Ordinary Light, Polarized light, Refraction & Reflection

**UNIT – I**

Physical properties of minerals. Physical properties of Important Silicate and economic minerals. Concept of Isomorphism, Polymorphism, Solid solution, Exsolution. Elementary idea about structure and classification of silicate minerals. Physical properties of the following minerals. Tourmaline, Talc, Gypsum, Fluorite, Calcite, Apatite, Barite, Asbestos, Corundum. Phosphorites, Beryl, Kyanite, Galena, Sphalerite, Chalcopyrite, Pyrite, Magnetite, Hematite, Chromite, Pyrolusite and Psilomelane, Bauxite, Coal and Lignite.

**UNIT – II**

Petrological microscope and its construction; principles of optics as applied to Orthoscopic and Conoscopic study of minerals: Colour, Form, Birefringence, Pleochroism, Uniaxial and Biaxial characters of minerals. Study of optical properties of Muscovite, Biotite, Quartz, Orthoclase, Microcline, Plagioclase, Olivine, Augite and Hornblende.

**UNIT – III**

Mineralogical study of the following families. (i) Olivine (ii) Pyroxene (iii) Amphiboles, (iv) Quartz (v) Feldspar (vi) Mica (vii) Garnet

**UNIT – IV**

Optical behaviour of crystals Propagation of light. Ordinary light ; Polarized light, Refraction & Reflection - Refractive index - Brewster's law , Nichol prism, Double refraction, Polarization of light, methods of production of plane polarized light, construction of polarizing microscopes; Ray velocity surface, Optical indicatrix of Uniaxial and Biaxial crystal

**UNIT – V**

Absorption colour and Pleochroism. Interference phenomenon in crystals, order of interference colour, birefringence, extinction. Determination of Refractive Index by (a) comparative method using Becke line, and by (b) liquid immersion method of isotropic minerals. Optical classification of minerals. Isotropic – Anisotropic minerals.

**Suggested Readings:**

**Text Books:**

1. Dana, E.S. (2006) A Text Book of Mineralogy, Wiley Eastern.
2. Nesse, W.D. (2003) Introduction to Optical Mineralogy, 3<sup>rd</sup> Edn., Oxford University Press. [Older edition of this book will also be useful].
3. Klein, C. (2002) The Manual of Mineral Science, 22<sup>nd</sup> Edn., John Wiley & Sons, 641 p. [Earlier editions of this book with Hurlbut and Klein as authors will be also useful]
4. Kerr, B.F. (1995) Optical Mineralogy. McGraw Hill, 5<sup>th</sup> Edition, New York.
5. Berry Mason, L.G. (1985) Mineralogy, W.H. Freeman & Co.

**Reference Books:**

1. Deer, W.A., Howie, R.A., & Zussman. (2013) An Introduction to Rock forming Minerals, Third Edition, ELBS Ed.
2. Ernest, E. Walhstrom. (1979) Optical Crystallography, John Wiley & Sons..
3. Perkins. (2010) Dexter Mineralogy (3<sup>rd</sup> Edition) Prentice Hall,.
4. Ravell Phillips, W.M., and Dana, T. Griffen. (2004) Optical Mineralogy, CBS publishers & Distributors, The Non-Opaque Minerals.
5. Mike Howard., and Darcy Howard. (1998) Introduction to Crystallography and Mineral Crystal Systems, Rock hounding Arkansas.
6. Nesse, W.D. (2000) Introduction to Mineralogy, Oxford University Press, New York, 442p.



Sl. No.:

Subject Code:

U16ST4N2P

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR - 05.**

**B.Sc., - GEOLOGY - IV SEMESTER NON CORE ELECTIVE - II**

(For the candidates admitted from 2016-17 onwards)

**BIO - STATISTICS- II  
(LAB ORIENTED - PRACTICAL)**

**Course Outcomes:**

To compute various statistical measures using Excel packages.

**Unit - I**

Diagrams and Graphs.

**Unit - II**

Measures of Central Tendencies - Mean - Median - Mode - Quartiles - Geometric Mean - Harmonic Mean.

**Unit - III**

Measures of Dispersion - Coefficient of Range - Quartile Deviation - Mean Deviation - Standard Deviation - Coefficient of variation.

**Unit - IV**

Correlation - Karl Pearson's Coefficient of Correlation - Spearman's Rank Correlation Coefficient.

**Unit - V**

Regression - Linear Models - X on Y and Y on X.

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**COE**

Sl. No.:

Subject Code:

U16GL5C7

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - V SEMESTER – CORE COURSE - VII**  
(For the candidates admitted from the year 2016-17 onwards)

**STRATIGRAPHY**

**Course outcomes**

- Ability to understand the Principles of Stratigraphy, Concept of Lithofacies and Biofacies and Chronostratigraphic Correlation.
- To be familiar with the Precambrian Stratigraphy of India, Achaean Stratigraphy – Tectonic framework, geological history and evolution of Dharwar and Eastern Ghats mobile belt.
- To be familiar with the Mesozoic Gondwana formations of Tamilnadu - Triassic of Spiti - Jurassic of Kutch and cretaceous formation of Tiruchirappalli.
- Cenozoic formations of India, Rise of the Himalayas and evolution of Siwalik fauna & flora of Siwalik -Tertiary rocks of Assam basin.

**UNIT – I** Principles of Stratigraphy: History and Development of Stratigraphy; Stratigraphic procedures (Surface and Subsurface); Concept of Litho facies and Bio facies; Stratigraphic Correlation - Litho, Bio- and Chronostratigraphic Correlation.

**UNIT – II** Study of standard stratigraphic code (Lithostratigraphic, Biostratigraphic and Chronostratigraphic); Concepts of Magneto stratigraphy, Chemo stratigraphy, Event stratigraphy, and Sequence stratigraphy; Nomenclature and the modern stratigraphic code. Radioisotopes and measuring geological time. Geological time-scale. Stratigraphic procedures of correlation of unfossiliferous rocks. Precambrian stratigraphy of India: Achaean stratigraphy - tectonic frame-work, geological history and evolution of Dharwar, and their equivalents; Eastern Ghats mobile belt;

**UNIT – III** Proterozoic stratigraphy - tectonic framework, geological history and evolution of Cuddapahs and their equivalents. Palaeozoic stratigraphy: Palaeozoic formations of India with special reference to type localities, history of sedimentation, fossil content of Salt range – Age of Saline series, Zanskar formation –Palaeozoic rocks of Spiti valley – (Peninsular India)

**UNIT – IV** Mesozoic stratigraphy ; Mesozoic Gondwana formations of Tamilnadu - Triassic of Spiti - Jurassic of Kutch - cretaceous formation of Tiruchirappalli - Bagh beds - Lameta beds. Deccan trap - age - structure – distribution - Infratrappean - Intratrappean beds.

