VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in

APPLIED GEOLOGY

SYLLABUS

Master of Science
(III Semester)

With effect from
2021-22

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Department of Applied Geology

Jnana Sagara, Ballari - 583105

Distribution of Courses/Papers in Postgraduate Programme I to IV Semester as per Choice Based Credit System (CBCS) Proposed for PG Programs

III – SEMESTER

With Practical

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	SEE	Total	L	T	P		
THIRD	DSC9	21APG3C9L	Exploration Geology	30	70	100	4	-	-	4	3
	DSC10	21APG3C10L	Hydrogeology	30	70	100	4	-	-	4	3
	DSE1	21APG3E1AL	A. Indian Mineral Deposits	30	70	100	4	-	-	4	3
		21APG3E1BL	B. Experimental Mineralogy and Petrology								
		21APG3E1CL	C. Marine Geology								
	DSE2	21APG3E2AL	A. Ore Dressing Technology	30	70	100	4	-	-	4	3
		21APG3E2BL	B. Watershed Management								
		21APG3E2CL	C. Energy Resources								
	GEC1	21APG3G1AL	A. Study of Geo science	20	30	50	2	-	-	2	1
		21APG3G1BL	B. Study of Geo informatics								
		21APG3G1CL	C. Study of Rocks and Minerals								
	SEC3	21APG3S3L	Research Methodology	20	30	50	2	-	-	2	1
	DSCL	21APG3C7P	Exploration Geology Lab	20	30	50	-	-	4	2	4
	DSCL	21APG3C8P	Hydrogeology Lab	20	30	50	-	-	4	2	4
Total Marks for III Semester						**600**				**24**	

Dept Name: Applied Geology
Semester-III

DSC9: 21APG3C9L

Course Title: Exploration Geology	Course code: 21APG3C9L
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Discuss about the exploration techniques.
2. Demonstrate the Geophysical and Geochemical exploration methods.
3. Ore estimations and reserve calculation.
4. Explain the prospecting and exploration methods

DSC9: Exploration Geology

Unit	Description	Hours
1	**Introduction of Exploration:** Definition of mineral. Resource reserve definitions, Mineral resources in industries. Geological criteria for mineral prospecting. Indications of ore. Geological prospecting methods. Small and large scale geological mapping. Methods of geological exploration	10
2	**Prospecting and Exploration:** Principles of mineral exploration, Prospecting and exploration- conceptualization, methodology and stages, Sampling techniques, subsurface sampling including exploratory grids, location and documentation of exploratory workings (pits, trenches underground workings)	10
3	**Geochemical Exploration:** Geochemical cycle, mobility of elements and geochemical anomaly. Mode of occurrence of trace elements. Primary dispersion patterns of deep seated origin, syngenetic and epigenetic. Geochemical rock surveys. Weathering and its products. Mobility of elements in the surficial environment and surficial dispersion patterns and forms. Anomalies in residual and transported over burden. Anomalies in waters and drainage sediments	10
4	**Geophysical exploration:** Geophysical anomalies, Electrical prospecting: Resistivity method, important electrode arrangements, instruments, interpretation and application of electrical methods in ground water investigation. Magnetic prospecting: Magnetic properties of rocks and minerals, Earth's magnetic field, instrument and measurements, interpretation of magnetic anomalies. Gravity prospecting: Earth's gravity field, regional and local gravity anomalies, instruments, interpretation of gravity anomalies	12

5	**Data Evaluation and Reserve estimations:** Evaluation of sampling data Mean, mode, median, standard deviation and variance. 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	10

References:

1. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration.
2. M B Ramachandra Rao: Outlines of geophysical prospecting - A manual for geologists.
3. Milton B Dobrin: Introduction to geophysical prospecting
4. Rose, A.W Hawkes. H.E & Webb J.S. 1979: Geochemistry in mineral exploration
5. Jakaosku J J: Exploration geophysics.
6. P V Sharama: Geophysical Methods in Geology
7. Bhimasanakaran and Gaur: Exploration Geophysics for geologist and Engineers.
8. D S Paransis: Principles of Applied Geophysics.
9. C H Howel: Introduction to Geophysics
10. Ginzburg. I.I Principles of geochemical prospecting

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
DSC10: 21APG3C10L

Course Title: Hydrogeology	Course code: 21APG3C10L
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Discuss about the groundwater flow through earth system
2. Demonstrate the skill to interpret potential for exploration of groundwater.
3. Analyze the Groundwater Basins and rain water harvesting methods
4. Explain properties of surface and subsurface water.

