BHARATHIDASAN UNIVERSITY, **TIRUCHIRAPPALLI – 620 024.**

M.Phil. GEOLOGY (FT / PT) PROGRAMME

(For the candidates to be admitted from the academic year 2022-23 onwards)

Eligibility : M.Sc in Geology / Applied Geology.

PROGRAMME OBJECTIVES :

- To make critical and independent inquiry in the geosciences including: the ability to gather and evaluate peer-reviewed literature; identify a research question; design and conduct a research plan to collect laboratory and/or field data; and interpret research results.
- To Demonstrate competence in fundamental geological skills including: mineral, rock and soil identification; interpretation of topographic maps, geologic maps, and various forms of imagery; construction of geologic maps and cross sections; three-dimensional conceptualization; and collection of organized field and laboratory data.
- To develop students to make decisions on issues of local and global environmental significance based on an understanding of the interrelationships between humans and natural Earth systems
- To develop students with fundamental strength in core areas of geology and environmental geology, and interpret a wide range of earth processes on different temporal and spatial scales.
- To demonstrate competence in collecting scientific data, including field observation and field and analytical measurements.
- To promote students to improve the skills of interpretive analysis and critical thinking with respect to geological problems involving temporal and spatial relationships.

PROGRAMME STRUCTURE

Sem-ester	Course	Title of the Course	Exam. Hours	Credits	Marks		
					IA	UE	Total
I	Course - I	Research Methodology	3	4	25	75	100
	Course - II	Recent Researches in Geology	3	4	25	75	100
	Course – III	Teaching and Learning skills (Common Paper)	3	4	25	75	100
	Course - IV	Paper on Topic of Research (The syllabus will be prepared by the Guide and the examination will be conducted by the COE)	3	4	25	75	100
II	---	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	--	8	--	--	200
Total				**24**	**--**	**--**	**600**

PROGRAMME OUTCOMES :

- The students will acquire knowledge on various modern techniques to find out rocks and minerals characteristics.
- The student will get well in knowledge on Remote Sensing, Geochemical, Hydrological applications in different fields of Geology.
- The students will able to do modeling in surveying and analysis
- The students will expertise in research and skills to design and conduct experiments, analyze data and interpret the results.
- The students will acquire field knowledge and technical skills in different Geological arena.

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COURSE I

RESEARCH METHODLOGY

Objectives

- To get an idea on review of literature
- To know about different modern techniques for mineral identification
- To understand applications of Remote Sensing in different fields of Geology

UNIT I

Library research and preparation of research report-Use of Libraries and information retrieval systems-Use of abstracts-Abstraction-Preparation of index cards-Methods of editing-preparation of Manuscript-title-introduction-Review of Literature-objectives and purposes of Experimental Methods-Results, tables and figures-Discussion-References-Style of Writing-Field methods of geological investigations-Preparation of Field Reports-plagerism-SCI-hindex-i_{10} index and etc.,

UNIT II

Microscope and U-stage Techniques-Determination of Anorthite content in Plagioclase and Twin laws-Optic Orientation-Extinction angle-Pleochroic scheme-Birefringence-Principles and basics of X-ray diffraction in methods of mineral investigation.

UNIT III

Modern techniques of chemical investigation of minerals and rocks using spectrophotometer, Flame photometer, and Atomic Absorption Spectrometer. Inductively Coupled Plasma-Inductively coupled plasma mass spectrometry (ICP-MS)-Coal petrography-Ore microscopy and Ore petrography-Nuclear Geology-Nuclear devices and techniques-Isotope age dating Stable Isotope- Cosmic ray induced radioactivity.

UNIT IV

Sedimentological techniques-Size and shape determination of grains in Clastic rocks and their graphic representations- placer and studies Heavy mineral-Palaeontological and Micropaleontological techniques pertaining to microfossils (Foraminifera,Ostrocoda,Spores and Pollen grains)-Field sampling and collection Separation of microfossils.

