DEPARTMENT OF GEOLOGY
SEMESTER – VI
BSC (H) Geology
Category - I

DISCIPLINE SPECIFIC CORE COURSE - DSC – 16: Remote Sensing and GIS (L3, P1)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC – 16: Remote Sensing and GIS (L3, P1)	**4**	**3**	**0**	**1**	**12th pass with science**	**Studied Earth System Science and Equivalent**

Learning Objectives

This course is intended to provide basic understanding of remote sensing, geographic information system and photogrammetry. The course also aims to familiarize the students with utilization of geo-processing tools in the field of geosciences.

Learning outcomes

After completing this course, the students will understand the basics of remote sensing and GIS techniques and their applications in various fields of the Earth Sciences. They will be able to utilize open source image processing and GIS software to make basic image correction and thematic maps. They will be able to integrate the GNSS and field-based data with the GIS to create maps for further analysis.

SYLLABUS OF DSC-16
Theory (45 hours)

UNIT – I (12 hours)

Detailed content

Fundamentals of remote sensing: Concept of remote sensing, electromagnetic spectrum, atmospheric windows, remote sensing system, sensors and scanners, remote sensing platforms, image resolution, data procurement, data formats- raster and vector, digital image processing.

UNIT – II (12 hours)

Detailed contents

Photogeology: Types and acquisition of aerial photographs, concept of scale and resolution; Principles of stereoscopy, relief displacement, vertical exaggeration and distortion. Elements of air photo interpretation, identification of the primary and secondary structures of rocks, lithology, landforms and surface processes.

UNIT – III (11 hours)

Detailed contents

Geographic Information System (GIS): Introduction to GIS, datum, coordinate systems and projection systems, spatial data models and data editing. Introduction to digital elevation model (DEM) analysis. Spatial and Temporal interpolation of datasets.

UNIT – IV (10 hours))
Detailed contents
Global navigation satellite systems (GNSS): Introduction to GNSS, GPS, GPS signals. Integrating GNSS data with GIS; GNSS applications in earth system sciences and disaster studies.

Practical Component- (30 Hours)
Introduction to QGIS software, plugins in QGIS, data procurement, creating FCC from raw data, Registration of satellite images, Image enhancement, Classification of images (Visual interpretation), Classification of images (Supervised and Unsupervised), Identification of geological structures, landforms and surface processes. Stereo viewing of images. Vector data editing, Generating slope map, aspect map and drainage network map, Spatial interpolation of datasets, Introduction to GPS.

Essential/recommended readings
Gupta, R.P. Remote Sensing Geology, Springer
Bhatta, B., Remote Sensing and GIS, 2nd Edition, Oxford.
Joseph, G., and Jeganathan, C., Fundamental of Remote Sensing, University Press, Hyderabad.

Suggestive readings
Gupta, R.P. Remote Sensing Geology, Springer
Joseph, G., and Jeganathan, C., Fundamental of Remote Sensing, University Press, Hyderabad.
Demers, M.N., 1997. Fundamentals of Geographic Information System, John Wiley & sons. Inc.
Hoffmann-Wellenhof, B., Lichtenegger, H. and Collins, J., 2001. GPS: Theory & Practice, Springer Wien New York.
Jensen, J.R., 1996. Introductory Digital Image Processing: A Remote Sensing Perspective, Springer-Verlag.
Lillesand, T. M. & Kiefer, R.W., 2007. Remote Sensing and Image Interpretation, Wiley.
Richards, J.A. and Jia, X., 1999. Remote Sensing Digital Image Analysis, Springer-Verlag.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – DSC – 17: Fuel Geology ((L3, P1)

Credit distribution, Eligibility and Prerequisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC – 17: Fuel Geology (L3, P1)	4	3	0	1	12th pass with science	Studied Stratigraphy, Earth System Science, Structural Geology or Equivalent

Learning Objectives

The course on fuel geology is intended to provide basic scientific knowledge and understanding about the natural fossil fuels i.e., petroleum and coal to students of geology. Because use of petroleum resources and its exploration is the most powerful driving forces shaping our modern world.

Learning outcomes

After completion of this course students will be able to understand and comprehend the processes involved in generation of hydrocarbons and the formation of coal and the exploration methods. Students will also have a comprehension about the conventional and non-conventional fuels and their demand through time.

SYLLABUS OF DSC- 17

Theory (45 hours)

UNIT – I (9 hours)

Detailed contents

Coal: Definition and origin of Coal; Classification of coal; Fundamentals of Coal Petrology - Introduction to lithotypes, microlithotypes and macerals in coal, Proximate and Ultimate analysis.

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UNIT – II (9 hours)

Detailed contents

Coal as a fuel: Coal Bed Methane (CBM): global and Indian scenario**;** Underground coal Gasification**;** Coal liquefaction

UNIT – III (9 hours)

Detailed contents

Petroleum: Chemical composition and physical properties of crudes in nature; Origin of petroleum; Maturation of kerogen; Biogenic and Thermal effect. Van Krevelen diagram

UNIT – IV (9 hours)

Detailed contents

Oil migration: Primary and secondary. Role of capillary pressure and Buoyancy. Petroleum Reservoirs and Traps: Reservoir rocks: general attributes and petrophysical properties.

