VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE (HONOURS)

MAJOR IN GEOLOGY

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE (HONOURS) MAJOR IN GEOLOGY
(under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. (Hons.)	3rd	V	SEMESTER-V							
			Major-8	GELHMJ08	T: Metamorphic Petrology; P: Practical	4	3-0-1	15	60	75
			Major-9	GELHMJ09	T: Principle of Stratigraphy and Precambrian Stratigraphy of India;	4	3-1-0	15	60	75
			Major-10	GELHMJ10	T: Phanerozoic Stratigraphy of India;	4	3-1-0	15	60	75
			Major Elective-01	GELHDSE1	T: Geodynamics;	4	3-1-0	15	60	75
			Minor-5 (Disc.-I)	GELMIN05	T: Resource Geology; P: Practical *(To be taken from other Discipline)*	4	3-0-1	15	60	75
			Semester-V Total			20				375
		VI	SEMESTER-VI							
			Major-11	GELHMJ11	T: Economic geology; P: Practical	4	3-0-1	15	60	75
			Major-12	GELHMJ12	T: Hydrology; P: Practical	4	3-0-1	15	60	75
			Major-13	GELHMJ13	T: Exploration geology; P: Practical	4	3-0-1	15	60	75
			Major Elective-02	GELHDSE2	T: Fuel Geology; P: Practical	4	3-0-1	15	60	75
			Minor-6 (Disc.-II)	GELMIN06	T: Geotectonics; P: Practical *(To be taken from other Discipline)*	4	3-1-0	15	60	75
			Semester-VI Total			20				375
			YEAR-3			40				750
			Eligible to be awarded Bachelor of Science in Geology *on Exit*			126	Marks (Year: I+II+III)			2325

MJ = Major, MI = Minor Course, DSE = Discipline Specific Elective Course, CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical

SEMESTER-V

MAJOR (MJ)

MJ-8: Metamorphic Petrology **Credits 04 (Full Marks: 75)**

MJ-8T: Metamorphic Petrology (Theory) **Credits 03 (45 Lectures)**

Course contents:

Unit 1: Introduction to Metamorphism
Definition of metamorphism; factors controlling metamorphism; limits of metamorphism. Types of metamorphism – on the basis of factors (dynamic, thermal, dynamothermal); on the basis of settings (contact, regional, fault zone metamorphism, impact metamorphism), Metasomatism: Protoliths of metamorphic rocks; Progressive and Retrogressive metamorphism; Metamorphic mineral reactions.

Unit 2: Phase equilibria in metamorphism
Concept of equilibrium; Gibbs Phase Rule and Mineralogical phase rule of closed and open system, Graphical relations in metamorphic assemblages – Interpretation and representation of mineral assemblages and mineral paragenesis; ACF, AKF and AFM diagrams; Quantification of equilibrium in metamorphism Metamorphic rocks as geochemical systems; Application of chemical thermodynamics in homogeneous phase equilibria; Geothermobarometry.

Unit 3: Genetic classification of metamorphism
Grade, Zone and metamorphic facies; metamorphic zones and isograds; Metamorphic Facies Series; Paired Metamorphic Belt.

Unit 4: Metamorphism vis-à-vis Deformation
Relationship between metamorphism and deformation; structure and textures of metamorphic rocks, Interpretation of porphyroblast – Si – Se relations.

Unit 5: Types of Metamorphism
Progressive metamorphism of pelitic and basic rocks; Contact metamorphism of impure limestone.

Unit 6: Granulites and Crustal anatexis
Introduction, mode of occurrence, lithology, structure, P-T estimation in granulite, origin; Role of fluids in granulite petrogenesis. Crustal anatexis, Partial melting in metamorphic rocks; Migmatites: Definition, types and their origin.

Unit 7: Metamorphic rock associations and plate tectonic settings
Heat flow and metamorphism. Role of plate tectonics in metamorphism; Pressure-Temperature-time paths and their interpretation; Types of metamorphism in plate boundaries (subduction zone, mid oceanic rift and continent-continent collision zone) and plate interior.

MJ-8P: Metamorphic Petrology (Practical) **Credits 01 (30 Hrs.)**

Course Outline:

Megascopic and microscopic study (textural and mineralogical) of common metamorphic rocks : Slate, phyllite, chlorite schist, muscovite-biotite schist , sillimanite-kyanite schist, amphibolites, marble, garnet-biotite gneiss, metagranitoid, orthopyroxene granulite, 2-pyroxene granulite, khondalite, calc granulite.
Laboratory exercises in graphic plots for composition paragenesis diagrams.
Determination of equilibrium P-T-fluid composition using thermodynamic expressions.