DSC10: Hydrogeology

Unit	Description	Hours
1	**Introduction of Hydrology:** Scope of Hydrologic cycle, hydrograph, origin and source, distribution of groundwater, aquifers, aquifer compressibility, porosity, rock properties, specific yield, storage coefficient, groundwater occurrence in various geological formations, geological structures. Hydrology of India	11
2	**Groundwater Flow:** Darcy's law; validity of Darcy's law, hydraulic gradient, hydraulic conductivity, field mapping, flow nets, K estimation in lab and by tracer techniques, transmissivity, homogeneity and heterogeneity, isotropic and anisotropic formations, groundwater resources evaluation, unsaturated flow	11
3	**Aquifer Parameters:** General groundwater flow equation, steady and unsteady radial flow towards wells, confined, unconfined and semi confined aquifers, impact of boundaries, multiple wells, estimation of aquifer parameters by pump tests, slug tests, well loss, groundwater recharge, groundwater modelling	10
4	**Groundwater Development:** Advantage of groundwater use. Construction of wells, shallow and deep wells, methods of well completion and development, testing for yield, safe yield, horizontal wells, galleries, interference between wells and aquifer boundaries, aquifer response to pumping, land subsidence. Groundwater recharge	10
5	**Groundwater Quality:** Constituents in groundwater, dissolved ions, chemical analysis, reporting of results, groundwater quality for various uses,	10

	geochemical evolution of groundwater, sources of contaminants, solute and particle transport, remediation, seawater intrusion. Case studies	

References:

1. Domenico P.A. and F.W. Schwartz (1990), Physical and chemical hydrogeology. John Wiley.
2. Fetter,C. W (1994): Applied Hydrogeology,(3rd edition),New York,Macmillan
3. Freeze, R.A and Cherry, J.A (1979), Groundwater, Prentice Hall
4. Elango, L and Jayakumar, R (Eds.) (2001) Modelling in Hydrogeology, Unesco-IHP Publications, Allied Publ.
5. Elango, L (Ed.) (2011) Hydraulic conductivity – Issues, Determinations and applications, Intech Open Acces Publishers, ISBN 978-953-307-288-3, 434 P
6. Todd, D.K Groundwater Hydrology, John Wiley
7. Hiscock, K, Hydrogeology (2005): Principles and Practice, Wiley-Blackwell.
8. C.F.Tolman: Groundwater
9. S.N.Davis and R.J.M Dewiest: Hydrology
10. R.H.Brown and others: Groundwater Studies

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III

DSE1: 21APG3E1L-A

Course Title: Indian Mineral Deposits	Course code: 21APG3E1L-A
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Discuss about the process of Ore formation
2. Demonstrate the skill to Salient Metallic mineral groups.
3. Analyze the Mineral economic strategies

