

FYUGP

GEOLOGY HONOURS/ RESEARCH

FOR UNDER GRADUATE COURSES UNDER
BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITY, DHANBAD



Implemented from
Academic Session 2022-2026


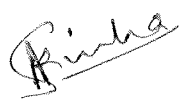



UNIVERSITY DEPARTMENT OF GEOLOGY

BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITY,
DHANBAD- 828130 (JHARKHAND)

Memo No: BBMKU/R/1292/2022, dated on 20.09.22

As per Guidelines of the Binod Bihari Mahto Koyalanchal University, Dhanbad, Syllabus for undergraduate courses of Geology honours/research under NEP-2020 was prepared by Members of Board of Studies of FYUGP. List of members are following below

Name of Members		Signature
1. Dr. Shailendra Kr. Sinha, Dean, Faculty of Science, BBMK Univ, Dhanbad	-Chairman	
2. Dr. Atul Kumar Sinha, HoD, University Dept. of Geology, BBMK Univ, Dhanbad	-Convenor	
3. Dr. Sagar Kumar Swain, HoD, Dept. of Geology, PKRM College, BBMK Univ, Dhanbad	-Member	
4. Dr. Krishna Gopal, University Dept. of Geology, BBMK Univ, Dhanbad	-Member	
5. Shri Pradeep Kumar Adhikari Head, Department of Geology, K.C.B College, Bero, Ranchi University, Ranchi	-External expert	

COURSE STRUCTURE FOR FYUGP 'HONOURS/ RESEARCH'

Table 1: Credit Framework for Four Year Undergraduate Programme (FYUGP) under State Universities of Jharkhand [Total Credits =176]

Undergraduate Programme (T I U Gr) under State Universities of Jharkhand [Total Credits =176]																					
Semester	Common Courses (29)										Introductory Courses (15)		Internship/ Project (4)	Major (PHYSICS) (54) + Adv. Major (PHYSICS) (24)	Minor* (32)		Research Courses (18)				Total Credit
	Language and Communication Skills (Modern Indian Language including TRL) (6)	Language and Communication Skills (English) (6)	Environmental Studies (3)	Understanding India (2)	Health & Wellness, Yoga Education, Sports & Fitness (2)	Digital Education (3)	Mathematical & Computational Thinking and Analysis (2)	Value-Based Course/ Global Citizenship Education (2)	Community Engagement/ NCC/ NSS/ (3)	Introductory Courses [Natural Sc./ Humanities/ Social Sc./Commerce] (9)	Introductory Course [Vocational Studies] (6)	Natural Sc./ Humanities/ Social Sc./ Commerce (18)			Vocational Studies (14)	Research Methodology Courses (6)	Research Proposal, Review of Literature (4)	Research Internship/ Field Work (4)	Preparation of the Research Project Report (4)		
I	2	3	4	5	6	7	8			9	10	11	14	15	16	17	18	19	20	21	
II	6			2	2					3	3		6							22	
III							2	2		3	3		6							22	
IV													6+6	6	4					22	
Exit Point: Undergraduate Certificate																					
V										3		4	6							22	
VI													6+6	6	4					22	
Exit Point: Undergraduate Diploma																					
VII													6+6	6	4					22	
VIII													6+6	6	4					22	
Exit Point: Bachelor's Degree																					
IX													6+6 (Adv. Topics)			6	4			22	
X													6+6 (Adv. Topics)		2			4	4	22	
Exit Point: Bachelor's Degree with Hons. /Research																					

*A student has to select three subjects for 'Introductory Regular Courses' from a pool of subjects associated with the Major (GEOLOGY) offered by the institution. One of the three subjects will continue as 'Minor' from semester IV onwards, based on the academic interest and performance of the student.

