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Kasaragod, Kerala, India, 671123

DEPARTMENT OF GEOLOGY

No. CUK/GEO/BOS/MIN/2017/01

Dtd: 27/07/2017

Minutes of the 1st Meeting of Board of Studies in Geology held at Conference Hall, Central University of Kerala, Perive at 10.30 a.m. on 27/07/2017

The Department of Geology, Central University of Kerala conducted the Board of Studies (BoS) meeting on 27th July, 2017. It was the first BoS meeting since the establishment of the department in 2016. The venue was Conference Hall, Central University of Kerala, Main Campus, Periya. The meeting started at 10.30 am and ended at 2.30 pm. The panel members included invited subject experts, Head of the Department and internal members. The attendees of the meeting were as follows: -

BoS Attendees:

Invited subject experts

- Dr. R. Shankar, Professor, Dept. of Marine Geology, Mangalore University, Mangalagangothri-574199
- Dr. V. Prasannakumar, Professor (Rtd) and Emeritus Fellow, University of Kerala
- Dr. Ganesh Raj, General Manager, Regional Remote Sensing Centre- South, NRSC, ISRO, Bengaluru-560037
- Shri. Suresh Chandran, Dy. Director General (Rtd), Geological Survey of India, Thiruvananthapuram.

Internal members from the Central University of Kerala

- Dr. Sandeep K, Assistant Professor and HOD (i/c), Dept. of Geology.
- Dr. Pratheesh P, Assistant Professor, Dept. of Geology.
- Dr. Jayabalan Sangeetha, Assistant Professor, Dept. of Environmental Science.

The BoS meeting started with the welcome address by Dr. Sandeep K, Head of the Department (i/c). Dr. Sandeep gave a brief introduction of the Dept. of Geology as well as the objectives of the BoS. Thereafter, he welcomed all experts and faculty to the meeting, and briefed the agenda of BoS meeting.

The agenda for discussion in the BoS meeting was proposed by the Head of the Department. The main items discussed in the BoS are given below:

1. The approval and ratification of the M.Sc. Geology Curriculum prepared by the Consultative Committee.



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- 2) Consider and decide on proposals from the Faculty Council regarding curriculum.
 - (a) The inclusion of elective course 'Oceanography' and the syllabus thereof (Annexure 1).
 - (b) The inclusion of core course 'Palaeontology Practical' and the syllabus thereof (Annexure 2).
 - (c) The inclusion of elective course 'Climatology' and the syllabus thereof (Annexure 3).
 - (d) The inclusion of elective course 'Geotectonics' and the syllabus thereof (Annexure 4).
 - (e) Changing the GEOL-5303 core course title from 'Exploration Geophysics' to 'Exploration Geology'.
 - (f) Modification in the core courses GEOL5106 (Survey and Geological Field Training) GEOL5206 (Field Geology) (Annexure 5 and 6).
 - (g) The inclusion of B.Sc. triple main course offered by many universities (with geology as one of the main subjects) as eligibility for admission to M.Sc. Geology Programme.

3. Any other matter permitted by the Chair.

The details of agenda-wise discussion and the final recommendation by the BoS are given below.

Agenda 1: The approval and ratification of the M.Sc. Geology Curriculum prepared by the Consultative Committee.

The syllabus of M.Sc. Geology Programme was discussed course-wise.

1.1. GEOL 5101: Geomorphology

Dr. Sandeep inquired whether some of the contents in the course can be elaborated. In particular, the 'Theories of landscape evolution' can be elaborated by mentioning the models such as 'Davis, Penck, Hack, Morisawa and King's'. Dr. Prasannakumar replied that if some points in the course need to be elaborated, it can be done. Dr. R. Shankar opined that 'Classification of sediment constituents' can also include biogenic and organic deposits also. Dr. Sandeep inquired whether some portions of the course can be deleted as it is already studied by students in graduate level. However, Dr. Prasannakumar pointed out that it can be retained. Dr. Ganesha Raj suggested to include more references in the course particularly the book by 'A. L. Bloom'. Dr. Jeyabalan Sangeetha inquired whether it is possible to complete whole course content within a semester. Dr. Ganesha Raj also opined that the syllabus itself is too heavy. However,



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Dr. Prasannakumar suggested that some of the portions can be covered as seminar and assignment topics.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Geomorphology' with minor modifications like elaboration of some points and adding a few more references.