DSE1: A). Indian Mineral Deposits

Unit	Description	Hours
1	**Introduction and Definitions:** Ores, gangue minerals, tenor, grade and lodes Resources and reserves; Use of various minerals in industries; Production and its effect on prices of minerals; Demand and supply, their effect on prices; Mineral resources in India and their present status and future development	11
2	**Metallic mineral resources:** Study of the following Indian ore deposits with reference to their mineralogy, mode of occurrence, origin, geological association and geographical distribution: Iron, manganese, gold, aluminium, chromium, copper, lead and zinc	10
3	**Non-metallic mineral resources:** Study of the following mineral deposits with reference to their mineralogy, mode of occurrence, origin, geological association and geographical distribution in India: Minerals used in ceramics, cosmetic, glass, fertilizers, cement, chemical, paints and pigments, electrical and gemstone industries	10
4	**Metallurgy application mineral resources:** Study of the following Indian ore deposits with reference to their mineralogy, mode of occurrence, origin, geological association and geographical distribution: Tin, tungsten, titanium, nickel and molybdenum; Minerals used in metallurgical, refractory and abrasive industries	11
5	**Karnataka and Indian mineral resources:** Study of the Important Karnataka and Indian ore deposits with reference to their mineralogy, mode of occurrence, origin, geological association and geographical distribution: Iron, manganese, gold, silver, chromium	10

References:

1. Babu, T.M. (1994) Tin in India, Geological Society of India, Bangalore.
2. Babu, T.M. (1998) Diamonds in India, Geological Society of India, Bangalore.

3. Banerjee, D.K. (1992) Mineral Resources of India, The World Press Pvt. Ltd., Kolkata
4. Deb, S. (1980) Industrial Minerals and Rocks of India, Allied Publishers, New Delhi.
5. Karanth, R.V. (2000) Gems and Gem Industry in India, Geological Society of India, Bangalore.
6. Krishnaswamy, S. (1979) India's Mineral Resources, Oxford and IBH, New Delhi.
7. Radhakrishnan, B.P. and Curtis, L.C. (1999) Gold in India, Geological Society of India, Bangalore.
8. Sharma, N.L. and Ram, K.S.V. (1964) Introduction to India's Economic Minerals, Dhanbad Publishers

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
DSE1: 21APG3E1L-B

Course Title: Experimental Mineralogy and Petrology	Course code: 21APG3E1L-B
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Explain the principles of Experimental mineralogy and petrology
2. Discuss about the concepts of thermodynamics
3. Demonstrate the skill to Raoult's Law and Henny's Law.
4. Analyze the Oxidation reaction

DSE1: B). Experimental Mineralogy and Petrology

Unit	Description	Hours
1	**Experimental Mineralogy:** Ore mineral reactions with condensed phases, solid solutions, mixed volatile equilibria and thermobarometry. Steady-state geotherms. Genesis, properties, emplacement and crystallization of magmas. Phase equilibrium studies of simple systems, effect of volatiles on melt equilibria	12
2	**Experimental Petrology:** High Temperature, Pressure Techniques, Hydrothermal apparatus and Piston Cylinder, Experiments on Solid, Solid Dehydration and Decarbonation Reaction	10
3	**Thermodynamics:** Gibb's Energy and equilibrium constant, mole fraction, activity coefficients. Regular and sub regular solutions. Standard states, fugacity and activity	10
4	**Raoult's Law, Henny's Law:** Heat Capacity, Evaluation and tabulation of thermodynamic data. Isobaric thermal expansion and pressures	10
5	**Geothermometers and geobarometers:** Calibrations of Geothermometers and geobarometers from thermodynamic and experimental data. Reduced activity of water from dehydration reactions. Log O_2 from oxidation reactions	10

References:

1. Chatterjee.N.D.(1991) Applied Mineralogical Thermodynamics. Springer Verlag.
2. Koch, G.S and Link, R.F. (1970) Statistical Analysis of Geological Data. John Wiley.
3. Powell, R. (1978) Equilibrium Thermodynamics in Petrology, an Introduction,

Harper& Row
4. Wood, B.J. and Frasser, D.G (1976) Elementary Thermodynamics for Geologists. Oxford Univ. Press

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
DSE1: 21APG3E1L-C

Course Title: Marine Geology	Course code: 21APG3E1L-C
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Describe the concept of Marine geology
2. Preparation of man power to address the ocean resources and environment
3. Demonstrate the skill to identify the suitable remote sensing applications in ocean sciences.