COURSES OF STUDY FOR FOUR YEAR UNDERGRADUATE PROGRAMME

Table 2: Course structure for Undergraduate Certificate Programme [May Exit after Sem.-II]

Semester	Common Courses			Introductory Courses		Major	Total Credits
Sem.-I	LCS (MIL/TRL) (6 Credits)	Understanding India (2 Credits)	Health & Wellness, Yoga Education, Sports & Fitness (2 Credits)	IRC-1 (3 Credits)	IVS-1A (3 Credits)	MJ-1 (6 Credits)	(22)
Sem.-II	LCS (English) (6 Credits)	Global Citizenship Education (2 Credits)	Mathematical & Computational Thinking (2 Credits)	IRC-2 (3 Credits)	IVS-1B (3 Credits)	MJ-2 (6 Credits)	(22)

Total = 44 Credits

(LCS: Language and Communication Skills; MIL: Modern Indian Languages; TRL: Tribal Regional Languages; IRC: Introductory Regular Courses; IVS: Introductory Vocational Studies, MJ: Major)

Table 3: Course structure for Undergraduate Diploma Programme [May Exit after Sem.-IV]

Semester	Common Courses			Introductory	Major Courses Credits	Minor	Internship/ Vocational Project	Total
Sem.-III	Environmental Studies (3 Credits)	Community Engagement/ NCC/ NSS (3 Credits)	Digital Education (3 Credits)	IRC-3 (3 Credits)	MJ-3 (6 Credits)		Internship/ Project (4 Credits)	(22)
Sem.-IV					MJ-4, MJ-5 (6+6=12 Credits)	MN-1 (6 Credits)	VS-1 (4 Credits)	(22)

Total = 88 Credits

(MN: Minor; VS: Vocational Studies)

Table 4: Course structure for Bachelor's Degree Programme*[May Exit after Sem.-VI]*

Semester	Major Courses	Minor Courses	Vocational	Total Credits
Sem.-V	MJ-6, MJ-7 (6+6 = 12 Credits)	MN-2 (6 Credits)	VS-2 (4 Credits)	(22)
Sem.-VI	MJ-8, MJ-9 (6+6 = 12 Credits)	MN-3 (6 Credits)	VS-3 (4 Credits)	(22)

Total = 132 Credits**Table 5: Course structure for Bachelor's Degree with Hons./Research Programme**

Semester	Advance Courses	Research Courses	Vocational	Total Credit
Sem.-VII	AMJ-1, AMJ-2 (6+6=12 Credits)	Research Methodology (6 Credits)	Research Proposal (4 Credits)	(22)
Sem.-VIII	AMJ-3, AMJ-4 (6+6=12 Credits)	Research Int./Field Work (4 Credits)	Research Report (4 Credits)	(22)

Total = 176 Credits

(AMJ: Advance Major; VSR: Vocational Studies associated with Research)

Session 2022-26 onwards

SEMESTER WISE COURSES OF STUDY FOR FOUR YEAR UNDERGRADUATE
PROGRAMME **2022 onwards**

Table 6: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Credits
	Code	Papers	
I	CC-1	Language and Communication Skills (Modern Indian language including TRL)	6
	CC-2	Understanding India	2
	CC-3	Health & Wellness, Yoga Education, Sports & Fitness	2
	IRC-1	Introductory Regular Course-1	3
	IVS-1A	Introductory Vocational Studies-1	3
	MJ-1	Major paper 1 (Disciplinary/Interdisciplinary Major)	6
II	CC-4	Language and Communication Skills (English)	6
	CC-5	Mathematical & Computation Thinking Analysis	2
	CC-6	Global Citizenship Education & Education for Sustainable Development	2
	IRC-2	Introductory Regular Course-2	3
	IVS-1B	Introductory Vocational Studies-2	3
	MJ-2	Major paper 2 (Disciplinary/Interdisciplinary Major)	6
III	CC-7	Environmental Studies	3
	CC-8	Digital Education (Elementary Computer Applications)	3
	CC-9	Community Engagement & Service (NSS/ NCC/ Adult Education)	3
	IRC-3	Introductory Regular Course-3	3
	IAP	Internship/Apprenticeship/ Project	4
	MJ-3	Major paper 3 (Disciplinary/Interdisciplinary Major)	6
IV	MJ-4	Major paper 4 (Disciplinary/Interdisciplinary Major)	6
	MJ-5	Major paper 5 (Disciplinary/Interdisciplinary Major)	6
	MN-1	Minor Paper 1 (Disciplinary/Interdisciplinary Minor)	6
	VS-1	Vocational Studies-1 (Minor)	4