**UNIT – V** Cenozoic stratigraphy: Cenozoic formations of India, Rise of the Himalayas and evolution of Siwalik fauna & flora of Siwalik -Tertiary rocks of Assam basin  
Stratigraphic boundaries: Stratigraphic boundary problems in Indian geology. Gondwana Super group and Gondwanaland. Deccan volcanic. Quaternary stratigraphy- Rock record, Paleoclimates and Palaeo - geography.

**Suggested Readings:**

**Text Books:**

1. **Krishnan, M.S. (2006)** Geology of India and Burma, 6<sup>th</sup> Edition, CBS.
2. **Wadia, D.N. (1953)** Geology of India, TATA McGraw – Hill.
3. **Ravindrakumar, K.R.** Stratigraphy of India.
4. **Lemon, R.Y. (1990)** Principles of Stratigraphy, Merrill Publishing Co.
5. **Kumar, R. (1988)** Fundamentals of Historical Geology and Stratigraphy of India, Wiley, New Delhi.
6. **Weller, J.M. (1960)** Stratigraphic Principles and practice, University Book stall, New Delhi.
7. **Mehdiratta, R.C. (1974)** Geology of India , Pakistan, and Burma, Atma ram & sons, Delhi.

**Reference Books:**

1. **Pascoe, E.H. (1968)** A manual of the Geology India and Burma, Govt .of India Publications.
2. **Gregory, J.W. and Barret B.H.** General stratigraphy mathuen.
3. **Ramakrishnan, M. and Vaidyanathan, R. (2008)** Geology of India, Vol. 1, Geological Society of India, Bangalore.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - V SEMESTER – CORE COURSE - VIII**  
 (For the candidates admitted from the year 2016-17 onwards)

**IGNEOUS AND METAMORPHIC PETROLOGY**

**Course outcomes**

- To be familiar with Physical properties of magma and factors influencing physical properties of magma
- Ability to understand the important mineralogical and textural features of the following rocks With Indian examples: Alkali Feldspar Granite, Alkali Granite etc
- Ability to understand the importance of crystallization of melts with particular reference to phase rule.
- To be familiar with limits of metamorphism, types of changes in metamorphism in Mineralogical, textural and chemical aspects. Awareness about Classification of metamorphic rocks

**UNIT – I**

Physical properties of magma - factors influencing physical properties of magma; ascent and emplacement of magma. Forms of igneous rock bodies: description of the major forms of Extrusive and Intrusive and a general idea of their mode of emplacement - Central Eruptions, Fissure Eruptions, Pyroclastic Deposit, Volcanic Neck, Sill, Dyke, Ring dyke, Cone, Sheet, Laccolith, Lopolith, Phacolith, Stock, Batholith. Description and origin of the following structures of igneous rocks: Vesicular Structure, Amygdaloidal Structure, Pillow Structure, Flow Banding, Flow Lines, Schlieren, Ropy Lava, Block Lava and Columnar Joint.

**UNIT – II**

Important mineralogical and textural features of the following rocks with Indian examples: Alkali Feldspar Granite, Alkali Granite, Granite, Granodiorite, Tonalite, Trondhjemite, Pegmatite, Aplite; Rhyolite; Syenite; Foid Syenite, Diorite; Trachyte, Phonolite, Andesite; Dolerite, Gabbro, Norite, Anorthosite; Basalt, Spilite, Oceanite, Ankaramite; Pyroxenite, Peridotite, Kimberlite; Lamprophyre, Carbonatite, Pyroclastic rocks including Agglomerate, Volcanic breccia, Ignimbrite, Welded tuff, Tuff, and Ash.

**UNIT – III**

Studies on crystallization of melts (at 1 atm dry pressure and high pH<sub>2</sub>O) in the following systems with particular reference to phase rule: Diopside-Anorthite, Forsterite-Silica, Albite-Anorthite, Albite-Orthoclase, Diopside-Albite-Anorthite; Diopside-Forsterite-Silica, Nepheline-Kalsilite-Silica; Petro genetic significance of these systems; Role of volatiles in magmatic crystallization; Bowen's reaction series and its use in petro genesis. Concept of petrographic consanguinity, and petrographic province. Processes of diversification of igneous rocks: differentiation, assimilation, and partial melting; Petro genesis of the following rocks: Granite, Basalt, Anorthosite, Alkaline rocks.

**UNIT – IV**

P-T limits of metamorphism, types of changes in metamorphism - mineralogical, textural and chemical. Agents of metamorphism – temperature, pressure and fluid. Source of heat, heat transfer (conduction, convection and advection), geothermal gradient, steady-state and transient geotherm. Load pressure and fluid pressure. Fluids in metamorphism: evidence and role.

**UNIT – V**

Types of metamorphism on the basis of agents, association, plate tectonic settings and classification of metamorphic rocks. Composition of Protolith and its control on metamorphism. Metamorphic crystallization and growth of Porphyroblasts in relation to deformation. Classification of metamorphic rocks: Basis of classification: Non -foliated and foliated, High strain rocks; Mineralogy and texture of Phyllite, Schist, Green Schist, Greenstone, White Schist, Blue Schist, Amphibolite, Hornfels, Granulite, Eclogite.

**Suggested Readings:**

**Text Books:**

1. **Bose, M.K., (1997)** Igneous Petrology, The World Press, Kolkata, 568 p.
2. **Winter, J.D. (2009)** Principles of Igneous and Metamorphic Petrology, 2<sup>nd</sup> Edn., Prentice Hall, 702 p. [The first edition (2001) named An Introduction to Igneous and Metamorphic Petrology, is also useful].
3. **Turner, F.J., and Verhoogen, J. (2002)** Igneous and Metamorphic Petrology – CBS publishers.

