



KARNATAK UNIVERSITY, DHARWAD  
ACADEMIC (S&T) SECTION  
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ  
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ



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'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SSL-394A/2022-23/1056

Date: 23 SEP 2022

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2022-23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳಿಗೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್  
NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

- ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ  
ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ-1), ದಿ:7.8.2021.  
2. ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯ ಸಭೆಯ ಠರಾವುಗಳ ದಿನಾಂಕ: 06.09.2022  
3. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂ. 01, ದಿನಾಂಕ: 17.09.2022  
4. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 22-09-2022

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2022-23ನೇ  
ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ  
(NEP)-2020 ರಂತೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗಾಗಿ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ  
ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. [www.kud.ac.in](http://www.kud.ac.in) ಅಂತರ್ಜಾಲದಿಂದ ಡೌನ್‌ಲೋಡ  
ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತಾ, ವಿದ್ಯಾರ್ಥಿಗಳು ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ  
ಕಾರ್ಯಪ್ರವೃತ್ತಿರಾಗಲು ಕವಿವಿ ಅಧೀನದ / ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಕುಲಸಚಿವರು.

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ  
ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಮಂಡಳ (ಪಿ.ಜಿ.ಪಿ.ಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ  
ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

**KARNATAK UNIVERSITY, DHARWAD**



**04 - Year B.Sc. (Hons) Programme**

**SYLLABUS FOR  
GEOLOGY**

**FOR SEM - III**

**DSCC-05: Geology (Theory)-I (Code: 033GEG011)**

**DSCC-06: Geology (Practical)-II (Code: 033GEG012)**

**OEC-03: Marine Geology (Code: 003GEG051)**

**FOR SEM - IV**

**DSCC-07: Geology (Theory)-I (Code: 034GEG011)**

**DSCC-08: Geology (Practical)-II (Code: 034GEG012)**

**OEC-04: Geology and Society (Code: 004GEG051)**

**EFFECTIVE FROM-2022-23**

**AS PER N E P – 2020**

**KARNATAK UNIVERSITY, DHARWAD**

**SYLLABY AND COURSES OF STUDY IN GEOLOGY (B.Sc NEP-2020 Pattern)**

**Effective from-2022-23**

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC-5 Geology (Theory)-V	033GEG011	04 Hrs	56	02 Hrs	40	60	100	04
	DSCC-6 (Practical)-VI	033GEG012	04 Hrs	52	03 Hrs	25	25	50	02
	OEC-3 Marine Geology	003GEG051	03 Hrs	42	02 Hrs	40	60	100	03
IV	DSCC-7 Geology (Theory)-VII	034GEG011	04 Hrs	56	02 Hrs	40	60	100	04
	DSCC-8 Geology (Practical)-VIII	034GEG012	04 Hrs	52	03 Hrs	25	25	50	02
	OEC-4 Geology and Society	004GEG051	03 Hrs	42	02 Hrs	40	60	100	03

**\* Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected.**

**Study Tour/Field work/Resource Mapping / Institution visit/ Project /Viva /Mine Visit/ Report/Sample collection.**

Study tour forms integral part of the course. Since it is a field-oriented course as many numbers of field visits will help the student to get an exposure in the subject. Observation mind is very important in the case of Geology students. Combined study tour in II, IV and VI Semester has to be arranged. One study tour can be restricted to the State and another as far as possible in different areas so that students will get good collection of rocks, minerals and fossils. The college museum can also be enriched. Field work, Resource mapping, Geological Institution visit, Mine visit etc are part of the study tour. The students may be trained to write field reports. Sample collections collectively and individually have to be encouraged. They have to prepare a detailed report on the assignment carried out and submit it for the examination for evaluation. Project means a small Group work as decided by the Departmental Council to generate a research mind in the student. It can be their observation on the geological work of ground water, stream, wind, waves or detailed observation of a Quarry, landslide area or flood plain or groundwater conservation, waste management, land use pattern, Resource mapping of a Panchayath etc., as decided by the Departmental Council every year.

Without project and study tour report student should not be allowed to take up the Practical examination. All the male and female students should undergo all these trainings. Viva-Voce should be conducted internally and externally

**Name of Course /Subject: GEOLOGY**

**Programme Specific Outcome (PSO):** On completion of the 03/ 04 years Degree in Geology students will be able to:

**PSO 1:** The study of this paper strengthens student's knowledge with respect to understanding the essentials of the dynamics of earth.