DSE1: C). Marine Geology

Unit	Description	Hours
1	**Physical features of the ocean:** Introduction and scope of Marine Geology; oceanic profile, oceanic features; beaches, coastal classification, erosion and accretion; waves, currents and tides, coastal protection structures	10
2	**Ocean resources:** Classification of marine mineral deposits. Origin and depositional system of marine resources; beach placers, shelf deposits, deep ocean Phosphatic, Polymetallic nodules, sulfate deposits, hydrocarbon deposits Sea water as a resource	10
3	**Oceanographic instrumentations:** Descriptions of research vessels, cruise, position fixing in the sea; sampling devices. Grab samplers, bottom samplers, dredges, sediment traps, boomerang samplers, water samplers, Winches, temperature measurement instruments, tools for studying ocean floor topography. POD, COD, GOD and BOD tools kit	12
4	**Sea water and marine pollution:** Concept of sea level changes, physical and chemical properties of seawater. Marine pollutionpathways, residence time, pollutants in the marine environment	10
5	**Oceanic crust, sediments and law of the sea:** Origin of oceanic crust, ocean sediments, classification, digenesis, Ocean tectonics. Law of the sea, EEZ. Fundamentals of Remote sensing applications to ocean science	10

References:

1. J.J. Bhatt. Oceanography(1994): Exploring the Planet Ocean. D. Van. Nostrand Company, New York,
2. Shepard, F. P. (1994): Submarine Geology, Harper and Row Publ. New York.
3. Kerth. S (1996): Ocean Science, John Wiley and Sons. Inc. New York.

4. James, K, Marine geology Prentice Hall, Inc. Englewood Clifs. N. J. 07632.
5. Eric. C. Bird Coasts (1984): an introduction to coastal geomorphology, III ed. Basil Black well Publ.

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
DSE2: 21APG3E2L-A

Course Title: Ore Dressing Technology	Course code: 21APG3E2L-A
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Describe the concept of ore dressing
2. Preparation of man power to address the mineral processing technology
3. Demonstrate the skill to identify the suitable flow sheets for ore dressing

DSE2: A). Ore Dressing Technology

Unit	Description	Hours
1	**Introduction:** Definition: Nature and Scope of mineral dressing; Relation of ore dressing to smelting and utility; Properties of minerals in relation to their dressing. Ore microscopy usage in mineral technology, information from mineralogical studies, mineral dressing processes	10
2	**Liberation:** Practice of crushing and grading and grinding; Working principles of Jaw, Gyratory, Cone and roll crusher; Stamp, Rod and Ball Mills	10
3	**Concentration, screening and sizing:** Concentration processes such as preliminary washing and sorting; Heavy fluid separation; Use of Classifiers (Hydraulic and Pneumatic); Jigging; Tabling, Floatation and Agglomeration; Electrostatic, Centrifugal and Maganetic separation; Amalgamation and heat treatment methods; Concentration of ores by chemical leaching; Process of dewatering, filteration, drying and thickening methods, dressing systems and plants	12
4	**Flow sheets of common types of ores:** Methods of dressing of iron, gold, manganese, chromium, coal, clays, flurospar, graphite, micas, gypsum, talc, barite etc. Flow sheets of important concentration plants of India	10
5	**Experimental Study:** Mechanical analysis by sieving, size analysis under microscope. Separation of minerals by panning and tabling. Preparation of flow sheets of the important concentration plants of India and flow sheets of common types of ores	10

References:

1. Gaudin, A.M. (1974) Principles of mineral dressing, Tata McGraw Hill.
2. Kelly, E.G. and Spottiswood, D.J. (1982) Introduction to mineral processing, John

Wiley.
3. Taggart, A.F. ( ) Hand book of mineral dressing.
4. Wills, B.A. (1992) Mineral processing technology, Pergmon Press.

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
DSE2: 21APG3E2L-B

Course Title: Watershed Management	Course code: 21APG3E2L-B
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Describe the concept watershed
2. Preparation of man power to address the watershed plans
3. Demonstrate the skill to identify the suitable water harvesting technology.