UNIT V

Applications of Remote Sensing in Geology: oil and Mineral Exploration, Groundwater management, Site selection for Engineering projects, Geoenvironmental studies,Landslides, Introduction to GIS and its applications-Map components – Preparation of topographic ,Geologic ,Geomorphic ,Landuse and Soil maps-bathymetric maps-Geological techniques pertaining to offshore

mineral exploration for manganese nodules, phosphorites, and Petroleum-hydrocarbon deposits in Cauvery basin.

Petroleum exploration-Geophysical methods in Petroleum exploration-well logging methods –data interpretation-Geochemical and Geobotanical techniques for mineral exploration.

Text/REFRENCE BOOKS

1. Karl Karlstrom,James Hagadorn Laura Crossey ., (2018). Cambridge sauk transgression in the grand canyon region redefined by detrital zircons.
2. Hengue Yang,Zhiyong Ni., (2018).Wenzhi Wang: A new genetic mechanism of natural gas accumulation scientific reports.
3. A.Leleu,M.Jutzi & M.Rubin., (2018) Nature astronomy: The peculiar shapes of Saturn's small inner moons as evidence of mergers of similar sized moonlets.
4. Romain.C,Gougeon,M.Gabriela Mangano., (2018).Brittany A.Laing:Early Cambrain origin of the shelf sediment Mixed layer,Nature communications.
5. Freedman.P-The Principles of ScientificResearch, Mc Donald and Co., London, (1949).
6. Rajammal. P., Devadas and Kulandaivel-A Handbook of Methodology and Research, -Sri R.K.M. Vidyalaya Press, Coimbatore,(1976).
7. Jonathan Anderson et.al – Thesis and Assignment Writing – Wiley Eastern Ltd., New Delhi,(1970).
8. Parsons, C.J. –Thesis and Project work – Allen and Unwin Ltd., London, (1973).
9. Maeve O' Connon. R and Peter Woodford – Writing Scoentific Papers in English, (1976).
10. W.I.B. Beveridge –The Art of Scientific Investigation- 3rd Edition, Bpdley Head Pub. Co, London,(1952).
11. Winchell and Winchell – Optical Mineralogy Vol-I and II-Wiley Eastern Pvt.Ltd., New Delhi, (1968).
12. P.R.J.Naidu – Johanssen's Optical Mineralogy – Allied Publishers Pvt.Ltd., New Delhi, (1967).
13. Groves A.W.-Silicate Analysis – Allen and Unwin Ltd., Uk, (1951).
14. Easton – Chemical Analysis of silicate Rocks-Elsevier Publications.
15. Sears,S.W.- Optics-Asia Publishing House, New Delhi,(1958).
16. Azaroff.L & Buerger, M.J-Power Method in X-ray Crystallography.
17. Shapiro, L & Brannock, W.M – Geological Survey Bulletin of America, No.165, (1063c), (1956).
18. Lueder, R.D – Aerial Photography Interpretation – McGraw Hill Book & Co., New York.
19. Miller V.C. & Miller. C.F-Photogeology-McGraw Hill Book & Co., New York.
20. Todd.D.K-Groundwater Hydrology-2nd Edition, Wiley Inter-science, New York, (1982).
21. Jones D.J-Introduction to Microfossils –Harper & Brothers, USA,(1958).
22. Brasier, M.D- Introduction to Micropaleontology – Chapman and Hall, UK, (1985).

23. Bignot – Elements of Micropaleontology – Chapman and Hall, UK, (1985).
24. Kummel. B., and Raup. D – Handbook of palaeontological Techniques, W.H. Freeman and Co., (1965).
25. Aswathanarayana. U, Principles of Nuclear Geology – Oxford & IBH Ovt.Ltd., New Delhi, (1985).
26. Faure. G-Principles of Isotope Geology – John Wiley and Sons, New York, (1987).
27. Pandey S.N – Principles and Applications of Photogeology-Wiley Eastern, New Delhi, (1994).
28. Curran P.J – Principles of Remote Sensing-Longman, London, (1985).
29. Sabins. F.Jr – Remote Sensing – Principles and Interpretation, Freeman, Sanfranciso.