**PSO 2:** The students will understand the origin and age of our Solar system and planets including earth.

**PSO 3:** The students will be able to learn the dynamic nature of the Earth processes. They will learn about the geodynamics of the lithosphere, concept of ocean floor spreading, continental drift and plate tectonics.

**PSO 4:** The courses designed for the students of understand geomorphological features of developed during glaciations, circulation of groundwater and oceans and coastal land forms.

**PSO 5:** To determine possible causes of formation of structures and forces responsible for it. This course also helps to know the relation of structure with tectonics.

**PSO 6:** Learn how to read geological features occurred by different endogenic process.

**PSO 7:** Collaborative learning is encouraged during the field training programmes and educational tours

**PSO 8:** Overall development of an ethical sense and increasing awareness in terms of gender sensitization, cleanliness, environmental protection etc.

**PSO 9:** Inculcation of value-orientation in students through the promotion of a sensitive attitude towards one's surrounding and culture

**PSO 10:** Assists students in competitive examination (JAM etc.)

<b>THEORY PAPER</b>			
<b>Programme/Class: B. Sc / B. Sc Hons.</b>	<b>Year: Second</b>	<b>Semester: Third</b>	
<b>DSCC-5 Theory (Code: 033GEG011)</b>		<b>Subject: GEOLOGY</b>	
<b>Course Title: Principles of Stratigraphy &amp; Palaeontology</b>		<b>Credits : 4</b>	<b>Total Hrs-56</b>
<b>Course Outcomes (CO):</b>			
<b>After completion of course, Geology (Theory) students will be able to:</b>			
<b>CO-1:</b> Understand and describe the basic principles of Stratigraphy and breaks in stratigraphic successions and their significance.			
<b>CO 2:</b> Understand and explain the elements of stratigraphic classification, Geological Time Scale, Stratigraphic correlation and define typical terms related to stratigraphic studies			
<b>CO 3:</b> Understand and describe the physiographic and geological divisions of India and acquire knowledge about cratons and mobile belts.			
<b>CO 4:</b> Understand and describe the Early Precambrian and Late Precambrian formations of India with emphasis on lithology, classification, age, structure, post- tectonic intrusives, and organic remains and economic resources.			
<b>CO 5:</b> Understand and describe the important Palaeozoic, Mesozoic and Cenozoic formations of India with reference to their distribution, lithology, classification, fossils and age.			
<b>CO 6:</b> Understand and describe the stratigraphy of Karnataka and explain the characteristics of the Precambrian terrain of Karnataka.			
<b>CO 7:</b> Understand and explain significance of palaeontology, the conditions and methods of fossilization, classification and nomenclature of fossils and the basic principles of Taxonomy, Systematics and Binomial nomenclature.			
<b>CO 8:</b> Understand and explain the morphology, classification, geological history and stratigraphic importance of Phylum Protozoa, Phylum Coelenterata – Class Anthozoa, Phylum Brachiopoda, Phylum Mollusca – Classes Pelecypoda, Gastropoda, Cephalopoda.			
<b>CO 9:</b> Understand and describe the morphology, classification, geological history and stratigraphic importance of Phylum Arthropoda – Class Trilobita, Phylum Echinodermata – Class Echinoidea and Phylum Hemichordata – Class Graptolithina.			
<b>CO 10:</b> Understand the basic ideas of Micropalaeontology and describe the characteristics of important plant fossils, morphology, distribution and significance of Gondwana flora.			
<b>UNIT 1</b>			
<b>Principles of Stratigraphy:</b> Concepts in stratigraphy: Basic principles and definitions of stratigraphy, Elements of Stratigraphic classification and code of Stratigraphic nomenclature, Stratigraphic correlation. Brief description of principal stratigraphic units: Lithostratigraphy, Biostratigraphy, Chronostratigraphy. Standard Geological time scale.			<b>14 Hrs</b>
<b>UNIT 2</b>			
<b>Geology of India:</b> Physiographic divisions of India; Brief introduction to the physiographic and tectonic subdivisions of India. Archaean and Proterozoic Formations of Peninsular India–distribution and classification with reference to Karnataka. Sargur Group, Dharwar Super Group, Peninsular Gneiss. <b>Proterozoic:</b> distribution, classification and economic importance of Cuddapah and Kaladgi, Vindhyan, Bhima and Kurnool Groups.			<b>14 Hrs</b>
<b>UNIT 3</b>			
<b>Palaeozoic Group:</b> Palaeozoic rocks of the Spiti. <b>Mesozoic:</b> (i) Triassic successions of Spiti, (ii) Jurassic of Kutch, (iii) Cretaceous successions of Cauvery basins. Cenozoic stratigraphy of India: (i). Kutch basin (ii). Siwalik successions. (iii). Assam basins.			<b>14 Hrs</b>