UNIT – V (9 hours)

Detailed contents

Classification of reservoir rocks - clastic and chemical. Hydrocarbon traps: definition, Structural, Stratigraphic and Mixed. Time of trap formation and time of Hydrocarbon accumulation. Cap rocks - definition and general properties. Plate tectonics and global distribution of hydrocarbon reservoir.

Practical Component- (30 Hours)

Study of hand specimens of coal. Reserve estimation of coal. Section correlation and identification of hydrocarbon prospect. Panel and Fence diagrams

Essential/recommended readings

Shelly R. C. (2014). Elements of Petroleum geology: Third Edition, Academic Press.
Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.

Suggestive readings (if any)

Shelly R. C. (2014). Elements of Petroleum geology: Third Edition, Academic Press.
Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.
Chandra D. (2007). Chandra's Textbook on applied coal petrology. Jinasa Publishing House
North, F.K., 1985 Petroleum Geology
Bastia, R., & Radhakrishna, M. (2012). Basin evolution and petroleum prospectivity of the continental margins of India (Vol. 59). Newnes.

DISCIPLINE SPECIFIC CORE COURSE– DSC – 18: Paleoceanography and Paleoclimate (L3, P1)

Credit Distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC – 18: Paleoceanography and Paleoclimate (L3, P1)	**4**	**3**	**0**	**1**	**12th pass with science**	**Studied Earth System Science, Structural Geology, and Mineralogy or Equivalent**

Learning Objectives
The course is intended to make students aware about the climate changes through geological time periods, the chaotic nature of the Climate System, its behaviour at various time scales, and its influence on biotic system. Students will also be introduced to futuristic approaches and projections of the Inter-Governmental Panel of Climate Change, and scientific issues related to climate change. As the Oceans cover 70 percent of the Earth's surface understanding the evolution of oceans through time is essential to understand their role in controlling the earth's climate at various time scales.

Learning Outcomes:
After completing the course, the student will be able to comprehend the role of Oceans in controlling the Earth's climate at various time scales. The students will be able to independently interpret the proxy record generated from various paleoclimate archives. Archives. The student will develop an overall understanding of the Ocean-Climate linkages, Tectonics -climate linkages and modern climate change.

SYLLABUS OF DSC-18
Theory (45 hours)

UNIT – I (9 hours)
Detailed contents
Weather, Climate, Components of climate, Climate classification. Insolation, short and long-term changes in Insolation.

UNIT – II (9 hours)
Detailed contents
Aerosols: Definition, origin, role in climate change. Greenhouse gases: Introduction, causes of changing concentration, role in climate change.

UNIT – III (9 hours)
Detailed contents
Origin and evolution of Oceans. Closing and opening of Ocean Gateways and the resultant effect on climate. Climate of the Arctic and Antarctica through the ages. Bipolar See Saw, Polar Amplifications. Ice core studies and climate change. Oceanic sediments, Terrigenous, biogenic sediments, and their distribution.

UNIT – IV (9 hours)
Detailed contents
Sea-level: factors affecting sea-level changes, Short and long-term sea-level variability, evidence of sea-level change from marine sediments. Ocean-climate linkage. Effect of topography/tectonics on climate. Natural variability in climate. Human influence on climate change.

UNIT – V (9 hours)
Detailed contents
Historical evidence of climate change. Effects of climate change on mankind. Sampling methods for retrieving archives of climate/oceanographic change. Various dating methods of the marine cores., merits and demerits of various dating methods Paleoclimatic/paleoceanographic reconstruction from archives. Elemental and isotopic analysis for paleoclimatic/paleoceanographic reconstruction, Instruments used for paleoclimatic/paleoceanographic studies. Modeling climate change, IPCC climate change projections.

Practical Component- (30 Hours)
Processing of marine core samples for paleoclimatic/ paleoceanographic studies. Exercises in oceanography. Interpretation of various types of paleoceanographic and paleoclimatic data.

Essential/recommended readings
Bradley, R.S., Paleoclimatology: Reconstructing Climates of the Quaternary, Academic. Press.
Brasier, M.D. 1980 Microfossils, George Allen and Unwin.

Suggestive readings
Frank J Millero, Chemical Oceanography, CRC Press, Taylor and Francis Group, 2013
Alan Trujillo (Author), Harold Thurman (Author), Essentials of Oceanography 13th Edition, 2023, Pearson Education.
Bradley, R.S., Paleoclimatology: Reconstructing Climates of the Quaternary, Academic. Press.
Brasier, M.D. 1980 Microfossils, George Allen and Unwin.
Cronin, T.M., 1999. Principles of Paleoclimatology, Columbia University Press.
Fischer, G. and Wefer, G 1999 Use of Proxies in Paleoceanography: Examples from the South Atlantic, Springer.
Haq and Boersma, 1978. Introduction to Marine Micropaleontology, Elsevier.
Kennett, J.P.1982 Marine Geology, Prentice-Hall Inc.
North, G.R. and Crowley, T.J., 1995. Palaeoclimatology, Oxford University Press
Schopf, TJ.M., 1980. Paleoceanography, Harvard University Press.
Tolmazin, D., 1985. Elements of Dynamic Oceanography, Allen and Unwin.