Course outcome

- Course To understand concepts of research work
- To understand different types of data of data collection
- To know about different between conceptual and contemporary methods of research
- To formulate the research hypothesis
- To identify the different research problem
- To formulate the research methodology
- To evaluate the different working principles of different geological instruments
- To understand the importance of data analysis tools

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COURSE II

RECENT RESEARCHES IN GEOLOGY

Objectives

- To know about origin and distribution of different rock types.
- To understand different methods for determine the quality of ground water
- To know about various energy resources

Unit I : Geochemistry

Geochemistry and its application to geological problems in Archean rocks- Distribution of Trace elements in different rock types and their significance in Petrological studies of Igneous, Sedimentary and Metamorphic rocks-Gneiss-Granulite terrain-Distribution in space and time –Geochronology and Isotope data-Different rock Formations and their geochemical aspects- Origin and evolution of Gneiss- Granulite terrain – Mineralization in the Archean High grade regions-chemical Index, Alteration; pollution load Alteration; pollution load index; Chemical Index of weathering.

Unit II : Hydrogeology

Quality of Ground Water – physical, Chemical and Biological constituents of Groundwater-Water quality criteria for drinking, industrial and irrigation purposes-Flow net analysis-Saturated and unsaturated flow net- seepage flow and Dupuit flow-Hydrologic budgets-Hillslope hydrology and stream flow generation-Groundwater in Crystalline and Sedimentary systems- Piezometric tests- Pumping tests- Basin yield-Sea water intrusion- Sources of groundwater contamination- Groundwater and Economic mineralization-Saline water intrusion-Groundwater depletion-remedial measures.

Unit III : Environmental Geology

Fundamental concepts of Environmental Geology-Geohazards-Renewable energy sources and non-renewable recourses-Geothermal resources- solar energy-(Atomic energy)-Tidal energy-Water power-Wind power- Energy from Biomass-Energy and water demand-Energy for tomorrow. Impacts sand mining M-sand:An alternative to natural sand- EIA-Environmental management plans-Air pollution and global climatic change-Mineral resources of the Ocean- Waste Disposal methods

Unit IV : Medical Geology

Introduction-Concentration of Trace elements in the Environment- Effects of Trace elements- Chromium- Cobalt-Flourine-Arsenic-Molybdenum- Influence of Geology and Geography on Disease- Water composition and cardiovascular health- Soil and Cancer-Endemic goiter- Osteoporosis- Dental cavities-Cardiovascular mortality.

Unit V : Geostatistics

Introduction-Plotting a semi – Variogram on a graph- Experimental semi- Variogram with reference to Vein deposits – measured rainfall at rain gauge sites – Volume variance calculations – Kriging – Sampling errors standardization of data/validation-Statistical Package for the Social Sciences (SPSS)- Basic Components-Applications.

Text/Reference Books:

1. Schabenberger, O. and Gotway, C. (2005) Statistical Methods for Spatial Data Analysis, Chapman &Hall/CRC.
2. Peter J. Diggle, Paulo J. Ribeiro, Jr (2007) Model-based geostatistics, Springer.
3. Cressie, N. (1993). Statistics for Spatial Data (Revised Ed.). John Wiley & Sons, Inc.
4. Chiles, J. P. and Delfiner, P. (1999) Geostatistics: Modeling Spatial Uncertainty. Wiley.
5. Stein, M. L. (1999) Interpolation of Spatial Data: Some Theory for Kriging. Springer.
6. Banerjee, S, Carlin, B., and Gelfand, A. E. (2004) Hierarchical modeling and analysis for spatial data. Chapman & Hall
7. Wackernagel, Hans (1998) Multivariate Geostatistics (2nd ed.) Springer.
8. Kitanidis, P.K. (1997) Introduction to geostatistics: applications in hydrology.
9. Goovaerts,Pierre (1999) Geostatistics for Natural Resource Evaluation.
10. Olea, R. A. (1999) Geostatistics for Engineers and Earth Scientists.
11. Christakos, G (2000) Modern Spatiotemporal Geostatistics.
12. Webster, R. and Webster, M (2001) Geostatistics for Environmental Scientists
13. Miomir M. Komatina, Effects Of Geological Environments On Human Health, Burgess Publishers - 2004
14. Olle Selinus, B. J. Alloway, Essentials of medical geology: impacts of the natural environment on public health, Lewis Publishers, USA - 2005
15. C. B. Dissanayake, Rohana Chandrajith, Introduction to Medical Geology, Lewis Publishers, USA - 2009
16. 4. Rolf O. Hallberg, Medical geology, Environmental geology – Burgess Publishers, 2007
17. Miomir Komatina, Base of medical geology, Lewis Publishers, 2007
18. Brain Mason and C.B. Moore- Principles of Geochemistry-4th Edition, Wiley Eastern, New Delhi,(1982)
19. C.S.Pichamuthu-Archean Geology- Oxford and IBH Pub Co, New Delhi, (1974)
20. D.K.Todd-Groundwater Hydrology-Willey Interscience,New York, (1982)
21. R.A.Freeze and J.A. Cherry- Ground water-Prientice Hall,inc.N.J
22. E.A.Keller- Environtal Geology-CBS Publishers and Distributors, New Delhi, (1988)
23. D.N.Cargo and B.F.Mallony Addison – Man and his environment – Addison Wesley Pub.Co., London.
24. G.Davis-Statistical and Data Analysis in Geology-2nd Edition, Wiley Interscience, New York,(1980).
25. Isobel Clark-Practical Geostatistics-Elsevier Pub.Co., London and New York(1980).
26. Krumbein and Graybill-Statistical Methods in Geology-McGraw Hill & Co.,(1964).
27. Bloss, F.D. (1971): Crystallography and Crystal Chemistry, Holt, Rinehart, and Winston, New York.
28. Evans, R.C., (1964): Introduction to Crystal Chemistry, Cambridge Univ. Press.
29. Hoefs, J. (1980): Stable Isotope Geochemistry, Springer-Verlag.
30. Klein, C. and Hurlbut, C.S. (1993): Manual of Mineralogy, John Viley and Sons, New York.
31. Krauskopf, K.B. (1967): Introduction to Geochemistry, McGraw Hill.
32. Mason, B. and Moore, C.B. (1991): Introduction to Geochemistry, Wiley Eastern.
33. Rollinson, H.R. (1993): Using geochemical data: Evaluation, Presentation, Interpretation. Longman U.K.

34. Shikazono, N. (2003): Geochemical and Tectonic Evolution of Arc-Backarc Hydrothermal Systems - Implication for the Origin of Kuroko and Epithermal Vein-Type Mineralizations and the Global Geochemical Cycle, Eslevier Science.
35. C.F. Tolman (1937): Groundwater, McGraw Hill , New York and London.
36. D.K. Todd (1995): Groundwater Hydrology, John Wiley and Sons.
37. F.G. Driscoll (1988): Groundwater and Wells, UOP, Johnson Div.St.Paul. Min. USA.
38. H.M. Raghunath (1990): Groundwater, Wiley Eastern Ltd.,
39. H.S. Nagabhushaniah (2001): Groundwater in Hydrosphere (Groundwater hydrology), CBS Publ.
40. K. R. Karanth (1989): Hydrogeology, Tata McGraw Hill Publ..
41. S.N. Davies and R.J.N. De Wiest (1966): Hydrogeology, John Wiley and Sons, New York.

Course Outcomes

- Able to understand various geochemical studies to find out the quality of ground water
- Get an idea on causes and impacts of sea level changes
- Ability to find out geological problems by considering different geochemical studies.
- Able to understand various modern techniques to find out rocks or minerals characteristics
- Well in knowledge on Remote Sensing applications in different fields of Geology
- Able to predict petroleum deposits by considering Geobotanical and Geochemical factors
- To understand Water composition and cardiovascular health
- To understand Ice Ages sea level fluctuation

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COURSE III

Teaching and Learning Skills

Course Objectives :

- Acquaint different parts of computer system and their functions.
- Understand the operations and use of computers and common Accessories.
- Develop skills of ICT and apply them in teaching learning context and Research.
- Appreciate the role of ICT in teaching, learning and Research.
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia /e- content in their respective subject.
- Understand the communication process through the web.
- Acquire the knowledge of Instructional Technology and its Applications.
- Develop different teaching skills for putting the content across to targeted audience.