<p><b>Volcanic provinces of India:</b> Deccan traps: Distribution, lithology and biostratigraphy, classification, intertrappeans, intratrappeans, infratrappeans, Bhag beds and lameta beds, age of Deccan traps, economic importance of Deccan traps. Siwaliks – lithology, distributions, classification, life and age.</p>	
<p><b>UNIT 4</b></p>	
<p><b>Palaeontology:</b> Introduction to palaeontology. Definition and classification of fossils. Types of fossils and fossilization- Modes of Preservation- Fossils of soft parts, fossils of hard parts (unaltered hard parts, altered hard parts (Moulds &amp; Casts, Petrification: Permineralization &amp; Replacement, and Carbonisation) and indirect fossils (Imprints, Traces of Biological Activity: Tracks, Trails and Burrows -Ichnofossils :). Significance of fossils. General classification, morphological characters, distribution and geological history of Following Invertebrate Fossils: Coelenterata, Brachiopods, Lamellibranchia, Cephalopods, Echinodermata, Arthropoda. <b>Microfossils and Classification of Microfossils:</b> Morphology, classification and evolution of foraminifera. Brief study of vertebrate life through ages. Plant fossils through ages. Gondwana flora and their significance.</p>	<p><b>14 Hrs</b></p>

<b>PRACTICALS</b>		
<b>Programme: B. Sc/B. Sc Hons</b>	<b>Year: Second</b>	<b>Semester: Third</b>
<b>Subject: GEOLOGY</b>		
<b>DSCC-6 Practical-VI (Code: 033GEG011)</b>	<b>Course Title: Stratigraphy and Palaeontology</b>	
<b>Max. Marks: 25+25=50</b>	<b>Core: Compulsory</b>	<b>Total= 52 Hrs</b>
<b>I</b>	<b>Stratigraphy</b>	
<b>01</b>	1. Preparation and study of Lithostratigraphic maps of India showing distribution of important geological formations. 2. Dharwar Province (Group), Cuddapah super group, Vindhyan super group, Jurassic of Kutch, Cretaceous of Trichinopoly, Gondwana super group and Deccan Traps.	3 Practical's
<b>II</b>	<b>Palaeontology</b>	
<b>02</b>	Study of fossils showing various modes of preservation– Moulds & Casts, Petrification: Permineralization & Replacement, and Carbonisation, Imprints.	1 Practical
<b>03</b>	Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils.	1 Practical
<b>04</b>	Coelenterata: Calceola, Zaphrentis and Montlivaltia	1 Practical
<b>05</b>	Brachiopoda-Terebratulata, Productus, Spirifer, Rhynchonella.	1 Practical
<b>05</b>	Lamellibranchia-Pectin, Gryphaea, Trigonina, Venus, Exogyra, Alectryonia, Areta and Arca.	1 Practical
<b>06</b>	Gastropods: Turitella, Murex, Cyprea, Voluta, Conus and Physa	
<b>07</b>	Cephalopods: Nautiloids- Nautilus, Orthoceras and Accanthoceras. Ammonoidea: Goniatite, Ceratite, Ammonite and Belemnites. Suture lines in Ammonites.	1 Practical
<b>08</b>	Echinodermata- Clypeaster, Clypeolampus, Breynia, Cidaris, Micraster, Hemiaster, Holaster, Stigmatopygus, Schizaster.	1 Practical
<b>09</b>	Trilobites -Calamine, Dalmanite, Paradoxide, Phacops	1 Practical
<b>10</b>	Plant fossils- Lepidodendron, Calamites, Sigilaria, Glossopteris, Gangamopteris, Neuropteris, Ptilophyllum, Alethopteris, Pecopteris, Sphenopteris.	2 Practical's

