



MODIFIED CBCS CURRICULUM OF

M. SC. GEOLOGY PROGRAMME

Departmental Council resolved to adopt the Ranchi University syllabus for M. Sc. in Geology under CBCS, for the:

- i. Academic Session: 2022 – 2024
- ii. and, Academic Session: 2023 – 2025

Department of Geology

St. Xavier's College, Ranchi



Contents

Sl. No.	Particulars / details			Page No.
1.	Members of Board of Studies			
2.	Contents			2
COURSE STRUCTURE FOR POST-GRADUATE PROGRAMME				
3.	Distribution of 80 credits			3
4.	Course Structure for M. Sc. in Geology			3
5.	Semester wise Examination Structure for Mid Semester & End Semester Examinations			4
Semester I				
6.	I	FC 101	Compulsory Foundation Course (FC)	5
7.	II	CC 102	Core Course – C1	7
8.	III	CC 103	Core Course – C2	9
9.	IV	CP 104	Practical I – C3	11
Semester II				
10.	I	CC 201	Core Course – C4	12
11.	II	CC 202	Core Course – C5	14
12.	III	CC 203	Core Course – C6	16
13.	IV	CP 204	Practical II – C7	18
Semester III				
14.	I	EC 301	Ability Enhancement Course (AE)	19
15.	II	CC 302	Core Course – C8	29
16.	III	CC 303	Core Course – C9	31
17.	IV	CP 304	Practical III – C10	33
Semester IV				
18.	I	EC 401	Generic / Discipline Elective (GE/DC 1)	34
19.	II	EC 402	Generic / Discipline Elective (GE/DC 2)	44
20.	III	EP 403	Practical – IV (based on GE/DC)	54
21.	IV	PR 404	Core Course (Project/Dissertation) – C 11	59
Annexure				
22.	Distribution of Credits for P.G. Programme (Semester-wise)			60
23.	Sample calculation for SGPA & CGPA for P.G. Vocational/M. Sc./M.A./M. Com			61
DISTRIBUTION OF MARKS FOR EXAMINATIONS				
24.	Distribution of Marks of Mid Semester Theory Examinations			62
25.	Distribution of Marks of End Semester Theory Examinations			63

COURSE STRUCTURE FOR M.Sc. GEOLOGY

Table AI-1: Distribution of 80 Credits for Subjects having Practical Papers

[*wherever there is a practical examination there will be no tutorial and vice –versa.]

Course	Papers	Credits Theory + Practical	Credits Theory + Tutorial
I. Foundation Course (FC) 1. Foundation Course Compulsory Foundation/ Elective Foundation	(FC) 1 Paper	1X5=5	1X5=5
II. Core Course (CC) Theory Practical/ Tutorial* Project	(CC 1 to 10/11) 7 Papers/11 Papers 3 Papers/----- 1 Paper	7X5=35 3X5=15 1X5=5	11X5=55 1X5=5
III. Elective Course (EC) A. Ability Enhancement Course of the Core Course opted	(AE/EC 1) 1 Paper	1X5=5	1X5=5
B. Discipline Centric Elective Theory + Practical	(DC/EC 2&3) 2 Papers 1 Paper	2X5=10 1x5=5	
OR Theory/Practical/Tutorial*	1Paper + 1 Practical/Dissertation		2X5=10
OR Generic Elective/ Interdisciplinary (GE/EC 2&3) Theory OR	2 Papers		
Theory/Practical/Tutorial*	1 Paper + 1 Practical/Dissertation		
Total Credit = 80			= 80

Table AI-1.1: Course structure for M.Sc. Programme with Practical Papers

Semester	Subject (Core Courses) 11 Papers	Allied (Elective Courses) 4 Papers	Foundation Course (Compulsory Course) 1 Paper	Total Credits
Sem-I	C-1, C-2, C-3 (5+5+5=15 Credits)		Foundation Course FC (05 Credits)	20 Credits
Sem-II	C-4, C-5, C-6, C-7 (5+5+5+5=20 Credits)			20 Credits
Sem-III	C-8, C-9, C-10 (5+5+5=15 Credits)	EC1 (05 Credits)		20 Credits
Sem-IV	C-11 (Project) (05 Credits)	EC2, EC3, EP (5+5+5=15Credits)		20 Credits

Total = 80 Credits

COURSES OF STUDY FOR M.Sc. GEOLOGY

Table AI-2 Subject Combinations allowed for M. Sc. Programme (80 Credits)

Foundation Course FC 1 Paper	Core Subject CC 11 Papers	Ability Enhancement Course AE 1 Paper	Discipline Centric Elective/ Generic Elective Course DC/ GE/ EC 3 Papers
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Table AI-2.1 Semester wise Examination Structure for Mid Sem & End Sem Examinations:

Sem	Core, AE/ GE/ DC/ EC & Compulsory FC Courses				Examination Structure		
	Paper	Paper Code	Credit	Name of Paper	Mid Semester Evaluation (F.M.)	End Semester Evaluation (F.M.)	End Semester Practical/ Viva (F.M.)
I	Foundation Course	FCGLG101	5	Geotectonics and Structural Geology	30	70	----
	Core Course	CCGLG102	5	Stratigraphy and Palaeobiology	30	70	----
	Core Course	CCGLG103	5	Crystallography and Descriptive Mineralogy	30	70	----
	Practical on Core	CPGLG104	5	Practical-I	----	----	70 + 30
II	Core Course	CCGLG201	5	Geomorphology and RS-GIS in Geology	----	70	30
	Core Course	CCGLG202	5	Geochemistry and Igneous Petrology	30	70	----
	Core Course	CCGLG203	5	Sedimentary and Metamorphic Petrology	30	70	----
	Practical on Core	CPGLG204	5	Practical-II	----	----	70 + 30
III	Ability Enhancement Course	ECGLG301	5	A. Fossil Fuel Geology-I/ B. Sedimentology-I/ C. Hydrogeology-I/ D. Ore Geology-I/ E. Environmental Geology-I	30	70	----
	Core Course	CCGLG302	5	Economic Geology	30	70	----
	Core Course	CCGLG303	5	Hydrogeology, Engineering Geology, Environmental Geology & Mining Geology	30	70	----
	Practical on Core	CPGLG304	5	Practical-III	----	----	70 + 30
IV	Elective	ECGLG401	5	A. Fossil Fuel Geology-II/ B. Sedimentology-II/ C. Hydrogeology-II/ D. Ore Geology-II/ E. Environmental Geology-II	30	70	----
	Elective	ECGLG402	5	A. Fossil Fuel Geology-III/ B. Sedimentology-III/ C. Hydrogeology-III/ D. Ore Geology-III/ E. Environmental Geology-III	30	70	----
	Practical on Elective	EPGLG403	5	A. Practical - Fossil Fuel Geology-IV/ B. Practical - Sedimentology-IV/ C. Practical - Hydrogeology-IV/ D. Practical - Ore Geology-IV/ E. Practical - Environmental Geology-IV	----	----	70 + 30
	PROJECT	PRGLG404	5	Project Work	----	----	70 + 30

Total 100 x 4 = 400 Marks

I. COMPULSORY FOUNDATION COURSE

[FCGLG101]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type** five questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** six questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

GEOTECTONICS AND STRUCTURAL GEOLOGY

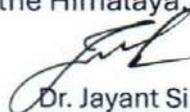
Theory: 60 Hours; Tutorial: 15 Hours

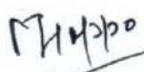
Unit 1:

Study of seismic waves – structure and composition of the earth – Radioactivity – Basic concept of palaeomagnetism Major tectonic features of the earth-shield areas, mobile belts, rift valleys, mid oceanic ridges, continental shelves and slopes, submarine canyons.