**Reference Books:**

1. **Phillpotts, A.R. and Ague, J.J., 2009**, Principles of Igneous and Metamorphic Petrology, Cambridge University Press, Cambridge, 667 p. [The older edition from Prentice Hall, 1990, is also useful].
2. **Best, M.G. (2002)** Igneous and Metamorphic Petrology, 2nd Edn., Blackwell, Oxford, 752 p.
3. **Wilson, M. (1989)** Igneous Petrogenesis: a global tectonic approach, Springer (2007), 466 p.
4. **Yardley, B.W.D. (1989)** An Introduction to Metamorphic Petrology, Longmans, 248 p.
5. **Bucher, K., and Frey, M. (2002)** Petrogenesis of Metamorphic Rocks, Springer, 34.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05****B.Sc., - GEOLOGY - V SEMESTER – CORE COURSE - IX**

(For the candidates admitted from the year 2016-17 onwards)

**SEDIMENTARY PETROLOGY****Course outcomes**

- Gaining knowledge on processes of sediment generation to formation of sedimentary Rocks, Weathering, Erosion, Transportation, Deposition and Diagenesis.
- Ability to understand the classification of sedimentary rocks: based on composition – Siliciclastic, Limestone, Chert etc., and based on source.
- Ability to understand the basic concept of facies association and modeling and Principles of stratigraphic correlation. Knowledge on the Primary sedimentary structure

**UNIT – I**

Scope of Sedimentology. Sediment genesis to diagenesis: processes of sediment generation to formation of sedimentary rocks; Weathering, Erosion, Transportation, Deposition And Diagenesis. Texture: Primary and Secondary; Textural components: Framework, Matrix, Cement, Allochemical and Orthochemical components; Textural parameters: Grain Size, Shape and their statistics; Surface texture; Fabric: Orientation, Packing; Porosity and Permeability.

**UNIT – II**

Classification of sedimentary rocks: based on composition - Siliciclastic, Limestone, Chert etc., based on source - Terrigenous-Extrabasinal, Chemogenic- Intrabasinal, based on grain size – Conglomerate-Rudaceous, Sandstone- Araceous, Shale-Argillaceous, Calcareous Sandstone, Micrite, based on mode of deposition - Clastic-Terrigenous-Allochemical, Non-Clastic-Orthochemical; Naming of rocks according to Terrigenous-Allochemical- Orthochemical proportions.

**UNIT – III**

Primary sedimentary structure: Fluidal Flow, Bed Forms - Current, Wave, and Combined Flow and their internal structures; structures generated by mass flow; Soft-sediment deformation structures; Biogenic structures including elementary concepts of stromatolite.

**UNIT – IV**

Conglomerate and Breccia: Composition, Fabric and Structure, Classification, Mode of Deposition; Intraformational and extra formational conglomerates and their significance. Sandstone, Limestone, Dolostone: definition, composition, classification, petro genesis; Sandstone classification - Pettijohn, Folk; Limestone classification - Dunham, Folk.

**UNIT – V**

Brief descriptions of Shale, Chert, Evaporate, BIF, and Volcanoclastic; elementary ideas on composition and depositional conditions. Facies concept: Definition of facies; Basic concept of facies association and modelling. Principles of stratigraphic correlation.

**Suggested Readings:****Text Books:**

1. **Pettijohn, F.J. (1975)** Sedimentary Rocks, 3<sup>rd</sup> Edn., Harper and Row, New York, 628 p.
2. **Tucker, M.E. (2001)** Sedimentary Petrology – an introduction to the origin of sedimentary rocks, Blackwell, Oxford, 262 p.
3. **Folk, R.L. (1974)** Petrology of Sedimentary Rocks, Hemphill Publishing Company, Austin, 159 p.
4. **Collison, J.D., and Thompson, D.B. (1989)** Sedimentary Structures, Allen & Unwin, London, 194 p.

**Reference Books:**

1. **Boggs, S.Jr., 2005**, Principles of Sedimentology and Stratigraphy, 4<sup>th</sup> Edn., Prentice Hall, New Jersey, 688 p.
2. **Sengupta, S., 2007**, Introduction to Sedimentology, 2<sup>nd</sup> Edn, CBS, 325 p.
3. **Reineck, H.E. and Singh, I.B., 1980**, Depositional Sedimentary Environments, 2<sup>nd</sup> Edn., Springer- Verlag, Berlin, 551 p.
4. **Blatt, H., Middleton, G., and Murray, R., 1972**, Origin of Sedimentary Rocks, 2<sup>nd</sup> Edn., Prentice- Hall, New Jersey, 782 p.
5. **Leeder, M.R., 1985**, Sedimentology: Processes and Products, 2<sup>nd</sup> Edn., Allen & Unwin, London, 344 p.

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**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - V SEMESTER – ELECTIVE COURSE - I**  
(For the candidates admitted from the year 2016-17 onwards)

**REMOTE SENSING & GIS**

**Course outcomes**

- Ability to understand the principle and the techniques involved in remote sensing and GIS.
- Ability to understand the Types and acquisition of aerial photograph and Principles of Stereoscopy.
- Ability to understand the Indian Remote Sensing Satellite mission and Basic idea of Radar Images. Recent ISRO launched space vehicles and their applications.
- Ability to understand Remote sensing applications in interpreting the structure and tectonics, Lithological mapping, mineral resources, natural hazards mitigation, groundwater potentials and environmental monitoring
- Ability to understand the Principles and components of Geographic Information System (GIS)

**UNIT – I**

Definition of Remote sensing - Electromagnetic radiation – characteristics, remote sensing regions and bands; General orbital and Sensor characteristics of remote sensing satellites; Spectra of common natural objects – Soil, Rock, Water and Vegetation.

**UNIT – II**

Types and acquisition of aerial photograph. Scale and resolution. Black and white, colour and infrared film. Photo mosaics. Orthophotographs. Principles of stereoscopy, Lens and Mirror Stereoscopes, Image Parallax, Relief, Displacement, Vertical Exaggeration, Distortion. Elements of air photo interpretation. Identification of Sedimentary, Igneous and Metamorphic rocks. Aeolian, Glacial, Fluvial and Marine Landforms.

**UNIT – III**

Physical principles of remote sensing. Early history of space imaging. Earth Resources Satellites characteristics and applications of imageries of LANDSAT1 to 7, SPOT missions, Indian Remote Sensing Satellite mission. Basic idea of Radar Images. Recent ISRO launched space vehicles and their applications.

**UNIT – IV**

Remote sensing applications in interpreting the structure and tectonics, Lithological mapping, mineral resources, natural hazards mitigation, groundwater potentials and environmental monitoring. Land sat, Skylab, Sea sat and other foreign systems of satellites and their interpretation for geological and other studies. Bhaskara and IRS systems and their applications, Thermal IR remote sensing and it's applications, Microwave remote sensing and its applications.