#### **References: Stratigraphy and Principles of Stratigraphy**

1. Krishnan, M.S. (1982) Geology of India and Burma, 6th Edition, CBS.
2. Wadia, D.N. (1944) Geology of India, Tata McGraw-Hill.
3. Ravindra Kumar (2020) Fundamentals of Historical Geology and Stratigraphy of India. 2<sup>nd</sup> edition, New Age International Private Limited.
4. Pascoe, E.H. (1954) A Manual of the Geology India and Burma, Govt. of India Publications.
5. Vaidyanathan and Ramakrishnan (2008). Geology of India (Vol. I & II). Geological Society of India, Bangalore.
6. Soman, K. (2013) Geology of Kerala, Geological Society of India, Bangalore.
7. Radhakrishna, B.P and R. Vaidyanadhan (1997) Geology of Karnataka, Geological Society of India, Bangalore.
8. Sanjib Chandra, Sarkar, Anupendra Gupta (2012). Crustal evolution and Metallogeny in India. Cambridge University Press, Delhi, India.

9. Amal Das Gupta (2006). An introduction to Earth Science, World Press Private Limited, Kolkata.

### **References: Palaeontology**

1. Woods, H. (1961) Invertebrate Palaeontology. Cambridge University Press.
2. Romer, A.S. (1966) Vertebrate Palaeontology. 3rd Edn., Chicago Univ. Press.
3. Arnold C,A. (1947) An Introduction to Palaeobotany. McGraw Hill.
4. Haq, B.U. and Boersma, A. (1978) Introduction to marine Micropalaeontology. Elsevier, Netherlands.
5. Raup, D.M. and Stanely, M.S. (1978) Principles of Palaeontology. CBS Publishers.
6. Moore, R.C., Lalicker, C.G. and Fishcher, A.G. (1952) Invertebrate Fossils, Mc-Graw Hill.
7. Shrock, R.R. and Twenhofel, W.H. (1953) Principles of Invertebrate Palaeontology. 2ndEdn. Mc-Graw Hill.
8. Brasier, M.D. (1980) Microfossils. George Allen & Unwin. -29-
9. Bignot, G. (1985) Elements of Micropaleontology. IHRDC-Boston.
10. Nield, E.W.; Tucker, V.C.T. (1985) Palaeontology – An Introduction. Pergamon Press, Oxford, England.
11. Anis Kumar Ray, (2008) Fossils in Earth Sciences, Prentice-Hall of India Pvt. Ltd, New Delhi.



<b>OPEN ELECTIVE SUBJECT (OEC)</b>		
<b>THEORY PAPER- OEC-3</b>		
<b>Programme/Class: B.Sc. / B.Sc. Hons.</b>	<b>Year: Second</b>	<b>Semester: Third</b>
<b>OEC -3 Theory (Code: 003GEG051)</b>	<b>Subject: GEOLOGY</b>	
<b>Credits: 3 L + T + P Model.</b>	<b>Course Title: MARINE GEOLOGY (42 Hrs)</b>	

**Course outcomes:** After completing the course, the student will be able to;

**CO 1:** Understand the morphological features of ocean floor with reference to Indian Ocean and describe the distribution various parameters in sea water and explain eustatic sea level changes.

**CO 2:** Understand and describe the oceanographic expeditions, ocean floor drilling programmes and ocean floor mapping and understand and explain marine pollution.

**CO 3:** Understand and describe the types of coasts and coastal geomorphological features and processes; explain tides and law of the sea.

**CO 4:** Understand and describe the different type of marine sediments and their distribution; explain the mineral resources of ocean floor including coal and petroleum.

### Theory Paper OEC-3:

**Marine Geology Importance of the course:** It is one of the branches of Earth Science. As the oceans cover about 71% of the Earth, study of this subject is important for the exploration of earth to a greater extent as the continental resources are depleting. Therefore, it is a good scope for multidisciplinary students for better understanding of the subject.

<b>Unit-1</b>	Oceanography - Physical properties of sea water, waves, tides and currents, Composition of seawater and processes controlling it. Food-web, primary, secondary and tertiary production. Classification of marine life, planktonic and benthic life in the ocean.	<b>14 hrs.</b>
<b>Unit-2</b>	Geological oceanography: Morphology of Ocean floor, Origin and evolution of the ocean basins. Continental drift, Sea-floor spreading and plate tectonics.	<b>14 hrs.</b>
<b>Unit-3</b>	Marine mineral resources: Distribution and classification of minerals of economic importance in different oceanographic settings: Seawater as sources of elements/minerals. Placer and heavy mineral deposits, petroleum and coal, phosphorites, gas hydrates, poly-metallic nodules, hydrothermal and metalliferous sediments.	<b>14 hrs.</b>

### List of Reference:

1. Alan Strahler (2016) Introducing Physical Geography, 6th Edition, Wiley.
2. Miller, C.B. (2004) Biological Oceanography. Blackwell Publishers. 416p.
3. Paul R. Pinet (1992) Oceanography: An introduction to the Planet Oceanus, West Publ., Co.571p.
4. Thruman, H. V. (1994) Introductory Oceanography. 7th Ed. McMillan Pub., Co.