1.2. GEOL 5102: Structural Geology

Dr. Pratheesh P inquired whether the word 'mechanical properties' in Unit-1 can be replaced with 'deformation'. However, Dr. Prasannakumar and Dr. Suresh Chandran opined that it can be retained as such. Dr. Ganesh Raj suggested that more references can be added particularly the book by 'Billings'.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Structural Geology' with addition of a few more references.

1.3. GEOL 5103: Palaeontology

Dr. Ganesh Raj suggested that a portion on 'applications of palaeontology' in various fields especially in oil field can be added in the course syllabus. Dr. Prasannakumar and Shri. Suresh Chandran opined that a portion on 'palynology' can be added in Unit-3. Shri. Suresh Chandran also opined that the palaeontology course can be shifted to third semester whereas sedimentology and sedimentology practical can be shifted to first semester. Dr. R Shankar pointed out that the term 'classification' is redundant in Unit-3 and the term 'human' can be used instead of 'man' in Unit-4. He also suggested including total number of pages and year of publications in many of the references.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Palaeontology' with minor modification and revision of the course content and references. Members also recommended to shift the course from First semester to Third Semester.

1.4. GEOL 5104: Structural Geology Practical

Dr. Pratheesh suggested to include '3 point problems' in the course. All the members of BoS consented to this suggestion.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Structural Geology Practical' with minor modification and revision of the course content.



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1.5. GEOL. 5105: Mineral Optics Practical

Shri. Suresh Chandran inquired how Mineral Optics Practical can be taught without theory course; Dr.Prasannakumar replied that the theory component is included in the practical course itself. All the members consented to this opinion.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Mineral Optics Practical'.

1.6. GEOL. 5106. Survey and Geological Field Training

Shri. Suresh Chandran and Dr. Ganesh Raj opined that the 'Total Station survey' can be included in the course. However, Dr.Prasannakumar opined that if one is well-versed in basics of survey, total station survey would be easy. Dr. Ganesh Raj also opined that Total Station and GPS surveys can be added in the course. Dr. Shankar suggested that Bhima and Kaladgi terrain are ideal locations for field studies and mapping.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Survey and Geological Field Training' with minor modification and revision.

1.7. GEOL. 5201. Igneous Petrology

Dr. Shankar suggested to revise the term 'process' to 'processes' in Unit-I.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Igneous Petrology' with minor modification.

1.8. GEOL 5202. Metamorphic Petrology and Thermodynamics

Dr. R Shankar suggested some minor revisions in Units 2 and 4.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Metamorphic Petrology and Thermodynamics' with minor modifications.

1.9. GEOL 5203. Geochemistry

Dr.Pratheesh suggested to shift the course from second semester to first semester; Dr.Prasannakumar answered to him that geochemistry, igneous petrology and metamorphic petrology should be taught in a single semester. All the members consented to retain it in second semester. Dr. R Shankar suggested some minor revisions.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Geochemistry' with minor modifications.



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1.10. GEOL 5204. Igneous Petrology Practical

Dr. Ganesh Raj suggested to correct the 'Magaseopic' to 'megaseopic'.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Igneous Petrology Practical' with minor modifications.

1.11. GEOL 5205. Metamorphic Petrology Practical

Dr. Shankar suggested deleting the first sentence as the following sentence says the same thing. It was consented by all the members.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Metamorphic Petrology Practical' with minor revision.

1.12. GEOL 5206. Field Geology

Dr. R. Shankar suggested some minor revisions.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Field Geology' with minor revision.

1.13. GEOL 5301. Sedimentology

Shri. Suresh Chandran opined that the course can be shifted to First Semester. He also suggested that 'sedimentary petrology' can also be included in the course. Dr. Prasanmakumar and Dr. Shankar pointed out that the sedimentary petrology is already included in the sedimentology practical. Dr. Shankar suggested some minor corrections in the terms.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'sedimentology' with minor revision. Members also agreed to shift the course to First Semester.