V	MJ-6	Major paper 6 (Disciplinary/Interdisciplinary Major)	6
	MJ-7	Major paper 7 (Disciplinary/Interdisciplinary Major)	6
	MN-2	Minor Paper 2 (Disciplinary/Interdisciplinary Minor)	6
	VS-2	Vocational Studies 2 (Minor)	4
VI	MJ-8	Major paper 8 (Disciplinary/Interdisciplinary Major)	6
	MJ-9	Major paper 9 (Disciplinary/Interdisciplinary Major)	6
	MN-3	Minor Paper 3 (Disciplinary/Interdisciplinary Minor)	6
	VS-3	Vocational Studies 3 (Minor)	4
VII	AMJ-1	Advance Major paper 1 (Disciplinary/Interdisciplinary Major)	6
	AMJ-2	Advance Major paper 2 (Disciplinary/Interdisciplinary Major)	6
	RC-1	Research Methodology	6
	RC-2	Research Proposal	4
VIII	AMJ-3	Advance Major paper 3 (Disciplinary/Interdisciplinary Major)	6
	AMJ-4	Advance Major paper 4 (Disciplinary/Interdisciplinary Major)	6
	RC-3	Research Internship/Field Work	4
	RC-4	Research Report	4
	VSR	Vocational Studies (Associated with Research)	2
		Total Credit	176

Abbreviations:

CC	Common Courses
IRC	Introductory Regular Courses
IVS	Introductory Vocational Studies
IAP	Internship/Apprenticeship/ Project
VS	Vocational Studies
MJ	Major Disciplinary/Interdisciplinary Courses
MN	Minor Disciplinary/Interdisciplinary Courses
AMJ	Advance Major Disciplinary/Interdisciplinary Courses
RC	Research Courses
VSR	Vocational Studies associated with Research

SEMESTER WISE COURSES IN PHYSICS FOR FYUGP

2022 onwards**Table 7: Semester wise Examination Structure for Physics Major:**

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure			
	Code	Papers	Credits (T+P)	Mid Semester Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical/ Viva (F.M.)
I	MJ-1	Earth System Science, Crystallography & Mineralogy	6 (4+2)	15	60	25
II	MJ-2	Structural Geology	6 (4+2)	15	60	25
III	MJ-3	Igneous Petrology	6 (4+2)	15	60	25
IV	MJ-4	Sedimentary & Metamorphic Petrology	6 (4+2)	15	60	25
	MJ-5	Economic Geology	6 (4+2)	15	60	25
V	MJ-6	Stratigraphy & Paleontology	6 (4+2)	15	60	25
	MJ-7	Elements Of Geochemistry	6 (4+2)	15	60	25
VI	MJ-8	Hydro Geology & Geomorphology	6 (4+2)	15	60	25
	MJ-9	Engineering Geology, Remote Sensing & GIS	6 (4+2)	15	60	25
VII	AMJ-1	To be selected from the pool of Advance papers	6			
	AMJ-2	To be selected from the pool of Advance papers	6			
	RC-1	Research Methodology	6			
	RC-2	Research Proposal	4			
VIII	AMJ-3	To be selected from the pool of Advance papers	6			
	AMJ-4	To be selected from the pool of Advance papers	6			
	RC-3	Research Internship/Field Work	4			
	RC-4	Research Report	4			
	VSR	Vocational Studies (Associated with Research)	2			
		Total Credit	98			

Note:

- Total 6 credits of AMJ papers will be distributed either as 4(T) +2(P) OR 6(T); depending upon the paper. Distribution of marks in Mid-Semester and End-Semester will be accordingly.