Unit 2:

Plate Tectonics: concept, geological and tectonic environment of Plate boundaries, Sea Floor Spreading, Island arcs, Hydrothermal vents; Orogeny and orogenic cycles – Epeirogeny and evolution of plateaus. Structural and tectonic features of India. Tectonic framework of India; Structure and Origin of the Himalaya, Quaternary tectonics


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Ms. Mable M. Toppo


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Unit 3:

Mechanical principles of rock deformation; Concept of stress, strain and the resulting ellipsoids; Factors controlling behavior of rock material. Folds, Recognition, mechanics and causes of folding – Recognition of top and bottom of beds; Faults, recognition criteria and mechanics of faulting; Joints- Quantitative and qualitative classification of joints; Unconformities – types, recognition, significant distinction from faults and their use in dating structural events.

Unit 4:

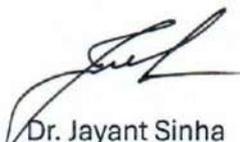
Cleavage, Schistosity and Lineation – their description, origin and relation to major structures. Petrofabric analysis – Field and laboratory techniques – petrofabric diagrams and their interpretation. Classification and characteristics of Tectonites, Diapirs and related structural features.

Unit 5:

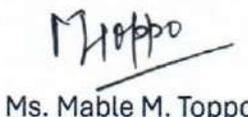
Toposheets: – Definition, scale, reading various components of a toposheet. Geological map - definition, various components of a geological map including scale, legend, structures etc. Geological Field work instruments, Use of clinometer compass, Brunton compass, strike and dip measurements; Sampling and oriented sample and its significance; Geological mapping of igneous, sedimentary and metamorphic terrains. GPS and its applications in Geology.

Suggested Books:

- Condie, Kent. C. (1982): Plate Tectonics and Crustal Evolution, Pergamon Press Inc.
- Gass I.G. (1982): Understanding the Earth. Artemis Press (Pvt) Ltd. U.K.
- Ghosh, S.K. (1993): Structural Geology: Fundamental and Modern Development. Pergamon Press.
- Hobbs, B.E., Means, W.D. and Williams, P.F. (1976): An outline of Structural Geology, John Wiley and Sons, New York
- Naqvi, S.M. (2005) Geology and Evolution of the Indian Plate (From Hadean to Holocene - 4Ga to 4Ka) GSI, Bangalore
- Ramsay, J.G. (1967): Folding and fracturing of rocks, McGraw Hill.
- Windley B. (1973): The Evolving continents, John Wiley and Sons, New York.
- N.J. Price and J.W. Cosgrove (1990) Analysis of Geological Structures, Cambridge University Press
- Ragan, Donal M.: Structural Geology, Cambridge University Press
- Whitten, E. H. Timothy (1966) Structural geology of folded rocks. Chicago: Rand McNally,
- George H. Davis (2011) Structural Geology of Rocks and Regions, John Wiley and Sons
- Fossen H (2010) Structural Geology, Cambridge University Press



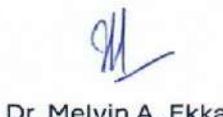
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Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

II. CORE COURSE [CCGLG102]: (Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1 mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

STRATIGRAPHY AND PALAEOBIOLOGY

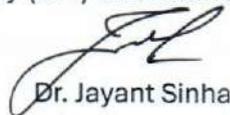
Theory: 60 Hours; Tutorial: 15 Hours

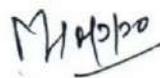
Unit 1

Principles of Stratigraphy; Concept of Lithofacies and Biofacies; Stratigraphic Correlation; Concepts of Magnetostratigraphy and Sequence stratigraphy. Precambrian Stratigraphy of Dharwar and Singhbhum- Chotanagpur craton; Proterozoic stratigraphy -tectonic framework, geological history and evolution of Vindhyan Super Group, Cuddapahs and their equivalents;

Unit 2

Palaeozoic stratigraphy: Palaeozoic formations of India with special reference to type localities, history of sedimentation, fossil content; Concept, classification, lithology, life and age of Gondwana supergroup ; Mesozoic formations of India with special reference to type localities, history of sedimentation, fossil content; Tertiary formations of North-eastern India, Siwalik Group; Stratigraphic boundary problems –Pre Cambrian-Cambrian (P/C), Permian-Triassic(P/Tr) and Cretaceous –Tertiary (K/T) boundaries.


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Unit 3

Study of Ichnofossils; Taphonomy and preservation. Morphology, classification, biostratigraphy and evolutionary trends of Trilobites, Brachiopods, Bivalves, Cephalopoda, Gastropods and Echinoids.

Unit 4

Vertebrate and its classification. Evolutionary trends in Equidae, Proboscidae and Man; Siwalik mammals and their causes of extinction;

Unit 5

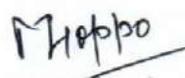
Micropalaeontology; Foraminifera, diamorphism, morphology and biostratigraphy; Gondwana flora and their significance, Palynology, types of Gondwana palynomorphs and its importance; Microfossils and their significance in oil exploration.

Suggested Books:

- A.Sahni, (1996), Cretaceous Stratigraphy and Palaeoenvironments. GSI, Bangalore
- Boggs, S. (2001): Principles of Sedimentology and Stratigraphy, Prentice Hall.
- Danbar, C.O. and Rodgers, J. (1957): Principles of Stratigraphy, John Wiley and Sons.
- Doyle, P. and Bennett. M.R. (1996): Unlocking the Stratigraphic Record, John Wiley and Sons.
- Krishnan, M.S. (1982): Geology of India and Burma, C.B.S. Publ. and Distributors, Delhi.
- M. Ramakrishnan & R. Vaidyanadhan (2008) Geology of India – (Vol. 1 & 2) GSI, Bangalore
- T.M. Mahadevan (2002), Geology of Bihar and Jharkhand. GSI, Bangalore
- Naqvi, S.M. and Rogers, J.J.W. (1987): Precambrian Geology of India, Oxford University Press.
- Naqvi, S.M. (2005) Geology and Evolution of the Indian Plate (From Hadean to Holocene - 4Ga to 4 Ka) GSI, Bangalore
- Pascoe, E.H. (1968): A Manual of the Geology of India and Burma (Vols. I-IV), Govt. of India Press, Delhi.
- Schoch, Robert, M. (1989): Stratigraphy: Principles and Methods, Van Nostrand Reinhold, New York.
- Boardman, R.S., Cheethan, A.M. and Rowell, A.J. (1988): Fossil Invertebrates, Blackwell.
- Clarksons, E.N.K. (1998): Invertebrate Paleontology and Evolution, Allen and Unwin, London.
- Horowitz, A.S. and Potter, E.D. (1971): Introductory Petrography of Fossils, Springer Verlag.
- Raup, D.M. and Stanley, S.M. (1985): Principles of Paleontology, CBS Publ.
- Shrock R.R. (1953) Principles of Invertebrate Paleontology, Mc Graw Hill Book Co.