1.14. GEOL 5302. Ore Geology

Dr. Shankar suggested to specify the deposits in the deep sea floor (Unit-5). Members agreed that it can be specified as polymetallic nodules, gas hydrates, phosphorites, lime mud and seafloor massive sulphides (SMS). Dr. R. Shankar also suggested some minor revision of the terms in the course content. Dr. Prasanmakumar suggested to delete the term 'sea water' in Unit-5. Shri. Suresh Chandran opined that extraction of elements can be deleted as it is beyond the scope of the course. He also opined that 'offshore exploration' can be added in Unit-5.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Ore Geology' with minor revision.



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1.15. GEOL 5303. Exploration Geophysics

All the members suggested and agreed to change the course title to 'Exploration Geology' as it contains geological, geophysical and geochemical methods of exploration. Dr. R. Shankar also suggested some minor revision. Dr. Ganesha Raj suggested to include remote sensing and GIS based exploration methods.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Exploration Geology' with minor revision. Members also agreed to change the course title to Exploration Geology.

1.16. GEOL 5304. Sedimentology Practical

Dr. Shankar suggested to revise 'graphical parameters' to 'statistical parameters'.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Sedimentology Practical' with minor revision.

1.17. GEOL 5305. Economic Geology Practical

Shri. Suresh Chandran suggested to delete the 'bore hole problems'. Dr. Shankar enquired what is intended to be done under the heading 'mining methods'. Dr. Prasannakumar replied that students can be exposed to different mining methods. Dr. Shankar inquired whether there are lab facilities to carry out ore dressing practicals. Dr. Prasannakumar answered him that it can be carried out at metallurgy department of nearby engineering colleges.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Economic Geology Practical' with minor revision.

1.18. GEOL 5306. GIS and Image Interpretation Practical

Dr. Ganesha Raj opined that the topics like database creation, modelling, GIS softwares (ArcGIS, Q-GIS, WebGIS), image processing softwares, object based and contextual based methods can be included in the course.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'GIS and Image Interpretation Practical' with a few additions.

1.19. GEOL 5401. Hydrogeology

Dr. Shankar suggested some minor modifications in the terms. Dr. Ganesha Raj suggested including artificial recharge and rain water harvesting methods in Unit-5.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Hydrogeology' with a few additions.



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1.20. GEOL 5402. Stratigraphy

Dr. Shankar suggested to change 'south India' to 'southern India'. He also opined that 'Precambrian of southern India, Major Phanerozoic Basins in India: General description, age, development, evolution, stratigraphy and classification of the following basins in India - Gondwana, Kaveri, Kerala and Cambay Basins' can be shifted to Unit-4. Dr. Ganesha Raj suggested to add more references including the book by 'M.S. Krishnan'.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'stratigraphy' with a few modifications.

1.21. GEOL 5403. Hydrogeology Practical

Dr. Ganesha Raj suggested to include 'Preparation of ground water potential map' in the course.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Hydrogeology Practicals' with minor revision.

1.22. GEOL 5409. Dissertation

Dr. Shankar suggested that the internal guides for the dissertation work should be on the basis of student's research interests and specialisation of teachers. Suresh Chandran opined that the work can be started from the First Semester itself. The members agreed to change the course code to GEOL5404. Dr. Sandeep inquired with Dr. Jeyabalan Sangeetha how the dissertation topics are decided. Dr. Jeyabalan Sangeetha replied that the topics are decided according to research interests of students and specialisations of guides.

Recommendation: Following a detailed discussion on the contents, the members approved the course 'Dissertation' with minor revision and change of course code.

1.23. GEOL 501. Industrial Minerals and Gemstones

Dr. Shankar suggested some minor revisions in the contents.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Industrial Minerals and Gemstones'.

1.24. GEOL 502. Mining and Engineering Geology

Dr. Shankar suggested some minor revisions in the contents. Dr. Ganesha Raj suggested to include application of remote sensing and GIS (Unit-5) and mine monitoring (Unit-3).

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Mining and Engineering Geology'.



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1.25. GEOL 503. Geomatics

Dr. Ganesha Raj suggested to delete the term 'cosmetic operations' in Unit-2. He also suggested including application of GIS in various fields and adding more references.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Geomatics'.