5. George Karleskint, Richard Turner, James Small, (2012) Introduction to Marine Biology Publisher: Brooks Cole, 512p.
6. Fasham, Michael J.R. (2003) Ocean Biogeochemistry. The Role of the Ocean Carbon Cycle in Global Change Series.
7. Komar, P. D., (1976) Beach Processes and Sedimentation, Prentice-Hall. 429p. 8. Reddy M.P.M. (2001) Descriptive Physical Oceanography, AA Balkema Press. 440p.

**Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks**

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8 <sup>th</sup> Week
Written test-2	10%	1 hr	12 <sup>th</sup> Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC**  
(60 marks for semester end Examination with 2 hrs duration)

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10marks

**Part-B**

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions: 20 marks

**Part-C**

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions: 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.**

<b>THEORY PAPER</b>		
<b>Programme/Class: B.Sc. / B.Sc.Hons.</b>	<b>Year: Second</b>	<b>Semester: Fourth</b>
<b>DSCC-7 Theory-VII (Code: 034GEG011)</b>		<b>Subject: GEOLOGY</b>
<b>Course Title: Structural Geology and Hydrogeology</b>	<b>Credits: 04</b>	<b>Total Hrs: 56</b>
<b>Course Outcome: Structural Geology</b>		
<p><b>CO-1.</b> Describe various structural forms of rocks.  <b>CO-2.</b> Describe concept of brittle and ductile deformation.  <b>CO-3.</b> Describe primary and secondary structural forms.  <b>CO-4.</b> Give classification and describe various types of folds and their recognition criteria.  <b>CO-5.</b> Describe faults on the basis of geometrical pattern.  <b>CO-6.</b> Give classification of joints and describe joints of tectonic origin.  <b>CO-7.</b> Describe fault and mention its types.  <b>CO-8.</b> Give an account of linear and planar structures and describe secondary foliations.</p>		
<b>Course Outcome: Hydrogeology</b>		
<p><b>CO-1.</b> Discuss hydrological cycle and its importance.  <b>CO-2.</b> What is precipitation? Discuss its different types.  <b>CO-3.</b> Explain vertical distribution of water in the crust with diagram.  <b>CO-4.</b> Discuss porosity, permeability, specific yield and specific retention.  <b>CO-5.</b> What is aquifer? Describe their various types.  <b>CO-6.</b> Describe Darcy's Law.  <b>CO-7.</b> Describe physical and chemical characteristics of groundwater.  <b>CO-8.</b> Explain water harvesting and watershed management.  <b>CO-9.</b> Give in detail about natural and artificial recharge of groundwater.</p>		
<b>STRUCTURAL GEOLOGY</b>		
<b>UNIT- 1</b>		
<p><b>Introduction.</b> Structural Forms of Rocks: Primary Structural Forms &amp; Secondary Structural Forms. Concept of brittle and ductile deformation. Forces – compression, tension, torsion and shear. <b>Contours and Types;</b> topographic and geological map. Elementary idea of bed, Strike and Dip and its types. Brunton compass and uses. <b>Primary structural forms</b> – Sedimentary and Igneous Rocks-Stratification, current or crossbedding, graded bedding, ripple marks, mud cracks and rain prints, flow layers, primary joints, vesicular and amygdaloidal structures and pillow structure. Lamination, Foliation and Unconformities. Description and origin of foliations: axial plane cleavage and its tectonic significance. Description and origin of lamination and relationship with the major structures. Unconformity types – para, dis, non, angular and regional unconformities.</p>		<b>14 Hrs</b>
<b>UNIT-2</b>		
<p><b>Secondary structural forms:</b><b>A. Cohesive Dislocations</b> – Distortion, bending and Folds. <b>Folds:</b> Definitions - Parts of folds, axis, axial planes, limb, plunge. Crest and troughs. Mechanics of folding: Buckling, Bending, Flexural slip and flow folding. <b>Types of folds-</b> symmetrical and asymmetrical-anticline, syncline, anticlinorium, synclinorium, overturned fold, recumbent fold. Isoclinal, chevron, fan folds, monocline and drag folds. <b>Denudational structures</b> - Outlier and inlier. <b>B. Disruptive Dislocations</b> – Joints and Faults. <b>Joints:</b> Definition, Dip, Strike. Joint plane, block Joint, Joint set, Joint system. <b>Classification</b>–I. <b>Geometrical:</b> Dip, Strike, Oblique and bedding joints <b>II. Genetic</b>–columnar, mural sheet</p>		<b>14 Hrs</b>