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III. CORE COURSE [CCGLG103]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

CRYSTALLOGRAPHY AND DESCRIPTIVE MINERALOGY

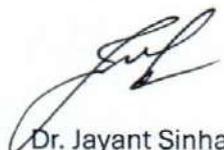
Theory: 60 Hours; Tutorial: 15 Hours

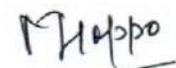
Unit 1

External symmetry of crystals: Symmetry Elements, methods of projection, Hermaun Mauguin notation. Internal symmetry of crystals: Derivation of 230 space groups, diffraction of crystals by X-rays, Braggs' law.

Unit 2

Principles of optical mineralogy: polarized light, behaviour of isotropic and anisotropic minerals in polarized light, refractive index, pleochroism, double refraction, birefringence, sign of elongation, interference figures, 2V, dispersion in minerals. Optic sign determination of Uniaxial and Biaxial minerals.


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Unit 3

Principles of crystal chemistry; Chemical bonds, ionic radii, Coordination principle, Radius ratio; Principles of ionic substitution in minerals; Isomorphism, Exsolution, Polymorphism, Pseudomorphism; Introduction to XRF, XRD and Electron Probe Microanalysis

Unit 4

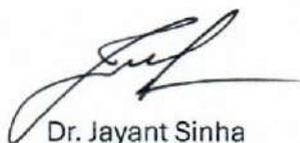
Structural classification of silicate minerals; Description of chemistry, optical and physical properties, and paragenesis of the following mineral groups: Olivine group, Garnet Group, Epidote group, Pyroxene group, Amphibole group

Unit 5

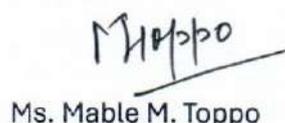
Description of chemistry, optical and physical properties and paragenesis of the following mineral groups: Mica group, Chlorite group and clay minerals, Quartz group, Feldspar group, Feldspathoids and Zeolites.

Suggested Books

- Dexter Perkins, 2003 – Mineralogy, Pearson Education Private Ltd.
- Carmelo Giacovazzo, 2002 – Fundamentals of crystallography, Oxford University Press
- Boris Konstantinovich Vaĭnshteĭn, 1994 – Modern Crystallography: Fundamentals of crystals, symmetry and methods of structural crystallography, Springer
- William D. Nesse, 2009 – Introduction to Mineralogy, Oxford University Press
- Dana, E.S. – 1955 – Text Book of mineralogy, Wiley
- Wade, F.A. and Mattox, R.E – 1960 – Elements of crystallography and Mineralogy, Harmer and brods.
- Philips, P.C. – 1971 – An introduction to Crystallography, John Wiley
- Winchell, A.N. – 1968 – Elements of optical Mineralogy, parts, I & II Wiley Eastern
- Berry, L.G. and Mason B, Dietrich. 1983 – Mineralogy- Concept, Descriptions Determinations, Freeman
- Buerger, M.J. – 1956 – Elementary Crystallography, Wiley
- Heinrich, E.W. – 1965 – Microscopic identification of Minerals McGraw Hill
- Naidu, P.R.J. C.S. – 1971 – Johansen's optical mineralogy, Allied
- Haribury, C.S. – 1971 – Dana's Manual of Mineralogy, Wiley.
- Deer, W.A. Howie, R.A. & Zussman, J – 1992 – Rock forming Mineralogy Vols. 1 to 5, Longmans.
- Hammond, C. 1990. Introduction to Crystallography. Oxford: Oxford University Press.
- Klein, C. 2002. Manual of Mineral Science. 22nd edition. New York: John Wiley and Sons.



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IV. CORE COURSE PRACTICAL [CPGLG104]:

(Credits: Practical 05)

Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:

End Semester Practical Examination (ESE Pr):

The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

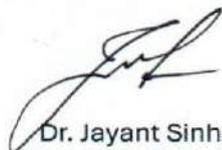
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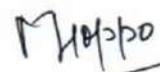
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

PRACTICAL-I

Practical: 60 Hours

- Completion of outcrops in given maps;
- Structural problems by Stereographic Net;
- Plotting of Geological Sections;
- Mineral formulae, calculation of important rock forming mineral groups;
- Microscopic identification of important rock forming minerals;
- Determination of Optic Sign of Uniaxial and Biaxial Minerals;
- Determination of pleochroic scheme;
- Determination of An content in Plagioclase feldspars;
- Study of rocks in hand specimens from known Indian stratigraphic horizons and type localities;
- Megascopic study of Invertebrate fossils;
- Study of Molar tooth of important vertebrate fossils;
- Study of morphological characters of selected microfossils;
- Megascopic study of Plant Fossils;
- Study of morphological characters of selected palynomorphs


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Total 100 x 4 = 400 Marks

I. CORE COURSE [CCGLG201]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

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Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

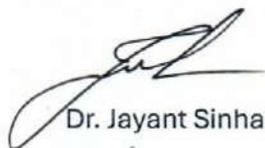
GEOMORPHOLOGY AND RS-GIS IN GEOLOGY

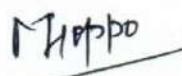
Theory: 60 Hours; Tutorial: 15 Hours

Geomorphology

Unit 1

Fundamental concepts – significance of structure, process and time; A brief account of concepts of evolution of landforms; Characteristic features of landforms, Characteristics and types of fluvial landforms, Fluvial cycle, concept of peneplains, stream rejuvenation, causes and effects; Aeolian landforms, Arid Cycle of erosion; Glacial landforms, periodicity of glaciation and its causes; Karst topography, Relationship of geologic structures to topography; Volcanic landforms


Dr. Jayant Sinha


Ms. Mable M. Toppo


Dr. Somesh Sengupta


Dr. Melvin A. Ekka

Unit 2

Geomorphology of the coasts, classification of shorelines and their evolution. Evidence of eustatic changes and their causes. Influence of lithology on relief. Development of landforms of flat lying, tilted, folded, dome and faulted structures, Development of drainage systems, Drainage Patterns, Drainage analysis in Geological interpretation. Geomorphic features of India; Application of Geomorphology in groundwater, mineral and oil exploration and Engineering projects.

RS-GIS in Geology

Unit 3

Electromagnetic spectrum and its properties, Atmospheric Windows; Interaction of electromagnetic radiation with matter, Spectral signatures; Basic ideas of Thermal Infra-red and Microwave Remote Sensing; Photogrammetry- recent advancements and applications; Remote Sensing Satellite programmes and their characteristics.