1.26. GEOL 504. Coal and Petroleum Geology

Dr. Shankar suggested some minor revisions in the contents.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Coal and Petroleum Geology'.

1.26. GEOL 505. Environmental Geology and Natural Hazards

Dr. Ganesha Raj suggested to include coastal environment and climate change, coastal management plans and tsunamis in Unit-4. Dr. Shankar suggested some minor revisions in the contents.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Environmental Geology and Natural Hazards'.

1.27. GEOL 506. Water Resource Management

Dr. Ganesha Raj suggested to include glaciers (in Unit-1), treatment of waste water and desalination (Unit-5). Dr. Shankar suggested some minor revisions in the contents.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Water Resource Management'.

1.28. GEOL 507. Isotope Geology

Dr. Shankar suggested some minor revisions in the contents. He suggested to delete some of the content in Unit-5 which is already included in Unit-4.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Isotope Geology'.

1.29. GEOL 508. Quaternary Geology

Dr. R Shankar opined that 'varves and tree rings' can be deleted in Unit-4. He also suggested some minor revisions in the contents and adding 'fission track and thermoluminescence dating methods' in Unit-4.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Quaternary Geology'.



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1.30. GEOL. 509. Structural Analysis

There were no revisions suggested by members.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Structural Analysis'.

1.31. GEOL. 510. Planetary Geoscience

Dr. Ganesha Raj opined that 'planetary missions' can be included in Unit-5. Dr. Shankar suggested some minor revisions in the contents.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Planetary Geoscience'.

Agenda 2: Consider and decide on proposals from the Faculty Council regarding curriculum.

Dr. Sandeep introduced the recommendation of Faculty Council regarding the syllabus.

2.1. The inclusion of elective course 'Oceanography' and the syllabus thereof (Annexure 1).

Dr. Sandeep explained the rationale for including 'Oceanography' as one of the elective courses. The rationale was that Oceanography is one of the important papers in CSIR-JRF/NET examinations. There was an elaborate discussion regarding the inclusion of 'Oceanography' as an open elective course in the programme. The proposed syllabus (Annexure 1) of the course was also discussed.

Recommendation: Following a detailed discussion on the contents, the members approved the elective course 'Oceanography'.

2.2. The inclusion of core course 'Palaeontology Practical' and the syllabus thereof (Annexure 2).

There was an elaborate discussion regarding the inclusion of 'Palaeontology Practical' as core course in the programme. The proposed syllabus (Annexure 2) of the course was also discussed.

Recommendation: Following a detailed discussion on the contents, the members approved the core course 'Palaeontology Practical'. It is also agreed that the course would be included in Third Semester.

2.3. The inclusion of elective course 'Climatology' and the syllabus thereof (Annexure 3).

Dr. Sandeep explained the rationale for including Climatology as one of the elective courses. The rationale is that Climatology is one of the important paper in CSIR-JRF/NET



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examination syllabus. There was an elaborate discussion regarding the inclusion of 'Climatology' as an open elective course in the programme. The proposed syllabus (Annexure 3) of the course was also discussed.

Recommendation: Following a detailed discussion on the contents, the members approved to include an elective course 'Climatology'.

2.4. The inclusion of elective course 'Geotectonics' and the syllabus thereof (Annexure 4).

There was an elaborate discussion regarding the inclusion of 'Geotectonics' as an elective course in the programme. The proposed syllabus (Annexure 4) of the course was also discussed.

Recommendation: Following a detailed discussion on the contents, the members did not approve the elective course 'Geotectonics' as contents of the course were already included in many of the core courses offered in the programme.

2.5. Changing the GEOL-5303 core course title from 'Exploration Geophysics' to 'Exploration Geology'.

This was already discussed earlier in agenda 1.15.

2.6. Modification in the core courses GEOL5106 (Survey and Geological Field Training) and GEOL5206 (Field Geology) (Annexure 5 and 6).