DSE2: B). Watershed Management

Unit	Description	Hours
1	**Introduction:** Definition, concepts of watershed, major objectives of watershed management, effects of watershed on community, ecosystem, Monitoring and evaluation of watershed	10
2	**Principles of watershed management:** Delineating the watershed. natural processes at work in watershed, common elements of watershed management, multidisciplinary approach in watershed management, participatory resources mapping and appraisal, benefits of watershed approach	11
3	**Degradation agents in watershed:** Flood, drought, fire, wind storms, erosion and deposition. Climate change. Glacial movement, Tectonic activity. Volcanic eruption. Human–induced changes. Impact of the degradation of watersheds in hydrology	11
4	**Engineering measures for soil conservation:** Rainfall parameters. Types of soil erosion. contour bunding, Surplusing structures contour and straggled trenching, gully control structures, graded bunding, bench terracing, land leveling and grading	10
5	**Water Conservation and Harvesting:** Water conservation methods for crop land, Treatment of catchments. Rainwater harvesting structures: Check dam, farm pond, percolation tank, basin, ditch and furrow, channel, flooding, irrigation, subsurface dyke, nalla bund and pit methods. Conjunctive use of surface and groundwater	10

References:

1. Rajora,R.,(1998),Integrated Watershed Management, Rewat Publications, New Delhi.
2. Tideman.E.M., (1996), Watershed Management: Guideline for Indian Conditions, Omega Scientific Publishers, 372p..
3. Lal.S., (2004), Watershed, Development, Management and Technology, Mangal

Deep Publications, 358p..
4. Suresh,R.,(2002), Soil and Water Conservation Engineering, Standard Publishers and Distributers, Delhi.
5. Kakade,B.K.,(2002), Soil and Water Conservation Structures in Watershed Development Progarmmes ,BAIF Development Research Foundation, Pune

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
DSE2: 21APG3E2L-C

Course Title: Energy Resources	Course code: 21APG3E2L-C
Total Contact Hours: 04 / week	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Describe the concept hydrocarbon deposit
2. Preparation of man power to address the oil and gas industry
3. Demonstrate the skill to identify the suitable coal for energy utilization

DSE2: C). Energy Resources

Unit	Description	Hours
1	**Origin of Coal:** Sedimentology of coal bearing strata; Structures associated with coal seams; Proximate and Ultimate analysis of coal; Rank, grades and types of coal; Indian and International classification for coking and non-coking coals; Coal preparation: coal carbonization, coal gasification, underground coal gasification (UCG), coal hydrogenation and coal combustion	10
2	**Coal petrology:** concept of 'lithotype', 'maceral' and 'microlithotype; Classification and optical properties of macerals and microlithotypes; Techniques and methods of coal microscopy; Reflectance and fluorescence microscopy; Application of coal petrology for different industrial purposes; Geological and geographical distribution of coal and lignite deposits in India; Coal exploration and estimation of coal reserves; Indian coal reserves and production of coal in India; Coal Bed Methane (CBM); Generation, retention and exploration of methane from coal beds	11
3	**Petroleum:** Different states, natural occurrences, chemical composition and physical properties of different fractions; Origin of Petroleum: Transformation of organic matter into kerogen, organic maturation, thermal cracking of kerogen; Migration of oil and gas; Reservoir rocks: General attributes and petrophysical properties; Classification of reservoir rocks-fragmental reservoir rocks and chemical reservoir rocks; Reservoir fluids-water, oil and gas; Hydrocarbon traps: Structural, stratigraphic and combination traps; Cap rock: Definition and general properties; Petroliferous basins of India; Elements of petroleum exploration; Hydrocarbons: Present	11

	status and future prospects	
4	**Hydrocarbon deposits:** Plate tectonics and its implication in Petroleum, future thrust areas. Sequence stratigraphy and its implications in Petroleum exploration. Application of logging and seismic techniques in Petroleum exploration. Geochemical prospecting in petroleum exploration. Unconventional sources of energy	10
5	**Nuclear energy:** Mineralogy and geochemistry of radioactive minerals; Mode of occurrence, origin, association and distribution of atomic minerals in nature (U, Th, Be, rare metals and REE etc); Atomic minerals as source of energy; Uranium and thorium exploration in India; Productive geological horizons in India; Atomic fuels and environment; Nuclear power stations of India and future prospects; Potential alternative (renewable) energy sources such as Geothermal, solar, wind, tidal, biomass, etc	10