References:

1. Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
2. Philpotts, A., & Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.
3. Frost, B. R. and Frost, C. D. (2019). Essentials of Igneous and Metamorphic Petrology, 2nd ed. Cambridge University Press
4. Vernon, R. H. & Clarke, G.L. (2008) Principles of Metamorphic Petrology, Cambridge University Press.
5. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.
6. Yardley, B. W., & Yardley, B. W. D. (1989). An introduction to metamorphic petrology. Longman Earth Science Series.
7. Myron G. Best (2001). Igneous and Metamorphic Petrology, 2nd ed. Wiley-Blackwell

MJ-9: Principle of Stratigraphy and Precambrian Stratigraphy of India Credits 04 (FM: 75)

MJ-9T: Principle of Stratigraphy and Precambrian Stratigraphy of India (Theory) Credits 04

Course contents: (60 Lectures)

Unit 1: Principles of stratigraphy

1. Fundamentals of lithostratigraphy, biostratigraphy and chronostratigraphy.
2. Introduction to concepts of dynamic stratigraphy (Chemostratigraphy, Seismic stratigraphy, Sequence stratigraphy).
3. Relevance of Type section.
4. Principles of stratigraphic correlation.

Unit 2: Code of stratigraphic nomenclature

1.International Stratigraphic Code – development of a standardized stratigraphic nomenclature
2. Concepts of Stratotypes. Global Stratotype Section and Point (GSSP)
3. Brief introduction to the concepts of lithostratigraphy, biostratigraphy, chronostratigraphy, seismic stratigraphy, chemostratigraphy, magnetostratigraphy, sequence stratigraphy and their subdivisions with Indian examples

Unit 3: Principles of stratigraphic analysis Facies concept in stratigraphy

1. Walther's Law of Facies.
2. Concept of paleogeographic reconstruction

Unit 4: Physiographic and tectonic subdivisions of India

1. Brief introduction to the physiographic and tectonic subdivisions of India
2. Introduction to Indian Shield, Craton
3. Introduction to Indian Precambrian belts.
4. Introduction to Proterozoic basins of India

Unit 5: Geologic evolution of Important Precambrian terrains

1. Geologic evolution with emphasis on sedimetation, lithology, magmatism, structure, metamorphism and geochronology of: Singhbhum, Dharwar, Rajasthan, Central India and Eastern Ghats.
2. Vindhyan and Cudappah basins of India.

Unit 6: Stratigraphic boundaries in India

1. Archaean-Proterozoic boundary.
2. Precambrian-Cambrian boundary and their status in global perspective.

Suggested Reading:

1. Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers, Delhi
2. Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley
3. Ramakrishnan, M. &Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.
4. Valdiya, K. S. (2010). The making of India, Macmillan India Pvt. Ltd.

MJ-10: Phanerozoic Stratigraphy of India **Credits 04(Full Marks: 75)**

MJ-10T: Phanerozoic Stratigraphy of India (Theory) **Credits 06 (60 Lectures)**

Course contents:

Unit 1: Important Phanerozoic successions in India

Important Palaeozoic successions in India with emphasis on succession, lithology, flora and fauna, correlation and palaeoenvironment of the following:

1. Paleozoic & Mesozoic of extra peninsular India:
   a) Paleozoic & Mesozoic of Spiti,
   b) Paleozoic of Kashmir
   c) Siwalik successions
2. Stratigraphy of peninsular India: a. Gondwana basins, b. Stratigraphy of the intertrappeans Deccan, Rajmahal, Sylhet Trap
3. Stratigraphy of Coastal regions:
   a) Jurassic of Kutch,
   b) Cretaceous successions of Cauvery basins,
   c) Stratigraphy and structure of Krishna-Godavari basin
4. Cenozoic stratigraphy of India:
   a. Bengal, Assam, Andaman and Arakan basins.
   b. Bombay offshore basin

Unit 2: Important boundaries

Important Stratigraphic boundaries during Phanerozoic time in India –

a) Permian-Triassic boundary, and
b) Cretaceous-Tertiary boundary.

Unit 3: Quaternary Geology

Principles of subdivision of Quaternary succession in India.