<p>joints, Master joints. Importance of joints. <b>Faults:</b> Definition - Elements of fault, Fault planes, Dip, Strike, Hade, Heave and Throw. Hanging and footwalls. <b>Classification – I. Geometrical:</b> a) Based on attitude of faults as compared to the adjacent beds. Dip, Strike, Diagonal and Bedding faults. b) Based on Apparent movement; Normal and Reverse faults. <b>II. Genetic:</b> Thrust faults, over thrust, and under thrust. Gravity faults - Step fault, Ridge fault. trough faults. Criteria for recognition of faults in the field.</p>	
<b>HYDROGEOLOGY</b>	
<b>UNIT-3</b>	
<p>Introduction and basic concepts. Scope of hydrogeology and its societal relevance. Hydrologic cycle. Precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water. Rock properties affecting groundwater- Specific yield, Specific retention, Permeability, Porosity, Openings in rocks and types of openings, Vertical distribution of subsurface groundwater-Zone of aeration and Zone of saturation and Water table. Types of aquifers-Confined and unconfined; Artesian aquifers; Perched aquifers, Leaky or Semi-confined aquifers; Darcy’s law and its validity, hydraulic head and groundwater flow directions. Intrinsic permeability and hydraulic conductivity, Groundwater flow rates and flow direction, Laminar and turbulent groundwater flow.</p>	<b>14 Hrs</b>
<b>UNIT-4</b>	
<p>Groundwater chemistry: Physical and chemical properties of water and water quality, Introduction to methods of interpreting groundwater quality data using standard graphical plots, Sea water intrusion in coastal aquifers. Groundwater management, Surface and subsurface water interaction, Groundwater level fluctuations, Basic concepts of water balance studies, issues related to groundwater resources development and management, Rainwater harvesting and artificial recharge of groundwater.</p>	<b>14 Hrs</b>

### References: Structural Geology

1. Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley
2. Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.
3. Park, R. G. (2004) Foundations of Structural Geology. Chapman & Hall.
4. Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
5. Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press (For Practical)
6. Lahee F. H. (1962) Field Geology. McGraw Hill
7. Hills, E. S. (1961) Elements of Structural Geology, Asia Publishing House.
8. Hobbs, Means and Williams (1976). An Outline of Structural Geology. John Wiley.
9. John Robberts (1982) Introduction to Geological Maps and Structures, Pergamon Press.
10. Ken McClay (1991) The mapping of Geological Structures. Geological Society of London. Wiley, New edition.
11. R. J. Twiss and E M Moore (2007) Structural Geology 2nd edition. Freeman & Company

### **References: Hydrogeology**

1. Todd, D.K. (1980). Groundwater Hydrology. John Wiley & Sons.
2. Todd, D.K. and L.W. Mays (2004). Groundwater Hydrology. 3rd Edn. John Wiley & Sons.
3. Davis, S.N. & Deweist, R.J.M. (1966). Hydrogeology, John Wiley & Sons, New York.
4. Rangunath, H.M (2007). Groundwater, New Age International Publishers, Delhi
5. Karanath, K.R. (1987). Groundwater Assessment, Development & Management, Tata Mc-Graw Hill.
6. Ramakrishnan, S. (1998). Groundwater. K.G. Graph Arts, Chennai.
7. C. W. Fetter, 2005. Applied Hydrogeology, Second edition; CBS Publishers and Distributers, New Delhi