LIST OF ADVANCE MAJOR (AMJ) PAPERS TO BE SELECTED BY THE STUDENTS FOR SEMESTER VII & VIII:

1. FUEL GEOLOGY
2. ORE GEOLOGY
3. EXPLORATION GEOLOGY
4. ENVIRONMENTAL GEOLOGY
5. EARTH & CLIMATE
6. SOIL GEOSCIENCE
7. SEDIMENTOLOGY
8. RIVER SCIENCE
9. INTRODUCTION OF GEOPHYSICS
10. EVOLUTION OF LIFE THROUGH TIME
11. URBAN GEOLOGY
12. FOSSILS & THEIR APPLICATIONS

Table 8: Semester wise Examination Structure for Geology Minor:

Semester	Code	Papers	Credits (T+P)	Mid Semester Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical/ Viva (F.M.)
IV	MN-1	Petrology, Geochemistry & Structural Geology	6 (4+2)	15	60	25
V	MN-2	Earth Resources & Essentials of Geology	6 (4+2)	15	60	25
VI	MN-3	Stratigraphy & Palaentology	6 (4+2)	15	60	25
		Total Credit	18			

**NEP UG Syllabus
Semester I**

Major – 1 (MJ - 1) EARTH SYSTEM SCIENCE, CRYSTALLOGRAPHY & MINERALOGY

Credit – 4

FM= 100 [75 +25]

Lectures – 60 Hours

T= 75 {60Ext. +15 Int.} (10+05)}

Instructions:

- There will be two groups of questions. **Group A** is compulsory which will contain **three** questions.
- **Question no. 1** will be **very short answer type** consisting of **five** questions of **1** mark each.
- **Question no. 2 & 3** will be of **short answer type** of **5** marks each.
- **Group B** will contain **descriptive type** **five** questions of **15** marks each, out of which **any three** are to answer.

Learning Outcomes:

After successfully completing this course, the students will be able to understand:

1. The aim of this course is to study the major mineral groups, their occurrences, physical, chemical and crystallographic properties and their possible uses in industry.
2. The course aims also to study the external symmetry of the crystals through external elements of symmetry, crystal classes and systems, and the relations of symmetry to the internal structure using the chemical and physical properties of the minerals.
3. Focus is given on the physical and chemical properties of minerals, from macroscopic to microscopic.
4. The course will investigate how geologic materials and processes influence mineral occurrence, stability, and composition.
5. The course is divided into different modules as given in the course content and covers the structure of minerals, characters of minerals and mineral chemistry.

Unit	Topic	Total no. of Lectures
Unit 1: Earth as a planet, Interior of Earth, Plate Tectonics		
1.1	Earth as a planet: 1.1.1: General characteristics and origin of the Universe, Solar System and its planets. The terrestrial and jovian planets. Meteorites and Asteroids,	04
	1.1.2: Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters and its age.	04

1.2	Interior of Earth	02
	1.2.1: Internal Structure of the earth & Composition	
	1.2.2: Primary & Secondary discontinuity with depth	02
	1.2.3: Earth's magnetic field: Convection in Earth's core and production of its magnetic field	02
1.3	Plate Tectonics	04
	1.3.1: Concept of plate tectonics, sea-floor spreading, Isostasy and continental drift	
	1.3.2: Geodynamic elements of Earth- Mid Oceanic Ridges, trenches, transform faults and island arcs Origin of oceans, continents, mountains and rift valleys	04
	1.3.3: Earthquake, earthquake belts, distribution, Scale Volcanoes- types, products and their distribution	04
Unit 2: Hydrosphere and Atmosphere, Soil, Understanding the past from stratigraphic records		Total no. of Lectures
2.1	Hydrosphere and Atmosphere	04
	2.1.1: Introduction to hydrosphere and atmosphere; Oceanic current system and effect of Coriolis force; Wave erosion and beach processes; Atmospheric circulation; Earth's heat budget.	
	2.1.2: Soils- processes of formation, soil profile and soil types.	02
2.2	2.2.1: Understanding the past from stratigraphic records: Stratigraphy: introduction and scope; Standard stratigraphic time scale, Introduction to geochronological methods and their application in geological studies; Laws of superposition and faunal succession; Concepts of uniformitarianism.	04
Unit 3: Crystallography, Crystal symmetry and projections		Total no. of Lectures
3.1	Crystallography: 3.1.1: Elementary ideas about crystal morphology in relation to internal structures Crystal parameters and indices Crystal symmetry and classification of crystals into six systems and 32 point groups	06
3.2	Crystal symmetry and projections 3.2.1: Elements of crystal chemistry and aspects of crystal structures Stereographic projections of symmetry elements and forms	04
Unit 4: Rock forming minerals		Total no. of Lectures