Suggested readings:

1. Doyle, P. & Bennett, M. R. (1996). Unlocking the Stratigraphic Record. John Wiley
2. Hedberg, H.D. (Editor), 1976. International stratigraphic guide. John Wiley & Sons, New York, 200.
3. Krishnan, M. S. (1982). Geology of India and Burma, C.B.S. Publishers, Delhi
4. Krumbein, W. and Sloss, L. (1963) Stratigraphy and Sedimentation. W.H. Freeman and Co., San Francisco, 660 p.
5. Ramakrishnan, M. &Vaidyanadhan, R. (2008). Geology of India Volumes 1 & 2, Geological Society of India, Bangalore.
6. Ravindra Kumar. Fundamentals of Historical Geology and Stratigraphy of India. 3rd Ed.

7. New Age International Private Limited
8. Schoch, Robert, M. (1989): Stratigraphy: Principles and Methods, Van Nostrand Reinhold, New York.
9. Valdiya, K. S. (2010). The making of India, MacMillan India Pvt. Ltd.

MAJOR ELECTIVE (DSE)

Major Elective -1: Geodynamics **Credits 04(Full Marks: 75)**

MJ DSE-1T: Geodynamics (Theory) **Credits 04 (60 Lectures)**

Course contents:

Unit-1: Fundamentals of geodynamics

1. Definition. Continental and oceanic crust. Internal processes of earth
2. Concept of lithosphere and asthenosphere. Physical character of lithosphere and asthenosphere. Concept of plate.
3. Concept of hot spot and mantle plume. Ophiolites.

Unit-2: Continental Drift, Sea floor spreading and Plate tectonics

1. Wegner Continental drifts hypothesis and its evidences. Continental position in the past.
2. Sea-floor spreading process and its evidences.
3. Plate tectonics model and its evidences. Distribution of plates in the Earth

Unit-3: Plate and Plate boundaries

1. Plates: Physical character of plates. Macro and micro plates.
2. Plate boundaries: types, character, Identification of boundaries. Movement of plates along boundaries. Plate velocities.
3. Volcanic arcs, island arcs, trenches, accretionary prisms, oceanic ridges, transform faults. Magmatism in oceanic ridges and in subduction zones

Unit-4:

1. Palaeomagnetism and motion of plates
2. Driving mechanisms of plates. Plate tectonics and mantle convection.
3. Supercontinents and their breakup and assembly. Wilson cycle

Suggested Readings:

1. Condie,K.C., 1982.PlateTectonicsand CrustalEvolution.2ndEdition,Pergamon Press.
2. Keary,P.,Klepeis,K.A.andVine,F.J.,2009.GlobalTectonics.3rdEdition,Wiley- Blackwell.
3. Brown,G.C.and Mussett,A.E.,1993.TheInaccessibleEarth.2ndEdition,Chapman&Hall, London.
4. Moores, E.M. and Twiss,R.J., 1995. Tectonics. W.H. Freeman.

MINOR (MI)

Minor (MI)-5: Resource Geology **Credits 04(Full Marks: 75)**

Minor (MI)-5T: Resource Geology **Credits 03 (45 Lectures)**

Course contents:

Unit 1:

1. Resource reserve definitions; difference between reserve and resources. mineral, energy and water resources.
2. A brief overview of classification of mineral deposits with respect to processes of formation

Unit 2:

1. Difference between Energy, Power and Electricity.
2. Renewable and Non- Renewable Sources of Energy
3. The concept and significance of Renewability: Social, Economic, Political and Environmental Dimension of Energy

Unit 3:

1. Resources of Coal, Natural Oil, Gas and Nuclear Minerals
2. Potential of Hydroelectric Power, Solar Energy, Wind, Wave and Biomass Based power and Energy

Unit 4:

1. Ground water resources in India, its role in economic development of the country and societal impact.
2. Current Scenario and Future Prospects of Solar Power, Hydrogen Power and Fuel Cells.

Minor (MI)-5P: Resource Geology **Credits 01 (30 hrs.)**

1. Study of coal in Hand specimen
2. Plotting of major Indian oil fields on map of India

Suggested Readings:

1. Energy and the Environment by Fowler, J.M 1984. McGraw-Hill
2. Energy Resources and Systems: Fundamentals and Non-Renewable Resources by Tushar K. Ghosh and M. A. Prelas. 2009, Springer
3. Introduction to Wind Energy Systems: Hermann-Josef Wagner and Jyotirmay Mathur. 2009, Springer.
4. Renewable Energy Conversion, Transmission and Storage. Bent Sorensen, 2007

SEMESTER-VI

MAJOR (MJ)