<b>PRACTICALS</b>		
<b>Programme: B. Sc/B. Sc Hons</b>	<b>Year: Second</b>	<b>Semester: Fourth</b>
<b>Subject: GEOLOGY</b>		
<b>DSCC-8 Practical-VIII (Code: 034GEG012) (Credits- 02)</b>	<b>Course Title: Structural Geology and Hydrogeology</b>	
<b>Max. Marks: 25+25=50</b>	<b>Core: Compulsory</b>	<b>Total= 52 Hrs</b>
<b>Structural Geology</b>		
<b>UNIT-1</b> 1. Study of Brunton Compass, Identification of different types of folds/faults, joints and unconformity from block models. 2. Exercise on structural maps: Preparation of cross-section profile from geological map. <ol style="list-style-type: none"> <li>a) Horizontal and inclined strata with and without intrusion.</li> <li>b) Inclined strata with faults; with and without intrusions.</li> <li>c) Map showing combined features such as faults, folds, unconformities and intrusions; unconformities without intrusions (at least a minimum of 2 (two) maps in each type to be given during practical's.</li> <li>d) Completion of outcrops.</li> <li>e) Solving Strike and Dip problems. (Minimum of 2 (two) problems from each set.</li> </ol>		<b>26 Hrs</b>
<b>Hydrogeology</b>		
<b>UNIT-2</b> <b>Water Analysis:</b> 1. Collection and preservation of water samples from: open well, tap, and bore well, river, water treatment plants, waste water treatment plants and proper labelling of samples. 2. Selection of parameters to be determined: <ol style="list-style-type: none"> <li>a) pH, Electrical Conductivity, and Hardness of water.</li> <li>b) Estimation of Ca, Mg, Carbonates &amp; Bicarbonates, Chemical Oxygen Deman (COD), Biological Oxygen Demand (BOD).</li> </ol> 1. Water quality analysis by Most Probable Number (MPN) test.		<b>26 Hrs</b>

**OPEN ELECTIVE COURSE- (OEC-04)**

<b>Programme/Class: B.Sc. / B.Sc.Hons.</b>	<b>Year: Second</b>	<b>Semester: FOURTH</b>
<b>OEC-4 Theory (Code: 004GEG051)</b>	<b>Subject: GEOLOGY</b>	
<b>Course Title: Geology and Society</b>	<b>Credits: 3. Model: L + T + P</b>	<b>42 Hrs</b>

**Course outcomes: After completion of the course the student will be able to;**

**CO-1:** The challenges and opportunities posed by the climate change, resource demands and conflicts, and natural disasters (due to man-made structures as well as natural climate change) point to the importance of studying transdisciplinary nature of the earth processes and their implications to our society.

**CO-2:** This interdisciplinary nature of Earth Science draws a special attention from the students with other branches of science.

**CO-3:** From this interdisciplinary optional course on Earth and Social Science, students gain an understanding of natural processes and the impact the distribution and use of natural resources such as water, fossil fuels, and critical minerals for economic growth.

**CO-4:** It also facilitates the understanding natural hazards such as climate change, landslides, tsunami induced coastal erosions, thermal disturbances in sea water & sea food, and earthquakes.

**Course Title: Geology and Society**

<b>Unit – 1:</b> Geological History of mineral evolution; Critical minerals for economic growth; rare earth elements and their uses in modern technology for low carbon economic growth. Water-Future: ground water exploration and exploitation, recycling water and pollution monitoring and water management. Desalination of coastal region water to improve the water quality. Understanding of hydrogeology and environmental conditions for water management.	14 Hrs
<b>Unit – 2:</b> Engineering geology for construction of earthquake resilience infrastructure for public; micro-zonation studies of seismic hazards analyses of smart cities, dams and nuclear power stations.	14 Hrs
<b>Unit – 3:</b> Understanding the basics of past climate change through field work near ancient stalagmites bearing caves to provide basic parameters for future earth. Thermodynamic modelling of carbon capture and sequestration using naturally occurring minerals. Modelling of probable risks of natural hazard and climate change with precise uncertainties.	14 Hrs

**Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks**

<b>Type of Assessment</b>	<b>Weight age</b>	<b>Duration</b>	<b>Commencement</b>
Written test-1	10%	1 hr	8 <sup>th</sup> Week
Written test-2	10%	1 hr	12 <sup>th</sup> Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC**  
(60 marks for semester end Examination with 2 hrs duration)

**Part-A**

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10marks

**Part-B**

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions: 20 marks

**Part-C**

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions: 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

**Total: 60 Marks**

**Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.**