4.1	Rock forming minerals 4.1.1: Minerals - definition and classification, physical and chemical properties Composition of common rock-forming minerals, Silicate and non-silicate structures; CCP and HCP structures	06
Unit 5: Properties of light and optical microscopy		Total no. of Lectures
	Properties of light and optical microscopy Nature of light and principles of optical mineralogy, Isotropic & Anisotropic, Birefringence, Interference color, Extinction, Uniaxial & Biaxial Indicatrix, Introduction to the petrological microscope and identification of common rock-forming minerals	08

Books Recommended

- Duff, P. M. D., & Duff, D. (Eds.). (1993). *Holmes' principles of physical geology*. Taylor & Francis.
- Emiliani, C. (1992). *Planet earth: cosmology, geology, and the evolution of life and environment*. Cambridge University Press.
- Gross, M. G. (1977). *Oceanography: A view of the earth*.
- Klein, C., Dutrow, B., Dwight, J., & Klein, C. (2007). *The 23rd Edition of the Manual of Mineral Science (after James D. Dana)*. J. Wiley & Sons.
- Kerr, P. F. (1959). *Optical Mineralogy*. McGraw-Hill.
- Verma, P. K. (2010). *Optical Mineralogy (Four Colour)*. Ane Books Pvt Ltd.
- Deer, W. A., Howie, R. A., & Zussman, J. (1992). *An introduction to the rock-forming minerals (Vol. 696)*. London: Longman.





**Practical
Semester I**

**Major – 1 (MJ - 1) P (Practical) EARTH SYSTEM SCIENCE,
CRYSTALLOGRAPHY & MINERALOGY**

Credit – 2
FM= 100 [75 +25]

Lectures – 30 Hours
P = 25 (20Ext. +05Int.)

Practical Marks**Distribution**

- 1. Experiments from 1-8**
- 2. Experiments from 9-10**
- 3. Experiments from 11**
- 4. Class record & Viva Voce**

05
05
05
05

Total=20

Suggested Practical:**MJ 1 EARTH SYSTEM SCIENCE, CRYSTALLOGRAPHY & MINERALOGY**

1. Study of major geomorphic features and their relationships with outcrops through physiographic models.
2. Detailed study of topographic sheets and preparation of physiographic description of an area
3. Study of soil profile of any specific area
4. Study of distribution of major lithostratigraphic units on the map of India
5. Study of distribution of major dams on map of India and their impact on river systems
6. Study of major ocean currents of the World
7. Study of seismic profile of a specific area and its interpretation
8. Observation and documentation on symmetry of crystals
9. Study of physical properties of minerals in hand specimen: Silicates: Olivine, Garnet, Andalusite, Sillimanite, Kyanite, Staurolite, Beryl, Tourmaline, Augite, Actinolite, Tremolite, Hornblende, Serpentine, Talc, Muscovite, Biotite, Phlogopite, Quartz, Orthoclase, Plagioclase, Microcline, Nepheline, Sodalite, Zeolite, Quartz varieties: Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rose quartz, Smoky quartz, Rock crystal.
10. Native Metals/non-metals, Sulfides, Oxides- Copper, Sulfur, Graphite, Pyrite, Corundum, Magnetite Hydroxides, Halides, Carbonates, Sulfates, Phosphates: Psilomelane, Fluorite, Calcite, Malachite, Gypsum, Apatite.
11. Study of some key silicate minerals under optical microscope and their characteristic properties.