MJ-11: Economic Geology **Credits 04 (Full Marks: 75)**

MJ-11T: Economic Geology (Theory) **Credits 03 (45 Lectures)**

Course contents:

Unit 1: Concept of Economic Geology

1. Importance of economic geology and its historical development.
2. Ores, gangue minerals, tenor, grade and lodes.
3. Resources and reserves- Economic and Academic definitions

Unit 2: Mineral deposits and classical concepts of ore formation

1. Mineral occurrence, Mineral deposit and ore deposit
2. Historical concepts of ore genesis: Man's earliest vocation- Mining
3. Plutonist and Neptunist concepts of ore genesis
4. Metallogenic provinces and epochs

Unit 3: Mineral exploration

1. Exploration and exploitation techniques
2. Brief idea on: Remote Sensing, Geophysical and Geochemical Explorations
3. Geological mapping at different scales, drilling, borehole logs and transverse sections

Unit 4: Ore forming processes

1. Endogenous processes: Magmatic concentration, skarns, greisens, and hydrothermal deposits
2. Exogenous processes: weathering products and residual deposits, oxidation and supergene enrichment, placer deposits, bedded deposits.

Unit 5: Structure and texture of ore deposits

Concordant and discordant ore bodies

Unit 6: Ore grade and Reserve

Assessment of ore grade and reserve, reserve estimation

Unit 7: Metallic and Non-metallic ore deposits

1. Important deposits of India including atomic minerals: Study of geologic set up, modes of occurrences, mineralogy and genesis of the following ore deposits in India - Iron ore in Singhbhum and Karnataka, Manganese of Central India, Copper of Malanjkhand, lead-zinc of Zawar area, Uranium of Singhbhum.
2. Non-metallic and industrial rocks and minerals, in India.
3. Introduction to gemstones.

MJ-11P: Economic Geology Lab (Practical) **Credits 01 (30 hrs.)**

Course Outline:

1. Hand sample identification of important ores and non-metallic minerals
2. Study of microscopic properties of ore forming minerals (Oxides and sulphides)
3. Preparation of maps: Distribution of important ores and other economic minerals in India

Suggested Readings

1. Guilbert, J.M. and Park Jr., C.F. (1986) The Geology of Ore deposits. Freeman & Co. Bateman, A.M. and Jensen, M.L. (1990) Economic Mineral Deposits. John Wiley.
2. Evans, A.M. (1993) Ore Geology and Industrial minerals. Wiley
3. Laurence Robb. (2005) Introduction to ore forming processes. Wiley.
4. Gokhale, K.V.G.K. and Rao, T.C. (1978) Ore deposits of India their distribution and processing, Tata-McGraw Hill, New Delhi.
5. Deb, S. (1980) Industrial minerals and rocks of India. Allied Publishers.
6. Sarkar, S.C. and Gupta, A. (2014) Crustal Evolution and Metallogeny in India. Cambridge Publications.

MJ-12: Hydrology **Credits 04 (Full Marks: 75)**

MJ-12T: Hydrology (Theory) **Credits 03 (45 Lectures)**

Course contents:

Unit 1: Introduction and basic concepts

1. Scope of hydrogeology and its societal relevance. Global and Indian distribution of water resource.
2. Hydrologic cycle: precipitation, evapo-transpiration, run-off, infiltration and groundwater flow. Basic concept of hydrographs Origin of groundwater, Vertical distribution of subsurface water, Genetic classification of groundwater.
3. Classification of rocks with respect to water bearing characteristics, geomorphic and geologic controls of groundwater, Types of aquifer– unconfined, confined and semiconfined. Water table and piezometric surface. Groundwater provinces in India and West Bengal.
4. Rock properties affecting groundwater: Porosity, void ratio, specific retention and Storage coefficient - specific yield, specific storage and storativity, Transmissivity, Anisotropy and heterogeneity of aquifers.

Unit 2: Groundwater flow

1. Darcy's law and its validity; Reynold's Number, laminar flow and turbulent flow. Groundwater velocity.
2. Intrinsic permeability and hydraulic conductivity, Measurement of hydraulic conductivity in laboratory – Constant Head Permeameter and Falling (Variable) Head Permeameter. Water Table and Piezometric surface contour maps and Groundwater flow direction, Laminar and turbulent groundwater flow

Unit 3: Well hydraulics and Groundwater exploration

1. Basic Concepts (drawdown; specific capacity etc)
2. Elementary concepts related to equilibrium and non-equilibrium (Steady and unsteady) conditions for groundwater flow to a well
3. Surface-based groundwater exploration methods Introduction to subsurface borehole logging methods

Unit 4: Groundwater chemistry

1. Physical, chemical and bacteriological properties of water and water quality
2. Introduction to methods of interpreting groundwater quality data using standard graphical plots
3. Elementary concept on Groundwater pollution: Arsenic, Fluoride and Nitrate, Sea water intrusion in coastal aquifers - Ghyben-Herzberg Relation

Unit 5: Groundwater management

Surface and subsurface water interaction. Recharge and discharge areas. Ground water level fluctuations. Effects of Climate Change on Ground water.