References:

1. Acharyya, S.K. (2000) Coal and Lignite Resources of India: An overview, Geological Society of India, Banglore.
2. Chandra, D., Singh, R.M. and Singh, M.P. (2000) Textbook of Coal (Indian Context), Tara Book Agency, Varanasi.
3. Francis, W. (1961) Coal, Edward Arnold Ltd.
4. Scott, A.C. (1987) Coal and Coal-bearing strata: Recent Advances, Blackwell Scientific Publications.
5. Singh, M.P. (Ed.) (1998) Coal and Organic Petrology, Hindustan Publ. Corp., New Delhi.
6. Stach, E. et al. (1975) Stach's textbook of coal petrology, Berlin: Gebruder Borntraeger.
7. Taylor, G.H., Teichmüller, M. and Davis, C. (1998) Organic Petrology: A new handbook incorporating some revised parts of Stach's Textbook of Coal Petrology.
8. Taylor, G.H., Teichmuller, M., Davis, A., Diessel, G.F.K., Littke, R. and Robert, P. (1998) Organic Petrology, Gebruder Borntraeger, Stuttgart.
9. Thomas, Larry (2002) Coal Geology, John Wiley and Sons Ltd., England
10. Van Krevelen, D.W. (1993) Coal: Typology-Physics-Chemistry-Constitution, Elsevier Science, Netherlands.
11. Holson, G.D. and Tiratsoo, E.N. (1985) Introduction to Petroleum Geology, Gulf Publ. Houston, Texas.
12. Leverson, A.L. (1970) Geology of Petroleum, Freeman and Company.
13. North, F.K. (1985) Petroleum Geology, Allen and Unwin.
14. Selley, R.G. (1998) Elements of Petroleum Geology, Academic Press.
15. Tissot, B.P. and Welte, D.H. (1984) Petroleum Formation and Occurrence, Springer-Verlag.
16. Aswathanarayana, U. (1985) Principles of Nuclear Geology, Oxford Press.
17. Boyle, R.W. (1982) Geochemical Prospecting for Thorium and Uranium Deposits,

EIsevier.
18. Dahlkamp, F.J. (1993) Uranium Ore Deposits, Springer Verlag.
19. Durrance, E.M. (1986) Radioactivity in Geology, Principles and Application, Ellis Hoorwool.

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III

GEC1: 21APG3G1L-A

Course Title: Study of Geoscience	Course code: 21APG3G1L-A
Total Contact Hours: 02 / week	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 01 Hour
Summative Assessment Marks: 30	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Discuss about the description of rocks and mineral investigations techniques.
2. Demonstrate the field geology.
3. Explore the geological time scale.

GEC1: A). Study of Geoscience

Unit	Description	Hours
1	**Physical Geology:** Introduction to Geoscience. Origin of the Earth. Age of the earth. Interior of the Earth. Geomorphic processes and cycles, Geological action of wind, water, glaciers. Volcanoes and earthquakes. Morphology of Oceans, Principles of Isostacy and uniformitarinism	08
2	**Structural Geology:** Petrology, Mineralogy, Rock deformation. Earth forces. Folds and Foldings, Fault and Faulting, Joints, Cleavage, Unconformities, Concepts of plate tectonics, sea floor spreading and geosynclines	08
3	**Stratigraphy:** Introduction, Definition of Stratigraphy, Branches of Stratigraphy and its relation ith other branches of Geology, Principles of Stratigraphy- Law of Uniformatianism, Law of order of superposition, Law of Faunal Succession.Geological Record and its nature Eon, Era, Period. Geological Time Scale. Classification of Standard Stratigraphic scale. Nomenclature and units-Litho, Bio and Chrono stratigraphic units, Correlation- Lithostratigraphic and Biostratigraphic	10