Unit I : Computer Application Skills

Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, Spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations-- **ICT for Professional Development**: Concept of professional development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research, etc.

Unit II : Communications Skills

Communication: Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and Written; Non-verbal communication – Intrapersonal, interpersonal, Group and Mass communication – Barriers to communication: Mechanical, Physical, Linguistic & Cultural – Skills of communication: Listening, Speaking, Reading and Writing – Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary – Classroom communication and dynamics.

Unit III : Pedagogy

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation - Versatility of Lecture technique – Demonstration: Characteristics, Principles, planning Implementation and Evaluation – Teaching-learning Techniques: Team

Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.

Unit IV : E- Learning, Technology Integration and Academic Resources in India

Concept and types of e-learning (synchronous and asynchronous instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software's for word processing, making presentations, online editing, etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology integration in teaching- learning processes; frameworks guiding technology integration (like TPACK; SAMR); Technology Integration Matrix- Academic Resources in India: MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National academic depository, National Digital Library; e-Sodh Sindhu; virtual labs; eYantra, Talk to a teacher, MOODLE, mobile apps, etc.

Unit V : Skills of Teaching and Technology based assessment

Teaching skills: Definition, Meaning and Nature- Types of Teaching Skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills- **Technology for Assessment:** Concept of assessment and paradigm shift in assessment; role of technology in assessment 'for' learning; tools for self & peer assessment (recording devices; e-rubrics, etc.); online assessment (open source software's; e-portfolio; quiz makers; e- rubrics; survey tools); technology for assessment of collaborative learning like blogs, discussion forums; learning analytics.

References

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Brandon Hall , E-learning, A research note by Namahn, found in: www.namahn.com/resources/ .../note-e-learning.pdf, Retrieved on 05/08/2011
3. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
4. Information and Communication Technology in Education: A Curriculum for schools and programmed of Teacher Development, Jonathan Anderson and Tom Van Weart, UNESCO, 2002.
5. Jereb, E., & Šmitek, B. (2006). Applying multimedia instruction in e-learning. Innovations in Education & Teaching International, 43(1), 15-27.
6. Kumar, K.L. (2008) Educational Technology, New Age International Publishers, New Delhi.
7. Learning Management system : https://en.wikipedia.org/wiki/Learning_management_system , Retrieved on 05/01/2016

8. Mangal, S.K (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana.
9. Michael,D and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New york.
10. Pandey,S.K (2005) Teaching communication, Commonwealth Publishers, New Delhi.
11. Ram Babu,A abd Dandapani,S (2006), Microteaching (Vol.1 & 2), Neelkamal Publications, Hyderabad.
12. Singh,V.K and Sudarshan K.N. (1996), Computer Education, Discovery Publishing Company, New York.
13. Sharma,R.A., (2006) Fundamentals of Educational Technology, Surya Publications,Meerut
14. Vanaja,M and Rajasekar,S (2006), Computer Education, Neelkamal Publications, Hyderabad.

Course Outcomes

After completing the course, the students will:

- Develop skills of ICT and apply them in Teaching Learning context and Research.
- Be able to use ICT for their professional development.
- Leverage OERs for their teaching and research.
- Appreciate the role of ICT in teaching, learning and Research.
- Develop communication skills with special reference to Listening, Speaking, Reading and Writing.
- Learn how to use instructional technology effectively in a classroom.
- Master the preparation and implementation of teaching techniques.
- Develop adequate skills and competencies to organize seminar / conference / workshop / symposium / panel discussion.
- Develop skills in e-learning and technology integration.
- Have the ability to utilize Academic resources in India for their teaching.
- Have the mastery over communication process through the web.
- Develop different teaching skills for putting the content across to targeted audience.
- Have the ability to use technology for assessment in a classroom.

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