MJ-12T: Hydrology (Practical) **Credits 01 (30 hrs.)**

Course Outline:

1. 1.Preparation and interpretation of depth to water level maps and water level contour maps.
2. Water potential zones of India (map study)
3. Graphical representation of chemical quality data and water classification (C-S and Trilinear diagrams).

Suggested Reading:

1. Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.
2. Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
3. Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGraw-Hill Pub. Co. Ltd.
4. Raghunath H, M. 2007, Groundwater, 3rd Ed. New Age International Publishers , New Delhi

MJ-13: Exploration Geology **Credits 04 (Full Marks: 75)**

MJ-13T: Exploration Geology (Theory) **Credits 03 (45 Lectures)**

Course contents:

Unit-1: Mineral Resources
Resource: Definitions, Mineral resources in industries – historical perspective and present scenario, classification of mineral deposits with respect to processes of formation; exploration strategies.

Unit-2: Prospecting and Exploration
1. Principles of mineral exploration
2. Prospecting and exploration: conceptualization, methodology and stages, Sampling, subsurface sampling including pitting, trenching and drilling
3. Geochemical exploration.
4. Outline of exploration techniques for ferrous and non-ferrous metals, limestone and coal and petroleum.

Unit-3: Evaluation of data
Evaluation of sampling data - Mean, mode, median, standard deviation and variance

Unit-4: Drilling and Logging
1. Core and non-core drilling
2. Planning of bore holes and location of boreholes on ground Core-logging

Unit-5: Reserve estimations
1. Principles of reserve estimation, Factors affecting reliability of reserve estimation.
2. Reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks).
3. Regular and irregular grid patterns.

MJ-13P: Exploration Geology (Practical) **Credits 01 (30 hrs.)**

Course Outline:

1. Identification of anomaly: Gravity and Magnetic.
2. Concept of weighted average in anomaly detection.

Suggested Reading:

1. Clark, G.B. 1967. Elements of Mining.3rd Ed. John Wiley & Sons.
2. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4 th Ed. Oxford- IBH.
3. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing.

MAJOR ELECTIVE (DSE)

Major Elective -2: Fuel Geology **Credits 04(Full Marks: 75)**

MJ DSE-2T: Fuel Geology (Theory) **Credits 03 (45 Lectures)**

Course contents:

Unit 1: Energy Resources
Different Sources of energy: Global and Indian scenario

Unit 2: Coal
1. Definition and origin of Coal
2. Basic classification of coal.
3. Fundamentals of Coal Petrology - Introduction to lithotypes, microlithotypes and macerals in coal
4. Proximate and Ultimate
5. Major coal basins of India

Unit 3: Coal as a fuel
1. Concept of clean coal technology
2. Coal Bed Methane (CBM): global and Indian scenario
3. Underground coal gasification
4. Liquefaction of coal

Unit 4: Petroleum
1. Chemical composition and physical properties of crudes oil
2. Origin and migration of petroleum
3. Kerogen: Maturation of kerogen; Biogenic and Thermal effect

Unit 5: Petroleum Reservoirs and Traps
1. Reservoir rocks: general attributes and petrophysical properties.
2. Cap Rocks: definition and general properties
3. Hydrocarbon traps: definition, Classification of hydrocarbon traps - structural, stratigraphic and combination
    a. Time of trap formation and time of hydrocarbon accumulation.
    b. Plate tectonics and global distribution of hydrocarbon reserves
    c. Petroliferous basins of India

Unit 6: Other fuels
1. Nuclear Fuel
2. Gas Hydrate

MJ DSE-2P: Fuel Geology (Practical) **Credits 01 (30 hrs.)**

1.Study of hand specimens of coal
2. Reserve estimation of coal
3. Panel and Fence diagrams

References:

1.Thomas, L., 2020. Coal Geology (Third Edition), Wiley-BlackwelSuarez-Ruiz, I. and Crelling, J.C., 2008.
2. Demirbas, A., 2010. Methane Gas Hydrate. Springer
3.Chandra D., 2007. Chandra's Textbook on Applied Coal Petrology. Jijnasa Publishing House
4.Chandra, D., Singh, R.M. and Singh, M.P., 2000. Textbook of Coal (Indian Context). Tara Book Agency, Varanasi
5.Diessel, C.F.K., 1992. Coal-Bearing Depositional Systems. Springer
6.Francis, W., 1964. Coal its Formation and Composition. Edward Arnold
7.Singh, M.P., 1998. Coal and Organic Petrology. Hindustan Publ. Corp., New Delhi.
8. Ward, C.R., 1984. Coal Geology and Coal Technology. Blackwell Science
9.Thakur, P., Schatzel, S.J., Aminian, K., Rodvelt, G., Mosser, M.H., D'Amico, J.S., 2020. Coal Bed Methane – Theory and Applications (Second Edition), Elsevier
10.Flores, R.M., 2014. Coal and Coalbed Gas – Fueling the Future. Elsevier
11. Singh, Ajay Kumar and Hajra, Partha Narayan, 2018. Coalbed Methane in India – Opportunities, Issues and Challenges for Recovery and Utilization. Springer
12. Letcher, T.M., 2020. Future Energy – Improved, Sustainable and Clean Options for our Planet (Third Edition). Elsevier
13. Bell, D.A., Towler, B.F. and Fan, M., 2011. Coal Gasification and Its Applications. Elsevier
14. Massey, L.G., 1973. Coal Gasification. American Chemical Society
15. Whitehurst, D.D., 1980. Coal Liquefaction Fundamentals. American Chemical Society
16. Shelly R.C., 2014. Elements of Petroleum Geology (Third Edition). Academic Press
17. Bjorlykke, K., 1989. Sedimentology and Petroleum Geology. Springer
18. Tissot, B.P. and Welte, D.H., 1984. Petroleum Formation and Occurrence. Springer
19. Levorsen, A.I., 2004. Geology of Petroleum; CBS Publishers and Distributors, India
20. North, F.K., 1986. Petroleum Geology, Allen & Unwin
21. Bastia, R. and Radhakrishna, M., 2012. Basin Evolution and Petroleum Prospectivity of the Continental Margins of India. Elsevier
22. Doveton, J.H., 1986. Log Analysis of Subsurface Geology. Wiley-Interscience
23. Hobson, G.D., 1977. Developments in Petroleum Geology. Applied Science Publishers
24. Aswathanarayana, U., 1985. Principles of Nuclear Geology. Oxford
25. Boyle, R.W., 1982. Geochemical Prospecting for Thorium and Uranium Deposits. Elsevier

MINOR (MI)

Minor (MI)-6: Geotectonics **Credits 04(Full Marks: 75)**

Minor (MI)-6T: Geotectonics (Theory) **Credits 04 (60 Lectures)**

Course contents:

Unit 1: Introduction

1. Definition. Continental and oceanic crust. Internal processes of earth.
2. Concept of lithosphere and asthenosphere. Physical character of lithosphere and asthenosphere. Concept of plate.

Unit 2: Plate and Plate boundaries

1. Plates: Physical character of plates. Macro and micro plates.
2. Plate boundaries: types, character, Identification of boundaries. Movement of plates along boundaries. Plate velocities.
3. Volcanic arcs, island arcs, trenches, accretionary prisms, oceanic ridges, transform faults.

Unit 3: Continental Drift, Sea floor spreading and Plate tectonics

1. Wegner Continental drifts hypothesis and its evidences. Continental position in the past
2. Sea-floor spreading process and its evidences.
3. Plate tectonics model and its evidences. Distribution of plates in the Earth

Unit 4: Plate Motion

1. Palaeomagnetism and motion of plates
2. Driving mechanisms of plates. Plate tectonics and mantle convection.
3. Supercontinents and their breakup and assembly. Wilson cycle

Suggested Readings

1. Condie,K.C., 1982.PlateTectonicsand CrustalEvolution.2ndEdition,Pergamon Press.
2. Keary,P.,Klepeis,K.A.andVine,F.J.,2009.GlobalTectonics.3rdEdition,Wiley- Blackwell.
3. Brown,G.C.andMussett,A.E.,1993.TheInaccessibleEarth.2ndEdition,Chapman&Hall, London.
4. Moores, E.M. and Twiss,R.J., 1995. Tectonics. W.H. Freeman.