References:

1. Arthur Holmes: Physical Geology
2. Billings: Structural Geology
3. P.K. Mukerjee: General Geology
4. Strahler: Physical Geology
5. Weller: Stratigraphic Principles and Practice
6. Kumberlein and Sloss: Stratigraphy

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology

Semester-III

GEC1: 21APG3G1L-B

Course Title: Study of Geoinformatics	Course code: 21APG3G1L-B
Total Contact Hours: 02 / week	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 01 Hour
Summative Assessment Marks: 30	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Discuss about the description of RS-GIS and GPS.
2. Demonstrate the Remotes Sensing techniques.
3. Explore the GIS and GPS tools.

GEC1: B). Study of Geoinformatics

Unit	Description	Hours
1	**Remote Sensing:** Introduction: History and Development of Remote Sensing, Fundamental Principles of Remote Sensing- Stages in Remote Sensing Process. Types of Remote Sensing- Advantages of Remote sensing, Aerial Photographs, Basics, Stereo models, Photo Mosaics and Photo scale. Electro Magnetic Radiation (EMR): EMR Spectrum – EMR Interaction with Atmosphere: Absorption, Scattering & Atmospheric windows	10
2	**Geographic Information System:** Introduction to GIS. Type of data, spatial and non spatial data, data structure, vector and raster formats, hardware for GIS, scanner, digitizer, standard GIS packages, database concepts, data input, retrieval. Assigning rank and weightage for geologic studies, overlay analysis	08
3	**Global Positioning System:** Introduction, Satellite, Control and User Segments, Signal Components, Errors in GPS observations, PS positioning, Differential GPS. GPS Mapping: Conventional Static, Kinematic GPS Semi kinematic (Stop & Go), Rapid static Mobile mapping	08

References:

1. D.R.Lueder. Aerial photographic interpretation, Principles and applications. McGraw-Hill New York. (1959)
2. Anji Reddy, M. (2012) Textbook of Remote Sensing & GIS, BS Publications,Hyderabad
3. Photogeology - Miller, J.C.
4. Manual of photogrammetry - Ed: MorrieM.Thompson.
5. Manual of Remote sensing - Ed: Robert G Reeves.

6. Theory of pattern recognition and modern forecasting - V.Karpin and Wright Pattern.
7. Remote sensing in Geology - Parry S. Siegal& Alan. R.Gillespie
8. Manual of photographic interpretation - Ed: Colwell, R.N.

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III

GEC1: 21APG3G1L-C

Course Title: Study of Rocks and Minerals	Course code: 21APG3G1L-C
Total Contact Hours: 02 / week	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 01 Hour
Summative Assessment Marks: 30	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Discuss about the description of petrology and mineralogy.
2. Demonstrate the types of rocks and minerals.
3. Explore the minerals and rocks

GEC1: C). Study of Rocks and Minerals

Unit	Description	Hours
1	**Introduction:** Introduction: Origin of the Earth. Age of the earth. Interior of the Earth. Magma, Concepts of plate tectonics. Morphology of Oceans, Principles of Isostacy and uniformitarinism	08
2	**Petrology:** Introduction to petrology, Rock cycle, Classification of rocks: Igneous, Metamorphic and Sedimentary, types of igneous rocks, types of metamorphic rocks, types of sedimentary rocks, structure and textures of all types of rocks	09
3	**Mineralogy:** Introduction, Definition, physical prosperities of minerals, chemical properties of minerals Mineral resources, metallic minerals, non-metallic minerals, industrial minerals. Industrial applications of minerals	09

References:

1. Arthur Holmes: Physical Geology
2. Billings: Structural Geology
3. P.K. Mukerjee: General Geology
4. Strahler: Physical Geology

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
SEC3: 21APG3S3L

Course Title: Research Methodology	Course code: 21APG3S3L
Total Contact Hours: 02 / week	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 01 Hour
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Discuss about the description of research problem and methods.
2. Demonstrate the research plan and design.
3. Explore the report writing skill.