**UNIT – V**

**Geographic Information System:** Principles and components of Geographic Information System (GIS): Definition – history – Spatial and attribute data Important GIS software and their producers – GIS operations – Basic of spatial data input, attribute data management, data display, data exploration, data analysis and GIS modelling operations – Advantages and applications of GIS - Global positioning system.

**Text Books:**

1. **Anji Reddy, M. (2012)** Textbook of Remote Sensing & GIS, BS Publications, Hyderabad.
2. **Curran, P. (1985)** Principles of Remote Sensing, Longman, London.
3. **Sabins, F. F. Jr. (2007)** Remote Sensing Principles and Interpretation, Freeman, Sanfrancisco.
4. **Miller, V.C. ( 1961)** Photogeology, Mc Graw Hill, New York.

**Reference Books:**

1. **John, T. Smith, Jr. (1973)** Manual of Colour Aerial Photography (I Edition) American Society of Photogrammetry, ASP Falls Church, Virginia.
2. **Lillesand, T.M. and Kiefer, P.W. (2007)** Remote Sensing and Image Interpretation, John Wiley & Sons, New York. Third Edition.
3. **Rampal, (1999)** Handbook of Aerial Photography and Interpretation, Concept publishing.
4. **Shiv N. Pandey, (1987)** Principles and Applications of Photo geology, Wiley Eastern Limited, India.
5. **Gupta, R.P. (2003)** Remote Sensing Geology, Springer - Verlag - New York, London.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - V SEMESTER – SKILL BASED ELECTIVE – II**  
 (For the candidates admitted from the year 2016-17 onwards)

**ECONOMIC GEOLOGY**

**Course outcomes**

- Ability to understand Epigenetic and Syngenetic Mineral Deposits, mineral beneficiation, Common Morphologies of Mineral Deposits and their litho-tectonic environments
- Ability to understand the Magmatic Crystallization - Differentiation and magma immiscibility - precipitation from hydrothermal solutions
- Ability to understand classification and origin of different varieties of Coal and their distribution in India - Special reference to Neyveli Lignite on Geology and occurrences

**UNIT – I**

**Economic Geology and its principal contents;** Definitions of the Terms: Protore, Ore, Gangue, Tenor, Hypogene and Supergene ore deposits - Epigenetic and Syngenetic Mineral Deposits; mineral beneficiation; Common Morphologies of Mineral Deposits - Mineral deposits their litho-tectonic environments, e.g., in continental rifts and continental margins - Greenstone belts and Ophiolites - in convergent plate boundaries in shallow shelves - accompanied by mafic volcanism.

**UNIT – II**

**Ore forming processes:** Magmatic Crystallization - Differentiation and magma immiscibility - precipitation from hydrothermal solutions - Sedimentation - Diagenesis- Ore forming processes on metamorphism and supergene transformation of protore; placer deposits their distribution and origin.

**UNIT – III**

**Mineral deposits in space and time:** Metallic mineral deposits of India - such as, Iron of Tamilnadu Jharkhand-Orissa and Karnataka - Manganese of Central India - Chromite of Orissa - Copper of Singhbhum and Malanjkand - Lead-Zinc of ZAWAR - Uranium of Singhbhum and Andhra Pradesh - Gold of Kolar-Hutti - Tungsten of Rajasthan - with particular reference to their geologic set up - modes of occurrence, mineralogy, age and genesis – Mineral Richness & Tamilnadu.

**UNIT – IV**

**Non-metallic mineral deposits of India** such as Bauxite, Mica, Phosphates, Barite, Diamond and Graphite, with special reference to their distribution, geology, origin and usage - Specification of the raw (mineral/rock) materials used in the following industries: iron and steel - cement refractory's - fertilizer.

**UNIT – V**

**Coal:** its chemical, petrographic constituents - classification and origin of different varieties of Coal and their distribution in India - Special reference to Neyveli Lignite on Geology and occurrences - Study of petroleum and natural gas deposits with special reference to their origin, migration, accumulation, and distribution in India both on-and off-shore.

**Text Books:**

1. **Evans, A.M. (1997)** An Introduction to Economic Geology and its Environmental Impact, Wiley-Blackwell, 364 p.
2. **Chandra, D. (1990)** The Story of Petroleum, Dev Sahitya Kutir (P) Ltd., Calcutta, 39 p.
3. **Chandra, D., Singh, R.M. and Singh, M.P. (2000)** Text Book of Coal: Indian Context, Tara Book Agency, Varanasi, 402 p.
4. **Banerjee, D.K. (1992)** Mineral Resources of India, The World Press, Calcutta, 440 p.
5. **Bateman Allan, M. (1962)** Economic Mineral Deposits, Asian Publishing House, 2nd Edition.
6. **Lindgren, W. (1933)** Mineral Deposits, McGraw Hill.

**Reference Books:**

1. **Robb, L.J. (2005)** Introduction to Ore Forming Processes, Wiley-Blackwell, 373 p.
2. **Stanton, R.L. (1972)** Ore Petrology, McGraw-Hill, 713.
3. **Krishnaswamy, S.** - India's Mineral Resources, oxford and IBH.
4. **Deb, S. (1980)** Industrial Minerals and Rocis of India, Allied, 1980.
5. **Gokhale, K.V.G.K. and Rao, T.C. (1978)** Ore deposits of India, their distribution and processing, Thomson press.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - V SEMESTER – SKILL BASED ELECTIVE – III**  
 (For the candidates admitted from the year 2016-17 onwards)

**ENGINEERING AND ENVIRONMENTAL GEOLOGY**

**Course outcomes**

- Ability to know Geological studies and evaluation in planning, design and construction Of major civil structures. Elementary concepts of rock mechanics and soil mechanics
- Ability to know Problems of groundwater in engineering projects. Environmental Considerations related to civil engineering projects
- Ability to know Concept and definition of Environmental Geology. Processes of soil formation, types of soils, soil degradation and changing land use pattern.
- Ability to know Mobility of elements. Impact assessment of water availability, quality and contamination of surface water and groundwater.
- Ability to know the Distribution, magnitude and intensity of earthquakes. Neotectonics and seismic hazard assessment. Preparation of seismic hazard maps

**UNIT – I**

Geological studies and evaluation in planning, design and construction of major civil structures. Elementary concepts of rock mechanics and soil mechanics. Site investigation, characterization and problems related to civil engineering projects: geological and geotechnical investigations for dams, reservoirs and Spillways, Tunnels, Underground Caverns, Bridges, Highways and Shorelines.