Unit 4

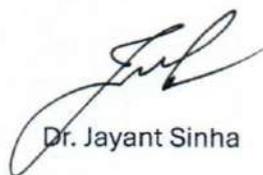
Basic principles of Image interpretation and Digital image techniques; Principles and applications of GIS; Image characters and their relations with ground objects based on tone, texture and pattern; Interpretation of topographic and tectonic features; Identification of Igneous, Sedimentary and Metamorphic rock types in images;

Unit 5

Principles of terrain analysis; Morphometric analysis; Geomorphological mapping based on genesis of landforms; Terrain evaluation for strategic purposes.

Suggested Books:

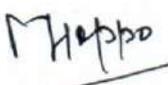
- Richard J. Huggett – 2007 – Fundamentals of Geomorphology, Routledge
- Keith A. Sverdrup, Alison Duxbury, Alyn C. Duxbury, 2006 – Fundamentals of Oceanography, McGraw-Hill Higher Education
- Thornbury, W.D., 1969 – Principles of Geomorphology, Wiley.
- Worcester, P.G., 1948 – A text book of Geomorphology
- B.W. Sparles, 1981 – Geomorphology, Longman Group Ltd.
- Bloom, A.L. 1979 – Geomorphology, Prentice Hall.
- Arthur L. Bloom, 2004 – Geomorphology: a systematic analysis of late Cenozoic landforms, WavelandPr Inc,
- Lillesand, T.M. and Keifer, R.W. 1987; Remote Sensing and Image Interpretation; John Wiley
- S.N. Pandey, 1987: Principles and Applications of Photogeology; Wiley Eastern, New Delhi
- Gupta R.P. 1990: Remote Sensing Geology; Springer Verlag



Dr. Jayant Sinha



Dr. Somesh Sengupta



Ms. Mable M. Toppo



Dr. Melvin A. Ekka

II. CORE COURSE [CCGLG202]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

GEOCHEMISTRY AND IGNEOUS PETROLOGY

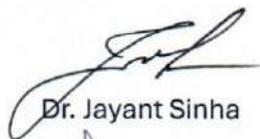
Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

Origin and abundance of elements in the Solar System and in the Earth, cosmic abundance of elements; Geochemical classification of Elements; Radiogenic Isotopes; Radioactive decay scheme of U-Pb, Sm-Nd, Rb-Sr, K-Ar and growth of daughter isotopes; Radiometric dating; Stable Isotopes: nature, abundance and fractionation.

Unit 2

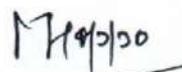
Laws of Thermodynamics and its application in Petrology; Age of the Earth. Geochemistry and principles of evolution of hydrosphere, biosphere and atmosphere. Geochemical cycle and principles of geochemical prospecting.



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Unit 3

Nature and evolution of magma; Plate tectonics and generation of magmas; Plume magmatism and hotspots; Large igneous provinces and mafic dyke swarms; Partial melting, batch and fractional melting; Crystal fractionation and Contamination; IUGS classification of the igneous rocks and CIPW norm.

Unit 4

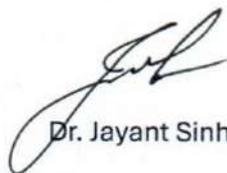
Phase equilibrium - binary systems (Ab-An, Ab-Or, Di-An, Fo-Si) and their relations to magma genesis and crystallization in the light of modern experimental works; Ternary systems (Di-Ab-An, Di-Fo-Si, Di-Fo-An, Fo-An-Si) and their relations to magma genesis and crystallization

Unit 5

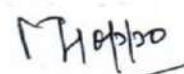
Petrogenetic significance of igneous textures; Petrology and petrogenesis of major igneous rock types with Indian examples of ultramafic, komatiite, basalt, anorthosite, granite, alkaline rocks, ophiolite, carbonatite, lamprophyre.

Suggested Books:

- Krauskopf, K.B. (1967): Introduction to Geochemistry, McGraw Hill.
- Mason, B. and Moore, C.B. (1991): Introduction to Geochemistry, Wiley Eastern.
- Rollinson, H.R. (1993): Using geochemical data: Evaluation, Presentation, Interpretation. Longman U.K.
- Bose, M.K. (1997): Igneous Petrology, World Press, Kolkata.
- Best, Myron G. (2002): Igneous and Metamorphic Petrology, Blackwell Science.
- Cox, K.G., Bell, J.D. and Pankhurst, R.J. (1993): The Interpretation of Igneous Rocks, Chapman and Hall, London.
- Faure, G. (2001): Origin of Igneous Rocks, Springer.
- Hall, A. (1997): Igneous Petrology, Longman.
- LeMaitre R.W. (2002): Igneous Rocks: A Classification and Glossary of Terms, Cambridge University Press.
- McBirney (1994): Igneous Petrology, CBS Publ., Delhi
- Phillipotts, A.R. (1994): Principles of Igneous and Metamorphic Petrology, Prentice Hall of India.
- Sood, M.K. (1982): Modern Igneous Petrology, Wiley-Interscience Publ., New York.
- Wilson, M. (1993): Igneous Petrogenesis, Chapman and Hall, London.
- Winter, J.D. (2001): An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, New Jersey.
- Hoefs, J. (1980): Stable Isotope Geochemistry, Springer-Verlag.
- Krauskopf, K.B. (1967): Introduction to Geochemistry, McGraw Hill.
- Mason, B. and Moore, C.B. (1991): Introduction to Geochemistry, Wiley Eastern.
- Rollinson, H.R. (1993): Using geochemical data: Evaluation, Presentation, Interpretation. Longman U.K.


Dr. Jayant Sinha


Dr. Somesh Sengupta


Ms. Mable M. Toppo


Dr. Melvin A. Ekka

I. CORE COURSE [CCGLG203]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

SEDIMENTARY AND METAMORPHIC PETROLOGY

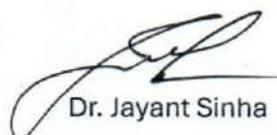
Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

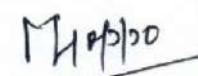
Surface processes and rock weathering; Processes of transport and generation of sedimentary rocks; Sedimentary Texture: Textural elements of clastic and non-clastic rocks, Structures: important erosional, depositional and post depositional sedimentary structures and their significance; Provenance: Source of sediments, compositional maturity; Significance of light and heavy minerals in provenance study.

Unit 2

Sedimentary environment and facies. Facies modeling for marine, non-marine and mixed sediments. Tectonics and sedimentation. Classification and definition of sedimentary basins. Sedimentary basins of India. Cyclic sediments. Seismic and sequence stratigraphy. Purpose and scope of basin analysis. Stratum contours and isopach maps.


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Dr. Melvin A. Ekka

Unit 3

Concept of Zones and Grades; Metamorphic facies and facies series; Fabric in metamorphism; Classification of Metamorphic Rocks; Mineralogical Phase Rule; A detailed description of each of low pressure, medium to high pressure and very high pressure with special reference to mineralogical assemblages Metamorphic Differentiation; ACF, AKF and AFM diagrams in metamorphic petrology.