Dr. Sandeep explained the rationale for revising the syllabus of core courses GEOL5106 (Survey and Geological Field Training) and GEOL5206 (Field Geology). The rationale was that both courses have overlapping contents. There was an elaborate discussion regarding the modification of course content. The proposed revised syllabus (Annexure 5 and 6) of the courses was also discussed.

Recommendation: Following a detailed discussion on the contents, the members approved to follow the recommendation of Faculty Council to revise the contents of 'Survey and Geological Field Training' and 'Field Geology'.

(g) The inclusion of B.Sc. triple main course offered by many universities (with geology as one of the main subjects) as eligibility for admission to M.Sc. Geology Programme.

Dr. Sandeep introduced the existing eligibility criteria and presented the recommendation of Faculty Council to include B.Sc. triple main course offered by many universities (with geology as one of the main subjects) as eligibility for admission. The proposal was rejected by



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the external members as it would be difficult to assess the weightage given to 'geology part' in such courses.

Recommendation: Following a detailed discussion on the eligibility criteria, with respect to minimum educational qualification for M.Sc. Geology admission, the BoS members recommended not to include B.Sc. triple main course with Geology as one of the subjects. The members recommended the following categories of educational qualifications:

- B.Sc. Geology
- B.Sc. Geology and Water Management

Agenda 3: Any other matter

Dr. Pratheesh inquired whether course 'Disaster Management' can be initiated by the Department in Distance Education mode. Dr. Prasannakumar pointed out that decision regarding the distance education would not come under the purview BoS.

After this, overall agenda discussed in the BoS were summarised by Dr. Sandeep. The BoS approved the M.Sc. Geology syllabus formed by the consultative committee with minor modifications and revisions.

Thereafter, Dr. Sandeep offered vote of thanks, which concluded the BoS meeting.

Sandeep

Dr. Sandeep K. വിജ്ഞാൻ വിഭാഗം
Head (I/c), Dept. of Geology
കേരള കേന്ദ്രീയ വിശ്വവിദ്യാലയം
Central University of Kerala
പെരിയാ റോഡ്, കശ്മിരഗോട്ട
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ANNEXURE 1:

GEO1511: Oceanography (3 credits)

Unit-1

History of development of Oceanography and Marine Geology. Physiochemical characteristics and chemistry of sea water: temperature, salinity, density, light transmission, sound transmission in sea water. Gases in sea water. Role of carbon-dioxide in keeping the pH of seawater and ocean acidification. Instruments used in the study of seawater. Ocean floor: Morphologic and tectonic domains. Bathymetric provinces- Submarine Canyons, Mid-Ocean ridges and Trenches. Morphologic and tectonic domains of Indian Ocean.

Unit-2

Offshore exploration techniques: Instruments and measurements—Position fixing systems—GPS. Tools for studying ocean water—sampling devices—Grabs, dredgers, Cores, Water Samplers, etc. - various platforms for ocean studies. Tools for studying the ocean floor—Echo-sounding methods—Sidescan Sonar—Current meters—SCUBA diving—submersibles. Ocean floor drilling—JOIDES.

Unit-3

Marine sediments: Distribution and geochronology of marine sediments. Eustatic changes of sea level and its effects. Carbonate Compensation Depth (CCD). Turbidity currents and turbidites. World ocean circulation patterns—role of ocean in deciding global climate—ocean water masses.

Unit-4

Origin of ocean basins and palaeoceanography. Palaeoceanographic reconstructions based of microfossils. Law of the Seas - UNCLOS, EEZ—coastal zone environment and its protection - CRZ Act. Mineral resources of the ocean basins, factors controlling their distribution. Origin and distribution of polymetallic nodules.

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- Emery, K.O. & Skinner, B.J. Mineral Deposits of the Deep Ocean Floor.
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- Gross, G.M. (1967): Oceanography. Merril Physical Science Series.
- Gross, G.M. (1995): Principles of Oceanography, VII edn., Prentice Hall.
- King, C.A.M. (1979): Introduction to Physical and Biological Oceanography, Edward Arnold.
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- Shepard, F.P. (1963): Submarine Geology, II edn., Harper & Row.
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- Weisberg, J. & Parish, H. (1974): Introduction to Oceanography, McGraw Hill.