**UNIT – II**

Problems of groundwater in engineering projects. Environmental considerations related to civil engineering projects. Resource evaluation of construction materials. Geological hazards and their remedial measures.

**UNIT – III**

Concept and definition of Environmental Geology. Processes of soil formation, types of soils, soil degradation and changing land use pattern. Concepts of natural ecosystems on the Earth and their mutual inter-relations and interactions with atmosphere, hydrosphere, lithosphere and biosphere. Environmental changes due to influence of human-dominated environment over nature- dominated system.

**UNIT – IV**

Concept of biodiversity. Mobility of elements. Impact assessment of water availability, quality and contamination of surface water and groundwater. Atmosphere and air pollution. Soil contamination due to urbanization, industrialization and mining. Basic concepts of environmental laws.

**UNIT – V**

Distribution, magnitude and intensity of earthquakes. Neotectonics and seismic hazard assessment. Preparation of seismic hazard maps. Impact of seismic hazards on long and short term environmental conditions. Mechanism of landslides causes of major floods, cyclones and storms. Deforestation and land degradation.

**Suggested Readings:**

**Text Books:**

1. Agrawal, K.M., Sikdar, P.K., and Deb, S.C. (2002) A text book of environment, 1<sup>st</sup> Edn., Macmillan India, 464 p.
2. Karanth, K.R. (1987) Groundwater assessment, development and management, Tata McGraw Hill, 448 p.
3. Singh, P. (1999) Engineering and General Geology, S.K. Kataria & Sons, New Delhi 110 006.

**Reference Books:**

1. Aswathanarayana, U. (1995) Geoenvironment - An introduction, Capital Books, 270 p.
2. Valdiya, K.S. (2004) Geology, Environment and Society, Universities Press.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - VI SEMESTER – CORE COURSE - X**  
 (For the candidates admitted from the year 2016-17 onwards)  
**PRACTICAL - III**  
**ROCK MEGASCOPY & MICROSCOPY**

**Course outcomes**

- Identifying the physical properties of minerals in rock hand specimens
- Identifying the optical properties of minerals in rock specimens under microscope
- Identifying the physical properties of rocks in hand specimens
- Identifying the optical properties of rock specimens under microscope

**UNIT – I**

**Identification in hand specimen by studying mineralogical composition and texture of the following rock types:** Granite, Granodiorite, Syenite, Nepheline Syenite, Aplite, Granophyre, Diorite, Gabbro, Anorthosite, Pyroxenite, Peridotite, Mica-Lamprophyre, Dolerite, Basalt, Andesite, and Rhyolite. C.I.P.W. norm calculation of granitic and basic rock (without foid).

**UNIT – II**

**Study, under microscope, of the following textures of igneous rocks:** Porphyritic, Poikilitic, Ophitic, Intergranular, Intersertal, Graphic, Perthitic, Myrmekitic, Hypidiomorphic, Allotriomorphic, Corona, Flowage.

**UNIT – III**

**Description and identification by microscopic characters of the following rocks:** Granite, Granodiorite, Tonalite, Syenite, Nepheline Syenite, Aplite, Granophyre, Diorite, Gabbro, Anorthosite, Pyroxenite, Peridotite, Mica-Lamprophyre, Dolerite, Rhyolite, Basalt, Andesite.

**UNIT – IV**

**Sedimentary Petrology Description and identification of the following rocks in hand specimens & Thin sections:** Sandstone, Grit, Limestone, Shale, Conglomerate. Study on sedimentary structures and their paleo environmental significance, Particle size distribution and statistical treatment, Heavy mineral analysis and provenance, paleo current analysis. Exercises based on vertical sedimentary sequences of different terrestrial, coastal and marine environments, Petrography of clastic and non-clastic rocks through hand specimens and thin sections.

**UNIT – V**

**Metamorphic petrology Description and identification of the following rocks in hand specimens & thin sections:**

Megascopic and microscopic study (textural and mineralogical) of the following metamorphic rocks: Low grade metamorphic rocks: Serpentinites, Albite-Epidote-Chlorite-Quartz schist, Slate, Talc-Tremolite Calcite-Quartz schist. Medium to high grade metamorphic rocks: Gneisses, Amphibolite, Hornfels, Garnetiferous schists, Sillimanite-Kyanite-bearing rocks, Granulites, Eclogite, Diopside-Forsterite marble. Laboratory exercises in graphic plots for petro chemistry and interpretation of Para genetic diagrams.

**Suggested Readings:**

1. **Phillipotts, A.R. and Ague, J.J. (2009)** Principles of Igneous and Metamorphic Petrology, Cambridge University Press, Cambridge, 667 p. [The older edition from Prentice Hall, 1990, is also useful].
2. **Turner, F.J., and Verhoogen, J. (2002)** Igneous and Metamorphic Petrology – CBS publishers.
3. **Bucher, K., and Frey, M. (2002)** Petrogenesis of Metamorphic Rocks, Springer, 34.
4. **Pettijohn, F.J. (1975)** Sedimentary rocks, Harper & Bros. 3rd Ed.
5. **Turner, F.J. and Verhoogen, J. (1960)** Igneous and Metamorphic petrology, McGraw Hill Book Co.,
6. **Tyrell, G.W. (1989)** Principles of petrology, Methuen and Co., (Students ed.).
7. **Best, M.G. (2002)** Igneous and Metamorphic Petrology, 2nd Edn., Blackwell, Oxford, 752 p.
8. **Wilson, M. (1989)** Igneous Petrogenesis: a global tectonic approach, Springer (2007), 466 p
9. **Yardley, B.W.D. (1989)** An Introduction to Metamorphic Petrology, Longmans, 248 p.



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**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**

**B.Sc., - GEOLOGY - VI SEMESTER – CORE COURSE - XI**

(For the candidates admitted from the year 2016-17 onwards)

**PRACTICAL - IV**

**ORES AND MINERALS MEGASCOPIY, MICROSCOPY AND BLOW PIPE ANALYSIS**

**Course outcomes**

- Ability to understand the physical habits of minerals.
- Study of physical properties of minerals in hand specimen.
- Study of optical characters of common rock forming minerals.
- Study of physical characters of common ore forming minerals

**UNIT – I**

**Description of Mineral Physical habits:**

Form, Structure, Color, Streak, Diaphaneity, Luminescence, Cleavage, Fracture, Hardness, Specific Gravity, Taste, Odour And Feel, Tenacity, Magnetism, Electricity And Radio Activity, Reaction With Acid.