Unit 4

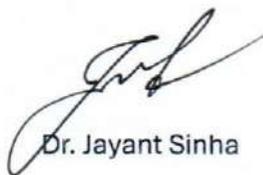
Regional metamorphism and Ocean Floor Metamorphism; Regional and thermal metamorphism of pelitic rocks. Regional and thermal metamorphism of basic and ultrabasic rocks; Regional and thermal metamorphism of impure, silicious carbonate rocks; Metamorphism of Granitoids, Charnockites and Migmatites.

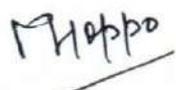
Unit 5

Metamorphism in space and time: Plate tectonics and metamorphic processes; Paired metamorphic belts, Archaean and Proterozoic terrains; polymetamorphism.

Suggested Books

- Blatt, H., Middleton, G.V. and Murray, R.C. (1980): Origin of Sedimentary Rocks, Prentice-Hall Inc.
- Collins, J.D., and Thompson, D.B. (1982): Sedimentary Structures, George Allen and Unwin, London.
- Lindholm, R.C. (1987) A Practical Approach to Sedimentology, Allen and Unwin, London.
- Miall, A.D. (2000): Principles of Basin Analysis, Springer-Verlag.
- Pettijohn, F.J. (1975): Sedimentary Rocks (3rd Ed.), Harper and Row Publ., New Delhi.
- Reading, H.G. (1997): Sedimentary Environments and facies, Blackwell Scientific Publication.
- Reineck, H.E. and Singh, I.B. (1973): Depositional Sedimentary Environments, Springer-Verlag.
- Selley, R. C. (2000) Applied Sedimentology, Academic Press.
- Tucker, M.E. (1981): Sedimentary Petrology: An Introduction, Wiley and Sons, New York.
- Bucher, K. and Martin, F. (2002): Petrogenesis of Metamorphic Rocks (7th Rev. Ed.), Springer-Verlag.
- Philpotts, A.R. (1994): Principles of Igneous and Metamorphic Petrology, Prentice Hall.
- Spry, A. (1976): Metamorphic Textures, Pergamon Press.
- Winter, J.D. (2005): An introduction to Igneous and Metamorphic Petrology, Prentice Hall.
- Yardley, B.W.D., Mackenzie, W.S. and Guilford, C. (1995): Atlas of Metamorphic Rocks and their textures, Longman Scientific and Technical, England.
- Yardley, B.W. (1989) An introduction to Metamorphic Petrology, Longman, NY
- Best, M.G. (2004) Igneous and Metamorphic Petrology, cbs Publ.
- Winkler H.G.F. (1979) Petrogenesis of Metamorphic Rocks, Springer Verlag


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Ms. Mable M. Toppo


Dr. Somesh Sengupta


Dr. Melvin A. Ekka

Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:**End Semester Practical Examination (ESE Pr):**

The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

Note:

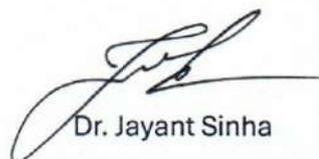
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

PRACTICAL-II**Practical: 60Hours****(A) Full Marks : 60**

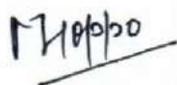
- (i) Megascopic and Microscopic studies of Igneous, Sedimentary and Metamorphic rocks.
- (ii) Megascopic studies of Sedimentary structures.
- (iii) Graphic representation of Modal analyses in QAP and APF diagrams
- (iv) Graphic representation of chemical analyses in ACF, AKF and AFM diagrams.
- (v) Calculation of C.I.P.W. Norm and Niggli Values
- (vi) Morphometric analysis of drainage system.
- (vii) Exercises on satellite imagery/photo interpretation

(B)**Full Marks : 40**

- (i) Geological Mapping of two weeks duration in a geologically complex area and Field Work Report based on it



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Total 100 x 4 = 400 Marks

I. ABILITY ENHANCEMENT COURSE**[ECGLG301A]:**

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100**Pass Marks (MSE:17 + ESE:28)=45****Instruction to Question Setter:****Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

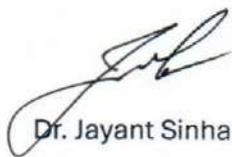
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks).

A. FOSSIL FUEL GEOLOGY-I**Theory: 60 Hours; Tutorial: 15 Hours****Unit 1**

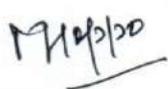
Definition and origin of coal, sedimentology of coal bearing strata; Mode of occurrence and structures of coal; Coal forming epochs in the geological past.

Unit 2

Physical and chemical characterization of coal; Proximate and Ultimate analysis of coal; Rank, grade and types of coal; Types of coking and non-coking coals; Classification of Coal



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Dr. Somesh Sengupta



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Unit 3

Macroscopic and microscopic examination of coal, Concepts of Macerals and Microlithotypes, Origin and classification of macerals, Concept of coal rank; Application of Coal Petrology

Unit 4

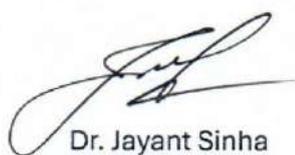
Basics of Coal Bed Methane, coal as its reservoir- its exploration and production; Application of microscopic methods for C.B.M. prospecting; Gas Hydrates, Shale gas.

Unit 5

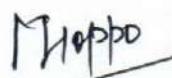
Microscopic techniques for evaluation of rank, Palaeoenvironmental study and characterization of coal for carbonization, gasification and hydrogenation processes.

Suggested Books

- Chandra, D., Singh, R.M. Singh, M.P. (2000): Textbook of Coal (Indian context), Tara Book Agency, Varanasi.
- Scott, A.C. (1987): Coal and Coal-bearing strata: Recent Advances, Blackwell Scientific Publications.
- Singh, M.P. (1998): Coal and organic Petrology, Hindustan Publishing Corporation, New Delhi.
- G.H., Teichmuller, M., Davis, A., Diessel, C.F.K., Littke, R. and Robert P. (1998): Organic Petrology, Gebruder Borntraeger, Stuttgart.
- Thomas, Larry (2002): Coal Geology, John Wiley and Sons Ltd., England.
- Van Krevelen Stach; E., Mackowsky, M-Th., Taylor, G.H., Chandra, D., Teichmuller, M. and Teichmuller R. (1982): Stach Textbook of Coal Petrology, Gebruder Borntraeger, Stuttgart.
- Taylor, D. W. (1993): Coal: Typology-Physics-Chemistry-Constitution), Elsevier Science, Netherlands



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Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

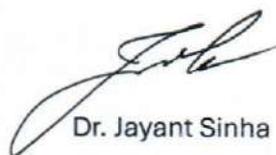
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

B. SEDIMENTOLOGY-I**Theory: 60 Hours; Tutorial: 15 Hours****Unit 1**

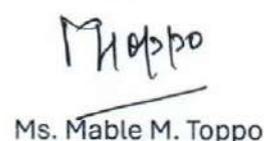
Sedimentary textures - shape, size, fabric and surface textures, methods of textural analysis, textural parameters and their significance. Framework, matrix and cement of terrigenous sediments.