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ANNEXURE 2:

GEOL 5106: Palaeontology Practical (1 credit)

Sample processing Techniques and separation of microfossils from matrix and marine sediments.

Identification of following types of microfossils (Calcareous and Siliceous)

Planktonic foraminifera, Benthic foraminifera, Ostracods, Pteropods and Radiolaria

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- Barghoorn, E.S., 1971, The Oldest Fossils, Scientific American, V. 224, No.5.
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- Gleessner, M.F., 1953, Principles of Micro Palaeontology, McGraw Hill.
- Jain, P.C. & Anantharaman, M.S., 1980, Palaeontology, Evolution and Animal Distribution, Vishal Pub., N.D.
- Jones, D.J., 1956, Introduction to Microfossils, Harper & Bros. Pub.
- Moore, R.C., Lalicker, C.G. & Fischer, A.G., 1952, Invertebrate Fossils, McGraw Hill.
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ANNEXURE 3:

GEOL 512: Climatology (3 credits)

Unit-1

Fundamental principles of climatology Atmosphere, its composition and internal structure. Greenhouse effect. Earth's radiation balance: latitudinal and seasonal variation of insolation, temperature, pressure. Fundamentals of meteorology, Scales of meteorology. Parameters of meteorology- pressure, wind, temperature, humidity, radiation; Radiations- Radiation laws, short wave and long wave radiations; Albedo; Emissivity; Radiation Budget of Earth.

Unit-2

General circulation of the atmosphere: Hadley cells, tropical easterlies, westerlies, polar easterlies, monsoon, Jet streams, tropical cyclones, local winds, Coriolis Effect and geostrophic winds, Cloud classification, condensation nuclei, growth of cloud drops and ice-crystals, precipitation mechanisms: Bergeron process, coalescence process, Types of precipitation, artificial precipitation. Electric field in the atmosphere.

Unit-3

Climate variability and forcings, causes and impacts of climate change, feedback processes, low frequency variability, MJO (Madden-Julian oscillation), ENSO, QBO (quasi-biennial oscillation) and sunspot cycles. Classification of climates - Koppen's and Thornthwaite's scheme of classification.

Unit-4

Synoptic weather forecasting, prediction of weather elements such as rain, maximum and minimum temperature and fog; hazardous weather elements like thunderstorms, duststorms, tornadoes. Basic principles of general circulation modelling, role of the ocean in climate modelling, interannual variability of ocean fields (SST, winds, circulation, etc.) and its relationship with monsoon, concepts of ocean-atmosphere coupled models.

Unit-5

Indian climatology with special reference to seasonal distribution and variation of temperature, humidity, wind and precipitation; Climate zones of India.

References:

- Lal, D. S. (2011): Climatology, ShardaPustakBhavan.
- Critchfield, H. J. (2009): General climatology, PHI Learning, New Delhi.
- Lal, D. S. (2013): Climatology and Oceanography, ShardaPustakBhavan.
- Siddhartha, K. (2016): Climatology-Atmosphere, weather and climate, KitabMalal, New Delhi.
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- William James Burroughs, 2001, Climate change, A multidisciplinary Approach, Cambridge University Press.
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DEPARTMENT OF GEOLOGY

ANNEXURE 4:

GEOL513: Geotectonics (3 credits)

Unit 1

History of Plate tectonics – Continental drift, sea-floor spreading and the birth of plate tectonics, geosynclinals theory; impact of plate-tectonics, Interior of the Earth – velocity-structure, composition, layers-crust, mantle and core, isostasy, lithosphere and asthenosphere.

Unit 2

Framework of plate-tectonics – plates and plate margins, relative and absolute plate motions, hotspots and superplumes, triple junctions; Ocean ridges – topography, structure, depth-age relationship of oceanic lithosphere; origin of the oceanic crust, propagating rifts and microplates, oceanic fracture zones; Continental rifts and rifted margins – general characteristics, rift initiation, rifted continental margins; Wilson cycle.

Unit 3

Subduction Zones – ocean trenches, morphology of island arc systems; variation in subduction zone characteristics, accretionary prisms, volcanic and plutonic activity, metamorphism at convergent margins, backarc basins, Orogenic belts – ocean-continent convergence, compressional sedimentary basins, continent-continent collision, arc-continent collision, terrane accretion and continental growth.