**UNIT – II**

**Study of physical properties of minerals in hand specimen - *Quartz Group*:** Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rose quartz, Smoky quartz and Rock crystal. ***Feldspar Group*:** Orthoclase, Albite, Anorthite, Labradorite and Bytownite. ***Feldspathoids*:** Nepheline, Leucite and Sodalite.

***Pyroxene Group*:** Enstatite, Bronzite, Hypersthene, Pigeonite, Diopside, Hedenbergite, Augite, Aegirine (Acmite), Jadeite, Spodumene and Omphacite. ***Amphibole Group*:** Cummingtonite, Tremolite, Actinolite, Hornblende and Anthophyllite.

**UNIT – III**

**Study of physical properties of minerals in hand specimen – *Mica Group*:** Muscovite, Phlogopite, Biotite, Lepidotite, Glauconite, Chlorite and Appophyllite. ***Clay Group*:** Kaolinite, Montmorillonite and vermiculite.

**Study of optical characters of common rock forming minerals:**

Quartz, Plagioclase, Microcline, Muscovite, Biotite, Fluorite, Olivine Garnet. Tourmaline, Staurolite, Andalusite, Kyanite, Sillimanite, Cordierite. Hypersthene, Augite, Diopside, Hornblende, Tremolite-Actinolite. Corundum, Beryl, Calcite and Barite

**UNIT – IV**

**Study of physical characters of common ore forming minerals:**

- ***Oxides*:** Magnetite, Magnesite, Hematite, Martite, Goethite, Limonite, Psilomelane, Pyrolusite, Braunite, Hausmanite, Chromite, Ilmenite, Columbite, Tantalite, Cassiterite, Uraninite, Pitchblende.
- ***Sulfides*:** Galena, Sphalerite, Pyrite, Pyrrhotite, Chalcopyrite, Bornite, Molybdenite, Realgar, Orpiment, Stibnite.
- ***Carbonates*:** Aragonite, Calcite, Dolomite, Magnesite, Rhodochrosite, Witherite, Siderite, Strontianite.
- ***Sulphates*:** Barite, Gypsum, Anglesite, Anhydrite, Celestite.

**UNIT – V**

**Study of optical properties of common ore forming minerals:**

Galena, Sphalerite, Pyrite, Pyrrhotite, Chalcopyrite.

Magnetite, Hematite, Psilomelane, Pyrolusite.

Study of association of ore forming and typical gangue minerals.

Preparation of maps showing distribution of important ores and other economic minerals in India.

**Identification of the following mineral powders by simple blow pipe tests:-**

Apatite, Barite, Calcite, Celestite, Cerusite, Chalcopyrite, Galena, Gypsum, Chromite, Hematite, Magnesite, Magnetite, Psilomelane, Pyrolusite, Siderite, Sphalerite, Strontianite, Witherite, Stibnite, Ilmenite and Worftramite.

**Suggested Readings:**

**Text Books:**

1. **Dana, E.S. (2006)** A Text Book of Mineralogy, Wiley Eastern.
2. **Nesse, W.D. (2003)** Introduction to Optical Mineralogy, 3<sup>rd</sup> Edn., Oxford University Press. [Older edition of this book will also be useful].
3. **Klein, C. (2002)** The Manual of Mineral Science, 22<sup>nd</sup> Edn., John Wiley & Sons, 641 p. [Earlier editions of this book with Hurlbut and Klein as authors will be also useful]
4. **Kerr, B.F. (1995)** Optical Mineralogy. McGraw Hill, 5<sup>th</sup> Edition, New York.
5. **Berry Mason, L.G, (1985)** Mineralogy, W.H. Freeman &Co.
6. **Kerr B.F, (1995)** Optical Mineralogy. McGraw Hill, 5<sup>th</sup> Edition, New York.
7. **Rabindra Nath Hota, (2012) - Geochemical Analysis**, CBS Publishers & Distributors (Reprint).

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**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**

**B.Sc., - GEOLOGY - VI SEMESTER – CORE COURSE - XII**

(For the candidates admitted from the year 2016-17 onwards)

**MINING GEOLOGY AND GEOPHYSICS**

**Course outcomes**

- To be familiar with the Role of geology in mining industries. Understanding the Surface methods of mining.
- To be familiar with Principles of mineral exploration, Prospecting and exploration Conceptualization, methodology and stages.
- To be Familiar with the Different types of Geophysical exploration Methods.
- To be familiar with Principles of reserve estimation and Different types of surveys

**UNIT – I:** Role of geology in mining industries – definition of mining terms - Shaft, Hanging wall, Adit, Roof, Drive, Cross cut, Tunnel, Raise, Winze and Stope – overhand stope and under hand stope , Level, Bonanza, Glory hole, Tenor, Gangue, Run – off- Mine, Ore suit, Ore country, Nuggets. Outline of mining policies and mining plan preparation. Scope of Mining Geology.

**UNIT – II:** Surface methods of mining, Alluvial mining - Pan& Batea, sluicing, Hydrauliclicking, Dredging. **Open cast mining.** benches, explosives, working slope, mining equipments - Dragline, Power shovels. **Subsurface mining:** - advantages and limitations. Stopping - open stopes, supported stopes and pillar. Resource reserve definitions; mineral resources in industries – historical perspective and present. A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies. Principles of mineral exploration, Prospecting and exploration- conceptualization, methodology and stages.

**UNIT – III:** Sampling, subsurface sampling including pitting, trenching and drilling, core and non-core drilling, planning of bore holes and location of boreholes on ground. Core - logging. Geochemical exploration- nature of samples, anomaly, strength of anomaly and controlling factors, coefficient of aqueous migration. Evaluation of sampling data. Mean, mode, median, standard deviation and variance, symmetrical and non-symmetrical variation, evaluation of assay values and determination of one sided cut-off grade.

**UNIT – IV:** Interrelationship between geology and geophysics - Role of geological and geophysical data in explaining. Geodynamical features of the earth. General and Exploration geophysics- Different types of Geophysical Methods; Gravity, Magnetic, Electrical, Seismic- their principles and applications. Concepts and Usage of corrections in geophysical data

**UNIT – V:** Principles of reserve estimation, density and bulk density, factors affecting reliability of reserve estimation, reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks), regular and irregular grid patterns, statistics and error estimation. Introduction to geophysical methods of exploration - Different types of surveys, grid and route surveys, profiling and sounding techniques, scales of survey, interpretation of geophysical data. Ambiguities in geophysical interpretation, Planning and execution of Geophysical surveys.