Unit 2

Sedimentary structures: classification, genesis and significance Primary structures, palaeocurrent analysis. Biogenic and chemical sedimentary structures; Use of structures and textures in basin studies



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Dr. Somesh Sengupta



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Unit 3

Origin of sediments and sedimentary rocks, Lithification and diagenesis.

Unit 4

Petrogenesis of sandstones, Graywacke and graywacke problem; plate - tectonics and sandstones composition.

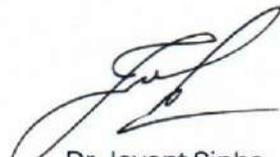
Argillaceous rocks, their classification and genesis.

Unit 5

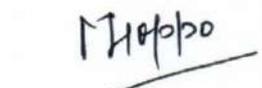
Carbonates: Mineralogy, chemistry, texture and classification of Limestones; Diagenesis of Limestone in various diagenetic realms, change in mineralogy, fabric, chemistry and petrophysical characteristics; Study of evaporites such as gypsum, anhydrite and halite.

Suggested Books:

- Blatt, H., Middleton, G.V. and Murray, R.C. (1980): Origin of Sedimentary Rocks, Prentice-Hall Inc.
- Collins, J.D., and Thompson, D.B. (1982): Sedimentary Structures, George Allen and Unwin, London.
- Lindholm, R.C. (1987) A Practical Approach to Sedimentology, Allen and Unwin, London.
- Pettijohn, F.J. (1975): Sedimentary Rocks (3rd Ed.), Harper and Row Publ., New Delhi.
- Reading, H.G. (1997): Sedimentary Environments and facies, Blackwell Scientific Publication.
- Reineck, H.E. and Singh, I.B. (1973): Depositional Sedimentary Environments, Springer-Verlag.
- Selley, R. C. (2000) Applied Sedimentology, Academic Press.
- Tucker, M.E. (1981): Sedimentary Petrology: An Introduction, Wiley and Sons, New York.
- Tucker, M.E. (1990): Carbonate Sedimentology, Blackwell Scientific Publication.



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Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

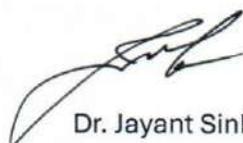
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

C. HYDROGEOLOGY-I**Theory: 60 Hours; Tutorial: 15 Hours***Unit 1*

Hydrologic Cycle, Distribution of water in Earth crust, Groundwater in hydrologic cycle; Ground water, origin, types, importance; Aquifer, their types and characteristics; Hydrologic properties of aquifer materials: porosity; permeability; specific yield; specific retention, hydraulic conductivity, transmissivity, storage coefficient.

Unit 2

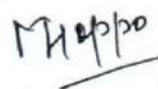
Forces and laws of groundwater movement; Darcy law and its application in hydrogeology; Confined, unconfined, steady, unsteady and radial flows of groundwater; Methods of pumping test and evaluation of aquifer parameters. Springs: types, origin and movement of water; Water Table map and its significance.



Dr. Jayant Sinha



Dr. Somesh Sengupta



Ms. Mable M. Toppo



Dr. Melvin A. Ekka

Unit 3

Hydrographic analyses, Water budget studies; Water resource inventory of the basin; Consumptive and conjunctive use of surface and groundwater; Causative factors for Water Table fluctuation. Wells: types, drilling methods, construction, design and development of wells.

Unit 4

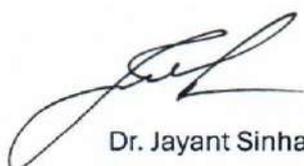
Physical and Chemical characteristics of groundwater. Interpretation of chemical analysis. Relationship of quality to use. Ground water pollution; Sources of surface and subsurface pollution; Control of groundwater pollution

Unit 5

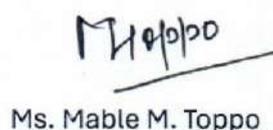
Chemical characteristics of groundwater in relation to various uses – domestic, industrial and irrigation; Water contaminants and pollutants, natural (geogenic) and anthropogenic contaminants; Saline water intrusion in coastal and other aquifers and its prevention; Groundwater contamination and problems of arsenic and fluoride in Indian subcontinent with special reference to Jharkhand.

Suggested Books

- C.F. Tolman (1937): Groundwater, McGraw Hill, New York and London.
- D.K. Todd (1995): Groundwater Hydrology, John Wiley and Sons.
- F.G. Driscoll (1988): Groundwater and Wells, UOP, Johnson Div. St. Paul. Min. USA.
- H.M. Raghunath (1990): Groundwater, Wiley Eastern Ltd.,
- H.S. Nagabhushaniah (2001): Groundwater in Hydrosphere (Groundwater hydrology), CBS Publ..
- K. R. Karanth (1989): Hydrogeology, Tata McGraw Hill Publ.
- S.N. Davies and R.J.N. De Wiest (1966): Hydrogeology, John Wiley and Sons, New York.
- Patra, H. P., Adhikari, Shyamal Kumar, Kunar, Subrata (2016) Groundwater Prospecting and Management, Springer
- Jakeman, A.J., Barreteau, O., Hunt, R.J., Rinaudo, J.-D., Ross, A. (2016) Integrated Groundwater Management: Concepts, Approaches and Challenges, Springer
- Ramanathan, A., Johnston, S., Mukherjee, A., Nath, B. (Eds.) 2015, Safe and Sustainable Use of Arsenic- Contaminated Aquifers in the Gangetic Plain
- A Multidisciplinary Approach; Springer
- C.W. Fetter Jr. (2016) Applied Hydrogeology (4th Edition) 4th Edition Pearson Education Ltd.
- Kevin M. Hiscock (2009) Hydrogeology: Principles and Practice, Wiley-Blackwell
- Singhal, B.B.S. Gupta R.P. (2010) Applied Hydrogeology of Fractured Rocks, Springer



Dr. Jayant Sinha



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Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

D. ORE GEOLOGY-I

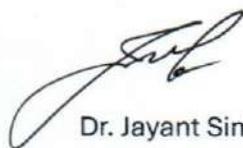
Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

Ore deposits and ore minerals. Classification of ore deposits. Magmatic processes of mineralization. Porphyry, skarn and hydrothermal mineralization.

Unit 2

Structure and texture of ores, Paragenesis, Controls of ore localization. Spatial and temporal distribution of ore deposits.



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Unit 3

Plate tectonics and ore genesis. Ore bearing fluids, movement of ore bearing fluids, Fluid inclusion studies of ores, Geothermometry.

Unit 4

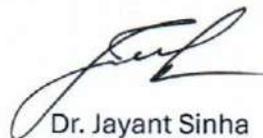
Mineralization associated with ultramafic, mafic and acidic rocks, Wall rock alteration, Magma related mineralization through geological time.

Unit 5

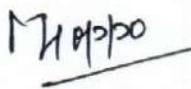
Mineralization associated with sedimentary rocks, submarine volcanism, Weathering and metamorphic processes. Stratiform and stratabound ores.