Unit 4

Precambrian tectonics and the supercontinent cycle – Precambrian heat flow, Archean tectonics, Proterozoic tectonics, supercontinent cycle; Mechanism of plate tectonics – contracting and expanding earth hypothesis; implications of heat flow, driving mechanism of plate-tectonics, mechanism of the supercontinent cycle.

Unit 5

Implications of plate tectonics - Environmental change – changes in sea level and sea water chemistry, changes in oceanic circulation and the Earth's climate, land areas and climate; Economic geology – autochthonous and allochthonous mineral deposits, deposits in sedimentary basins, deposits related to climate, geothermal power; Natural hazards.

References

- Condie, K.C. (1976) Plate tectonics and crustal evolution, Pergamon Press, 282p.
- Kroner, A. (1981) Precambrian plate tectonics, Elsevier, 781p.
- Kearey, P., Klepeis, K.A. and Vine, F.J. (2009) Global Tectonics, Wiley-Blackwell, 482p.
- Patwardhan, A.M. (2010) The dynamic Earth system, PHI Pvt. Ltd., 422p.
- Foulger, G.R. (2010) Plates vs plumes – a geological controversy, Wiley-Blackwell, 340p.
- Molnar, P. (2015) Plate tectonics – a very short introduction, 152p.



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DEPARTMENT OF GEOLOGY

ANNEXURE 5:

GEOL 5106: Survey and Geological Field Training (2 credits)

Surveying - Processes involved in Surveying, Objectives of survey, Different units of measurement.

Chain Survey: Running the survey line, Plotting the survey, Area calculation

Plane Table Survey: Plane Table Surveying, Plotting and Area calculation.

Leveling : The Dumpy level : Permanent and temporary adjustments of the Dumpy, Dumpy

Level surveying, finding the level difference.

Topo sheets: Map scales, features in toposheet, finding the coordinates of points.

Basic procedures in the field: Taking a compass bearing, taping and pacing, locating the position in the map, Use of GPS, Brunton compass, clinometer, Observations in the field, interpretation of the outcrop, taking field notes, drawing and photographing outcrops, measuring attitudes of planar and linear features, finding and collecting fossils, collecting rock samples—their identification and naming.

Identifying the characteristics of igneous, metamorphic, and sedimentary rocks in field.

Identification and Mapping of Faults—folds—foliations, cleavages, lineations, joints, shear zones.

Field visits to places of geological significance and field studies. Field studies in igneous, metamorphic and sedimentary terrain. Preparation of field reports.

References

- Punmia, B.C., Ashok, K. Jain and Arun, K. Jain (2010). Surveying Vol I and II, Laxmi Publications Pvt. Ltd., New Delhi
- Basak, N.N. (2012). Surveying and Levelling, McGraw Hill Publishing Company, New Delhi.
- Lahee, F.H. (2002). Field Geology, 6th Edition, CBS Publishers.
- Gokhale, N.W. (2009). A Guide to Field Geology, 1st Edition, CBS Publishers.
- Mathur, S.M. (2001). Guide to Field Geology (Revised Edition), 1st Edition, Phi Learning.



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DEPARTMENT OF GEOLOGY

ANNEXURE 6:

GEOL. 5206: Field Geology (2 credits)

Principles of geological mapping. Training in field mapping. Preparations for field mapping. Field equipments. Geological symbols and notations. Lithological and structural mapping. Identification and recording of rock types and structures in the field. Measurement and recording of field data. Finding and tracing contacts between rock units, correlating geologic units, mapping geologic structures, outcrop maps, locating points in the field. Selecting and preparing a base map—locating field data and geologic features.

Techniques of geological mapping in igneous, metamorphic and sedimentary terrains. Structural mapping: Mapping of Faults—folds—foliations, cleavages, lineations, joints, shear zones. Preparing final geological map and reports: report writing, major illustrations, photographs, drawings, diagrams, designing the report, format and specific parts of the report. Field mapping in terrains of geological significance and preparation of reports.