**Suggested Readings:**

**Text Books:**

1. **Ramachandra Rao, M.B., Prasaranga. (1975)** Outlines of Geophysical Prospecting - A manual for geologists, University of Mysore, Mysore.
2. **Lowrie, W. (2007)** Fundamentals of Geophysics. 2<sup>nd</sup> ed. Cambridge University Press, New Delhi.
3. **Ramachandra Rao, M.B. (1993)** Outlines of Geophysical Prospecting. EBD, Dhanbad.
4. **Telford, W.M., Geldart, L.P. and Sheriff, R.E. (1990)** Applied Geophysics. 2<sup>nd</sup> ed. Cambridge University Press, New Delhi.
5. **Hartman, H.L. (1992)** SME Mining Engineering Handbook. SMME Inc. Colorado.
6. **Kearey, P., Brooks, M., and Hill. I. (2002)** An Introduction to Geophysical Exploration, 3<sup>rd</sup> ed. Blackwell Science, Wiley Delhi.
7. **Dobrin, M.B. (1984)** An introduction to Geophysical Prospecting, McGraw Hill, New Delhi.
8. **Bhimasarikaram, V.L.S. (1990)** Exploration Geophysics - An Outline by Association of Exploration Geophysicists, Osmania University, Hyderabad.

**Reference Books:**

1. **Arogyaswamy, R.N.P. (1980)** Courses in Mining Geology. Oxford & IBH, New Delhi.
2. **Banerjee, P. K., and Ghosh, S. (1997)** Elements of Prospecting for Non Fuel Mineral Deposits, Allied Publishers, Chennai.
3. **Dobrin, M.B., and Savit, C.H. (1988)** Introduction to Geophysical Prospecting. 4<sup>th</sup> ed. McGraw Hill, New Delhi.
4. **Hawkes, H. E. (1959)** Principles of Geochemical Prospecting, Bulletin 1000F. USGS.
5. **Moon, C.J., Whateley, M.K.G., and Evans, A.M. (2006)** Introduction to Mineral Exploration, Wiley Blackwell, New Delhi.
6. **Mussett, A.E., and Khan, M.A. (2000)** Looking into the Earth: An introduction to Geological Geophysics, Cambridge University Press, New Delhi.
7. **Parasnis, D.S. (1975)** Principles of Applied Geophysics, Chapman & Hall. New York.
8. **Sharma, P.V. (1997)** Environmental and Engineering Geophysics, Cambridge University Press, New Delhi.
9. **Telford, W.M., Geldart, L.P., Sheriff, R.E., and Keys D.A. (1976)** Applied Geophysics Oxford and IBH Publishing Co. Pvt., Ltd. New Delhi.
10. **Arokyaswami, R.P. (1980)** – Courses in Mining Geology, Oxford & IBH, New Delhi.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - VI SEMESTER – CORE COURSE - XII**  
 (For the candidates admitted from the year 2016-17 onwards)

**GEOCHEMISTRY AND GEMMOLOGY**

**Course outcomes**

- Introduction to properties of elements and geochemical classification of elements.
- Ability to understand the Concept of radiogenic isotopes in geochronology and isotopic tracers
- Ability to understand the aqueous geochemistry and hydrothermal reactions.
- To understand the scope of gemology and basic megascopic and microscopic properties of gemstones
- Ability to understand the Important gemstone provinces in Tamilnadu

**GEOCHEMISTRY:**

**UNIT – I**

Introduction to properties of elements: The periodic table, chemical bonding, states of matter and atomic environments, geochemical classification of elements, the composition of different earth reservoirs and the Nucleus and Radioactivity. Conservation of mass, isotopic and elemental fractionation. Concept of radiogenic isotopes in geochronology and isotopic tracers ; dating by radioactive nuclides, Carbon 14, Beryllium 10, K-Ar method, radiogenic tracers.

**UNIT – II**

Aqueous geochemistry: basic concepts, speciation in solutions, elements of marine chemistry. Marine reactions – diagenesis and hydrothermal reactions. The solid earth – geochemical variability of magma, melting of the mantle and growth of continental crust. The earth in the solar system, the formation of solar system, composition of the bulk silicate earth. Meteorites-composition, size, shape, origin, kinds of meteorites, brief account of meteorite impact the and causes in the Earth. Geochemical behaviour of selected elements like Si, Al, K, Na etc.

**GEMMOLOGY:**

**UNIT – III**

Definition and scopes of gemmology. Gemstones, classification of gemstones. Essential characters and features of gemstones. Identification of gemstones: basic megascopic and microscopic properties of gemstones - gemstone refractometers, Polaroid films, hardness testing kits, heavy liquids, UV light, and spectroscopy methods. Artificial gem stones-their identification from natural gemstone characters and features.

**UNIT – IV**

Outline on exploration methods adopted in prospecting. Country rocks for gemstone origin and occurrence. Different processes and methods adopted for gemstone cutting and polishing. Small scale gemstone cutting and polishing industries in Tamilnadu. Gemstone occurrences and industries in other than Tamilnadu.

**UNIT – V**

Important gemstone provinces in Tamilnadu –Karur – Kangeyam belt – Manavadi, Ayyarmali, Panchampatti, Manikkapuram etc, Sittampundi layered complex, Samalpatti, Pakkanadu-Mulakkadu and Edappadi area. Brief note of mining policies and rules of gemstones in India.

**Suggested Readings for Geo chemistry:**

1. **Mason, B. (1986)** Principles of Geochemistry – 3rd Edition, New York.
2. **Hugh Rollinson. (2007)** using geochemical data- evaluation, presentation and interpretation 2<sup>nd</sup> Edition.
3. **Walther John, V. (2009)** Essentials of Geochemistry, Student Edition. Jones and Bartlett Publishers.
4. **Albarede, F. (2003)** An Introduction to Geochemistry, Cambridge University Press.

**Suggested Readings for Gemmology:**

1. **Keller, P.C. (1990)** Gemstones and their origins, VanNostrand Reinhold, New York.
2. **Herbert Smith, G.F. (1912)** Gemstones, Methuen, London.
3. **Read, P.G. (2005)** Gemmology III edition Elsevier, Singapore.
4. **Wadia, D.N,** Mineral deposits in India.