Suggested Books

- Edwards, R. and Atkinson, K. (1986) Ore Deposit Geology. Chapman and Hall, London.
- Craig, J.M. and Vaughan, D.J. (1981) Ore Petrography and Mineralogy. John Wiley.
- Evans, A.M. (2012) Ore Geology and Industrial Minerals. Third Edition (Reprint), Blackwell
- Sawkins, F.J. (1984) Metal Deposits in relation to Plate Tectonics. Springer Verlag.
- Stanton, R.L. (1972) Ore Petrology. McGraw Hill.
- Torling, D.H. (1981) Economic Geology and Geotectonics. Blackwell Sci. Publ.
- Barnes, H.L (1979) Geochemistry of Hydrothermal Ore Deposits. John Wiley.
- Klemm, D.D. and Schneider, H.J. (1977) Time and Strata Bound Ore Deposits. Springer Verlag.
- Guilbert, J.M. and Park, Jr. C.F. (1986) The Geology of Ore Deposits. Freeman.
- Mookherjee, A. (2000) Ore genesis -a Holistic Approach. Allied Publishers.
- Wolf, K.H. (1981) Handbook of Strata Bound and Stratiform Ore Deposits. Elsevier.
- Jensen, M.L. and Bateman, A.M. (1981) Economic Mineral Deposits. John Wiley and Sons, New York.
- McKinstry, H.E. (1972) Mining Geology. Prentice-Hall Inc.
- Arogyaswamy, R.N.P. (1995) Courses in Mining Geology. Oxford and IBH Publishing Co., New Delhi.
- Thomas, L.J. (1978) An Introduction to Mining. Methuen, Brisbane.
- Clark, G.B. (1967) Elements of Mining. Asia Publishing House.
- Sinha, R.K. & Sharma, N.L. (1993) An Introduction to Mineral Economics, Wiley Eastern
- Chatterjee, K.K. (1993) An Introduction to Mineral Economics, Wiley Eastern.



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

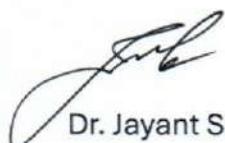
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

E. ENVIRONMENTAL GEOLOGY-I**Theory: 60 Hours; Tutorial: 15 Hours***Unit 1*

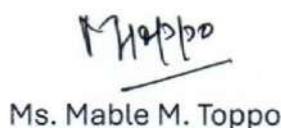
Basics of Environment; Type of Environment; Man and Environment; Components of environmental geology, Concepts and principles of Environmental Geology; Time scales of global changes in the ecosystem and climate;

Unit 2

Atmosphere, structure and composition of atmosphere; Global warming. Greenhouse effect.; CO₂ increase and global warming in the present and past atmospheres.



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Unit 3

Environmental Pollution: Sources of Air Pollution, emission of major industrial air pollutants, effects of air pollution on atmospheric processes, oxides of carbon as pollutants, greenhouse effect, global warming, chlorofluoro carbons (CFC's), depletion of ozone layer, effects of ozone depletion, smog, acidrain.

Unit 4

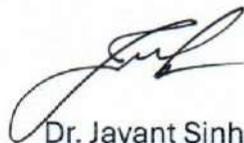
Components of Hydrosphere; Water cycle; solubility of gases in water, Acidification of Ocean; Impact of oceanic and atmospheric circulation on climate and rain fall. Fluctuation of water table due to anthropogenic and geogenic causes.

Unit 5

Water Pollution: Types of water pollution, groundwater pollution and its effects, sources of water pollution; organic and inorganic contamination of groundwater and its remedial measures.

Suggested Books:

- Abhijit Dutta. Environmental Issues and Challenges
- B. K. Sharma Environmental Pollution
- Bell, F.G. (1999): Geological Hazards, Routledge, London.
- Bryant, E. (1985): Natural Hazards, Cambridge Univ. Press.
- Keller, E.A. (1978) Environmental Geology
- Rekha Ghosh and D. S. Chatterjee: Environmental Geology
- Valdiya, K.S. (1987) Environmental Geology- Indian Context
- Patwardhan, A.M. (1999) The Dynamic Earth System
- Smith, K. (1992) Environmental Hazards
- Subramaniam (2001) Textbook of Environmental Hazards
- Strahler and Strahler: Environmental Geology



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

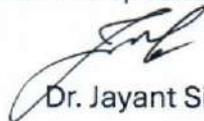
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

ECONOMIC GEOLOGY**Theory: 60 Hours; Tutorial: 15 Hours****Unit 1**

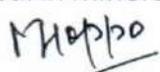
Concepts of Ore Genesis; Distribution of Ore Deposits-Global Perspective; Mode of occurrences and morphology of ore bodies, Controls of Ore localization; Classification of Ore deposits; Processes of Ore formation – Magmatic, Sedimentary, Metamorphic associations and Weathering processes; Ore deposits and Plate Tectonics.

Unit 2

Occurrence and distribution in India of metalliferous deposits - base metals, iron, manganese, aluminium, chromium, nickel, gold, silver, molybdenum. Indian deposits of non-metals – Diamond, mica, asbestos, barytes, gypsum, graphite, apatite and beryl. Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries. Building stones. Phosphorite deposits. Placer deposits, rare earth minerals.



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Unit 3

Coal: Origin, mode of occurrence and types of coal; Proximate and Ultimate analysis; Concept of Macerals and Microlithotypes; Classification, rank, and grade of coal; Important coal basins of India with special reference to Jharkhand. Fundamentals of Coal Bed Methane.

Unit 4

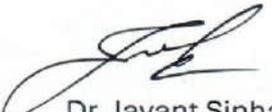
Petroleum: Origin and migration of Petroleum, Properties of source and reservoir rocks, Petroleum Traps; Geological and geophysical methods of petroleum exploration; Petroliferous basins of India; Atomic Minerals: Atomic fuel resources of India – distribution and prospects.

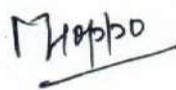
Unit 5

Geological Mapping techniques; Geological criteria for mineral prospecting; Basic principles of Geochemical Exploration; Principles and application of surface geophysical exploration techniques; Brief outline of various well logging techniques; Strategic, critical and essential minerals. India's status in mineral production vis a vis world scenario; National Mineral Policy.

Suggested Books:

- Arogyaswami, R.P.N. (1996): Courses in Mining Geology, Oxford and IBH Publ.
- Bagchi, T.C., Sengupta, D.K., Rao, S.V.L.N. (1979): Elements of Prospecting and Exploration, Kalyani Publ.
- Banerjee, P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.
- Chaussier, Jean – Bernard and Morer, J. (1987): Mineral Prospecting Manual., North Oxford Academic.
- Clark, G.B. (1967): Elements of Mining, (3rd Ed.), John Wiley.
- T.S. Ramakrishna (2006), Geophysical Practice in Mineral Exploration and Mapping GSI, Bangalore
- Mookherjee, A. (2000): Ore Genesis-A Holistic Approach, Allied Publisher
- Dhanraju, R. (2005): Radioactive Minerals, Geol. Soc. India, Bangalore.
- Craig J M and Vaughan D J (1981) Ore Petrography and Mineralogy, John Willey
- Evans (1973) Ore Geology and Industrial Minerals
- Cogen B and Dey A K (1975) Mineral and Nuclear Fuels of India, Oxford Pub.
- Bagchi, T.C., Sengupta, D.K., Rao, S.V.L.N. (1979): Elements of Prospecting and Exploration, Kalyani Publ.
- Banerjee, P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.
- Chaussier, Jean – Bernard and Morer, J. (1987): Mineral Prospecting Manual., North Oxford Academic.