SEC3: Research Methodology

Unit	Description	Hours
1	**Introduction to Research:** Nature and importance of research- Aims, Objectives and Principles: Fundamental research vs. applied research with examples: Qualitative vs Quantitative research: Theoretical research vs. experimental research with examples: Selection of a research problem and Sources of literature – Journals, Conferences, Books. Types of sources: Literature Survey engines- Scopus, web of Science, Google Scholar, PubMed, NCBI, Scihub, etc. Science citation index: Citations, h-index, i10 index, impact factor	08
2	**Methods of Data Collection:** Data Collection Methods- Framing a hypothesis, designing controlled experiments, choosing the sample-size, sampling bias, importance of independent replicates, conducting an experiment, maintaining a lab-notebook to record observations: Identifying experimental errors. Case-studies on well-designed experiments vs. poorly designed experiments. Correlations vs. Causation .Good laboratory Practices	08
3	**Data analysis (Practical):** Technical presentation, technical writing, Formatting, citations; MS Excel for plotting the data (pie chart, plots, bar charts) **Analysis using software tools:** Preparation of field geological maps, study area location maps, traversing map using GIS and CAD tools, GCD-ToolKit, Descriptive Statistics: Mean, standard deviation, variance, plotting data and understanding error-bars	10

References:

1. Qualitative Research Methods for Social Sciences by Bruce, L. B. 2001, Allyn and Bacon, Boston.

2. Computer Applications in the Social Sciences by Edward, E.B., 1990, Temple University Press, Philadelphia.
3. Survey Methodology by Robert, M. B, et al., 2009, Wiley, New Jersey.
4. Social Research Methods by Bryman, A. 2008, Oxford University Press, New York.
5. Research Design: Qualitative, Quantitative and Mixed Methods Approaches by John, W. C., 2011, Sage Publications, Thousand Oaks.
6. Power/Knowledge: Selected Interviews and Other Writings by Michel, F., edited by Colin Gordon, 1980, Vintage, New York.
7. The Structure of Scientific Revolutions by Thomas K., 1996, University of Chicago Press, Chicago.
8. Social Research Methods: A Reader by Seale C., 2004, Routledge, London C.R. Kothari, Research Methodology: Methods and Techniques, II Ed. New Age International Publishers, (2009).
9. Shanthibhushan Mishra, Shashi Alok, Handbook of Research Methodology, I Ed, 2017, Educreation Publishers.
10. Basic Statistical Tools in Research and Data Analysis (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5037948/).

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III
DSCL: 21APG3C7P

Course Title: Exploration Geology Lab	Course code: 21APG3C7P
Total Contact Hours: 04 / week	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 04 Hours
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Evaluate the reserve estimation and ore deposit
2. Identify the groundwater potential zone

DSCL: Exploration Geology Lab

List of Experiments

1. Delineation of ore deposit based on exploration data;
2. Classification of ore reserves;
3. Economic evaluation of ore deposit;
4. Geological cross-section
5. Models of reserve estimation
6. Preparation of geochemical anomaly maps
7. Interpretation of Geochemical maps for locating ore mineralization
8. Resistivity surveys – Wenner and Schlumberger methods

Date Course Coordinator Subject Committee Chairperson

Dept Name: Applied Geology
Semester-III

DSCL: 21APG3C8P

Course Title: Hydrogeology Lab	Course code: 21APG3C8P
Total Contact Hours: 04 / week	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 04 Hours
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Evaluate the water level and water quality
2. Identify the groundwater potential zone

DSCL: Hydrogeology Lab

List of Experiments

1. Delineation of isohyetal and thiessen polygon maps and interpreting volumes of rainfall;
2. Preparation and interpretation of water level contour maps and depth to water level maps Study;
3. Study of water potential zones of India;
4. Preparation of Iso-resisitivity maps and delineating groundwater potential zones
5. Graphical representation of chemical quality data and water classification

Date Course Coordinator Subject Committee Chairperson