References:

- Richard J. Lisle, Peter Brabham and John W. Barnes (2011). Basic Geological Mapping (Geological Field Guide). Revised 5th Edition. Wiley-Blackwell.
- Angela L. Coe (2010). Geological Field Techniques. 1st Edition. Wiley-Blackwell. 336p.
- Laher, F.H. (2002). Field Geology. 6th Edition, CBS Publishers.

GEOL 5401. Hydrogeology (3 credits)

Unit – 1

Definitions and differences of - Hydrology, Hydrogeology, Geohydrology and Groundwater hydrology. Hydrologic cycle and processes – Precipitation, Evaporation and transpiration, Runoff, infiltration. Water balance. Origin and types of waters – meteoric, juvenile, magmatic and metamorphic. Groundwater storage – Aquifer, Aquiclude, Aquifuge and Aquitard. Types of aquifers – Confined, Unconfined, Bonded aquifers Sloping Piezometric and Phreatic aquifers. Springs.

Hydrological properties of rocks – Porosity, Permeability, Void ratio Specific yield and Specific retention, Hydraulic conductivity, Transmissivity and Storativity. Elasticity of aquifers, barometric efficiency and barometric tidal efficiency. Geological framework in relation to Hydro geological environment: Rock types and distribution, rock matrix, fractures, weathered hard rocks and superficial materials.

Unit – 2

Groundwater flow-Water table and Piezometric surface- Flow characteristic of water – Head distribution, Laminar and turbulent flow. Darcy's law and its experimental verification. Flow through aquifers. Differential equation governing ground water flow. Hydrological boundaries, flow nets. Groundwater tracers.

Well hydraulics: Aquifer tests, organization and conduct of pumping tests, data analysis of pumping test, Recovery test, drawdown, cone of depression and cone of impression, Steady radial flow to a well in confined and unconfined aquifers – Thiem's equation and Dupuit-Forchheimer equation. Unsteady radial flow to a well in confined and unconfined aquifers – Theis equation – Theis, Chow and Cooper-Jacob methods – Isotropic non-leaky artesian aquifers.

Unit – 3

Groundwater exploration: Geological and Hydrological methods, Surface investigations of groundwater- Geophysical methods, Electrical Resistivity methods – Wenner and Schlumberger methods, Seismic refraction methods, Gravity and magnetic methods. Application of remote sensing and GIS in Groundwater exploration. Mapping methods Remote sensing data, Field reconnaissance and data acquisition.

Unit – 4

Water well designing - Types and mode of construction – Methods of deep well drilling- Cable tool method, Rotary method, Air rotary method, Rotary Percussion method, Reverse Circulation Rotary Method, DTH method – construction design – development and maintenance of wells. Production specification, well production, specific capacity pumps and pumping equipments.

Unit – 5

Quality of Groundwater: Chemical quality- Different chemical parameters and its analysis, Graphical representation of water quality data: various diagrammatic representations – interpretation of hydrochemical analysis data – Hill-Piper Trilinear diagram, Durov's diagram and U.S. Salinity diagram – Sodium Adsorption Ratio (SAR) – Water quality standard for different purposes – Drinking, Domestic, Irrigation and Industrial.

Threats to groundwater quality and reserve: Saline water intrusion in coastal and other aquifers and its prevention – Ghyben-Herzberg relationship. Water management, groundwater system planning. Groundwater development – safe yield, Groundwater provinces of India. Groundwater depletion due to mining.

References

- Bouwer,H. Groundwater Hydrology,1978.
- Davis,S.N. and Dewiest, R.J.N. Hydrogeology, John Wiley and Sons Inc. New York,1966.
- Karanth.K.R.Groundwater Assessment Development and Management, Tata Mc Graw Hill,1987.
- Linsley,R.K, Kohler, M.A. and Taulhus, J.L.H. Applied Hydrology, Tata Mc Graw Hill,1975.
- Todd,D.K. Groundwater Hydrology, John Wiley and Sons, 1980.
- Walton,W.C. Groundwater Resource Evaluation, Mc Graw Hill Inc,1970.
- Reghunath, H.M. Groundwater.2nd Edn.Wiley Eastern Limited. 1992.
- Sharma H.S.Well Hydraulics and Tube Wells.