**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - VI SEMESTER – ELECTIVE COURSE – II**  
 (For the candidates admitted from the year 2016-17 onwards)

**HYDROGEOLOGY**

**Course outcomes**

- Ability to understand the Hydrologic cycle and Vertical distribution of groundwater.
- Ability to understand the Classification of aquifers and Pumping tests and analysis of test data for evaluation of aquifer parameters.
- Ability to know the Darcy's law and various rain water harvesting methods.
- Ability to understand the Ground water exploration and various drilling techniques for exploring ground water.

**UNIT – I**

Hydrologic cycle – origin and sources of ground water - meteoric water, connate water, juvenile water. Surface water-groundwater interaction - Rock properties affecting ground water occurrence - Porosity - primary and secondary porosities- Permeability - Permeameter - factors affecting the permeability – permeable rocks and examples .Vertical distribution of groundwater.

**UNIT – II**

Classification of aquifers – unconfined, confined, leaky and perched aquifers- aquiclude, aquitard, aquifuge, isotropic and anisotropic aquifers. Water table and piezo metric surface – phreatic water table. Properties of aquifer – Porosity, hydraulic conductivity, transmissivity and storage coefficient. Ground water in non-indurated sediments. Pumping tests and analysis of test data for evaluation of aquifer parameters.

**UNIT – III**

Darcy's law and its validity – sheet flow – turbid flow. Coefficient of permeability. Springs – mechanism of springs – rock properties affecting the origin of springs – kinds of springs – spring water quality – medicinal value of springs – hot springs in India. Wells – kinds of well – rock structures controlling the well- well water quality in Tamilnadu – causes of overdraft of ground water– artificial water recharge methods- construction of percolation ponds and lake, desiltation monitoring in canal, pond, and lake. Rain water harvesting – importance and different methods. Insight of water conservation techniques in ancient period of Tamilnadu.

**UNIT – IV**

Ground water exploration: field geological traversing – reconnaissance survey- structural approach – satellite imagery interpretation – geophysical resistivity survey: Wenner array, Schlumberger array, Dipole method, and dowsing method– Water indicating plants. Brief account on drilling techniques for exploring ground water.

**UNIT – V**

Groundwater Quality and Chemistry: water salinity – causes of salinity, physical character of ground water- colour, odour, and density – chemical analyses of ground water – TDS and hardness of ground water. Graphical representations of quality of ground water – bar, vector, and pie. Biological analyses of ground water. Brief note on water quality chart for agriculture, domestic and industrial use. Ground water provinces of Tamilnadu.

**Text Books:**

1. **David Keith Todd., and Larry W. Mays. (2013)** Groundwater Hydrology, wiley.
2. **Fetter, C.W. (2007)** Applied Hydrology, CBS Publications.
3. **Herman Bouwer, (2014)** Groundwater Hydrology, McGraw hill education private limited.
4. **Raghunath, H. M. (2003)** Groundwater, New age international publications.

**Reference Books:**

1. **Demam, MCJ., Smith G.S., and Verstappen, H.T. (1986)** Remote Sensing for resources development and environmental management, A.A.Balkema Publishers, Totterdam, Netherlands.
2. **Paine, D.P. (1981)** Aerial photography and image interpretation for resource management, Wiley and Sons, New York.
3. **Ramakrishnan, S. (1998)** Groundwater, CBS Publishers & Distributors.

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**GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05**  
**B.Sc., - GEOLOGY - VI SEMESTER – ELECTIVE COURSE – III**  
(For the candidates admitted from the year 2016-17 onwards)

**FUEL GEOLOGY**

**Course outcomes**

- Ability to understand the fuel geology, coal and its properties, varieties and ranking. Ability to understand the Applications of Coal petrography. Indian Coal & Lignite deposits.
- Ability to know the Uses of coal for various industries e.g. carbonization, liquefaction, power generation, gasification and coal-bed methane production.
- Ability to know about Petroleum and its different states of natural occurrence, chemical composition and physical properties of crudes in nature.
- Ability to know the geologic factors controlling hydrocarbon migration and Hydrocarbon Traps

**UNIT – I**

Coal and its properties: Different varieties and ranks of coal. Origin of coal. Coalification process and its causes. Litho types, microlithotypes and macerals: their Physical, Chemical and Optical Properties. Maceral analysis of Coal: Mineral and organic matter in Coal. Petrographical methods and tools of examination.

**UNIT – II**

Fundamentals of Coal petrology, concept of Coal maturity, Peat, Lignite, Bituminous And Anthracite Coal. Application of Coal geology in hydrocarbon exploration. Applications of Coal petrography. Proximate and ultimate analyses. Indian Coal & Lignite deposits.

**UNIT – III**

Industrial evaluation of Coal characteristics with reference to Coal classification. Geology and coal petrography of different coalfields of India. Uses of coal for various industries e.g. carbonization, liquefaction, power generation, gasification and coal-bed methane production.

**UNIT – IV**

**Petroleum:** its different states of natural occurrence, chemical composition and physical properties of crudes in nature. Origin of petroleum (Organic and Inorganic theories), Bitumen and Kerogen; Types of kerogen. Maturation of kerogen. Reservoir rocks: General attributes and petrophysical properties. Porosity (Primary and Secondary) and Permeability (Absolute, Relative, Effective). Control of sediment character (grain size, texture) on Petrophysical property. Classification of reservoir rocks - fragmental reservoir rocks and chemical reservoir rocks.

**UNIT – V**

Migration of Oil and Gas: geologic framework of migration; short and long distance migration, primary and secondary migration; geologic factors controlling hydrocarbon migration; forces responsible for migration, migration routes and barriers.

Hydrocarbon Traps: definition; anticlinal theory and trap theory, classification of hydrocarbon traps - structural, stratigraphic and combination; time of trap formation and time of hydrocarbon accumulation. Cap rocks - definition and general properties.

**Suggested Readings**

**Bjorlykke, K. (1989)** Sedimentary and Petroleum Geology. Springer

1. North, F.K. (1985) Petroleum Geology. Allen & Unwin.
2. **Hobson, G.D. and Tiratsoo, E.N. (1975)** Introduction to Petroleum Geology and Geochemistry, Gulf Publishers.
3. **Shelley, R.C. (1997)** Elements of Petroleum Geology. Academic Press.
4. **Levorsen, A.I. (1985)** Geology of Petroleum, CBS Publishers and Distributors, Delhi, Second Edition.