Semester II

Major – 2 (MJ - 2) STRUCTURAL GEOLOGY**Credit – 4****FM= 100 [75 +25]****Lectures – 60 Hours****T= 75 {60Ext. +15 Int.} (10+05)}****Instructions:**

- There will be two groups of questions. **Group A** is compulsory which will contain **three** questions.
- **Question no. 1** will be **very short answer type** consisting of **five** questions of **1** mark each.
- **Question no. 2 & 3** will be of **short answer type** of **5** marks each.
- **Group B** will contain **descriptive type** five questions of **15** marks each, out of which **any three** are to answer.

Learning outcomes

After successfully completing this course, the students will be able to understand:

1. This course helps the students to understand how to use structures and appreciate the dynamic nature of the Earth's lithosphere.
2. The students will learn the skills of identifying different structure and will be acquainted with field measurements required for geological mapping, learn how to read geologic maps and solve simple map problems and preparations of cross sections.

Unit	Topic	Total no. of Lectures
Unit 1: Structure and Topography		
1.1	Effects of topography on structural features, Topographic and structural maps; Importance representative factors of the map, compass-Clinometer & Brunton, V's Rule	02
Unit 2: Stress and strain in rocks		
2.1	Concept of rock deformation: Stress and Strain in rocks & their types, Strain ellipses of different types and their geological significance. ductile and brittle deformation, Young's modulus of Elasticity Planar and linear structures; Concept of dip and strike; pitch and plunge, Outcrop patterns of	04

	different structures.	
Unit 3: Folds		
3.1	Fold morphology; Geometric and genetic classification of folds & recognition of fold in the Field. Introduction to the mechanism of folding: Buckling, Bending, Flexural slip and flow folding, shear zones and their types	10
Unit 4: Foliation and lineation		
4.1	Description, origin & types of foliations: axial plane cleavage and its tectonic significance, Description, origin & types of lineation and relationship with the major structures	06
Unit 5: Fractures, faults and Joints		
5.1	Geometric and genetic classification of fractures and faults, Effects of faulting on the outcrops Geologic/geomorphic criteria for recognition of faults and fault plane solutions, Joints types & significance, Unconformities: their types & significance	04

Books Recommended

- Davis, G. R. (1984) *Structural Geology of Rocks and Region*. John Wiley Billings, M. P. (1987) *Structural Geology*, 4th edition, Prentice-Hall.
- Park, R. G. (2004) *Foundations of Structural Geology*. Chapman & Hall.
- Pollard, D. D. (2005) *Fundamental of Structural Geology*. Cambridge University Press.
- Ragan, D. M. (2009) *Structural Geology: an introduction to geometrical techniques (4th Ed)*. Cambridge University Press (For Practical)
- Lahee F. H. (1962) *Field Geology*. McGraw Hill

**Practical
Semester II****Major – 2 (MJ - 2) STRUCTURAL GEOLOGY****Credit – 2****FM= 100 [75 +25]****Lectures – 30 Hours****P = 25 (20Ext. +05Int.)****Practical Marks****1. Experiments from 1-5****2. Experiments from 6-10****3. Field Visit Report****4. Class record & Viva Voce****Distribution****05****05****05****05**

Total=20**Suggested Practical****STRUCTURAL GEOLOGY**

1. Basic idea of topographic contours, Topographic sheets of various scales.
2. Introduction to Geological maps: Lithological and Structural maps
3. Structural contouring and 3-point problems of dip and strike
4. Drawing profile sections and interpretation of geological maps of different complexities, Exercises of stereographic projections of mesoscopic structural data (planar, linear, folded etc.)
5. Completion of outcrop of maps from partial data.
6. Outcrop pattern of horizontal and dipping beds, fold, fault, unconformity, dyke and sill.
7. Graphical solutions of simple structural problems: dip-strike, true dip-apparent dip
8. Three point problems and determination of dip and strike from borehole data.
9. Determination of vertical and true thickness of inclined beds.
10. Drawing of vertical geological sections to illustrate different geological structures.
11. Geological Mapping of two weeks duration in a geologically complex area and Field Work Report based on it