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CORE COURSE [CCGLG303]: (Credits: Theory-03, Practical-02)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

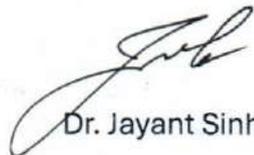
(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd., 5 marks).

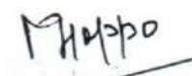
HYDROGEOLOGY, ENGINEERING GEOLOGY, ENVIRONMENTAL GEOLOGY, MINING GEOLOGY

Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

Role of groundwater in the hydrological cycle; Controls of geology on groundwater occurrence and distribution; Classification of aquifers and aquifer systems; Darcy's law; Hydraulic conductivity, transmissivity, storage coefficient and specific capacity; Water table contour maps and flow net analysis. Causative factors of groundwater level fluctuations and environmental influences


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Unit 2

Chemical characteristics of groundwater in relation to various uses – domestic, industrial and

irrigation; Groundwater contamination and problems of arsenic, fluoride and nitrates; Management of groundwater resources: Artificial recharge to groundwater and rainwater harvesting; Groundwater exploration; Hydrogeomorphic mapping using various Remote Sensing techniques; Groundwater provinces of India.

Unit 3

Engineering Properties of rocks, and Soils; Properties and selection of Construction Materials; Landslides and stability of Hill slopes; Geological investigation for Engineering Projects.: Geological investigations and criteria for sites selection of Dam sites, Reservoirs Tunnels and Bridges; Engineering Projects- Case Histories from India.

Unit 4

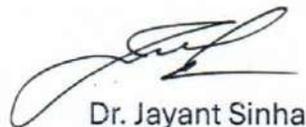
Components of environment. Carbon dioxide in atmosphere, global warming caused by CO₂ increase in the atmosphere. Impact assessment of degradation and contamination of surface water and ground water quality due to industrialization and mining. Soil Quality degradation due to irrigation, use of fertilizers and pesticides. Introduction to climatic changes, causes of climatic changes, world climate during geological periods. Impact of climate on society. Impact of man on climate.

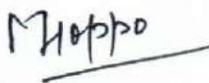
Unit 5

Mining of surface and underground mineral deposits involving diamond drilling, shaft sinking, drifting, cross-cutting, winging, stoping, room and pillaring, top- slicing, sub -level caving and block caving. Types of drilling methods. Mining Hazards: mine inundation, mine fire and rock burst.

Suggested Books:

- Arogyaswami, R.P.N. (1996): Courses in Mining Geology, Oxford and IBH Publ.
- Clark, G.B. (1967): Elements of Mining, (3rd Ed.), John Wiley.
- Dobrin, M. B.; Savit, C. H. (1988): Introduction to Geophysical Prospecting, McGraw-Hill.
- Rider, M. H. (1986): Whittles Publishing, Caithness. The Geological Interpretation of Well Logs, (Rev. Ed.).
- Robert, D. (1985): Encyclopedia of Well Logging
- T.S. Ramakrishna (2006), Geophysical Practice in Mineral Exploration and Mapping GSI, Bangalore
- D.K. Todd (1995): Groundwater Hydrology, John Wiley and Sons.
- H.M. Raghunath (1990): Groundwater, Wiley Eastern Ltd.,
- K. R. Karanth (1989): Hydrogeology, Tata McGraw Hill Publ..
- S.N. Davies and R.J.N. De Wiest (1966): Hydrogeology, John Wiley and Sons, New York.


Dr. Jayant Sinha


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Dr. Somesh Sengupta


Dr. Melvin A. Ekka

Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:**End Semester Practical Examination (ESE Pr):**

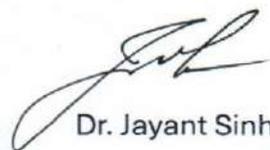
The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

Note:

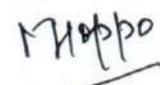
(Attendance Upto 60%, 1 mark; 60 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

PRACTICAL-III**Practical: 60Hours**

- Delineation of hydrological boundaries on geological sections;
- Hydrologic properties of rocks;
- Location of Hydrostratigraphic units of India;
- Location of different ore deposits, non-metallic deposits, atomic fuel, gemstones and REE on the outline map of Jharkhand, India and World;
- Location of different mineral deposits associated with convergent, divergent and transform plate margins;
- Reserve estimation for metals, industrial rocks and coal;
- Estimation of coal quality on the basis of proximate analysis data supplied;
- Location of petroliferous basins and coalfields on the outline map of India;
- Preparation of litholog on the basis of borehole data supplied and their interpretation;
- Study of the coal samples and plant fossils of Gondwana coal fields;
- Preparation of bar graphs showing production status of different minerals year wise and their interpretation;
- Study of Metallogenic provinces of India.



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Total 100 x 4 = 400 Marks

I. GENERIC/DISCIPLINE CENTRIC ELECTIVE [ECGLG401A]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

A. FOSSIL FUEL GEOLOGY-II

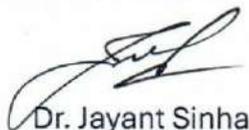
Theory: 60 Hours; Tutorial: 15 Hours

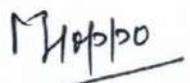
Unit 1

Elementary idea about coal preparation, Washing and beneficiation of coal, Blending of coal; coal carbonisation, coal gasification, coal liquefaction and coal combustion, Briquetting of coal

Unit 2

Assessment of coal reserves; Geological, Geobotanical and Geophysical survey for coal; Gondwanapalynology and its application for coal exploration.


Dr. Jayant Sinha


Ms. Mable M. Toppo


Dr. Somesh Sengupta


Dr. Melvin A. Ekka

Unit 3

Mining of coal- underground mining and open cast mining; Coal Mining hazards and its mitigation; Trace elements in coal; Coal as environment pollutant; Conservation of coal

Unit 4

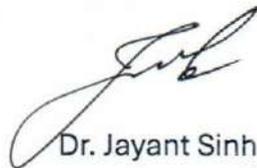
Unit Geological and geographical distribution of coal deposits of Jharkhand

Unit 5

Geological and geographical distribution of coal and Lignite deposits in India except Jharkhand;

Suggested Books:

- Chandra, D., Singh, R.M. Singh, M.P. (2000): Textbook of Coal (Indian context), Tara Book Agency, Varanasi.
- Scott, A.C. (1987): Coal and Coal-bearing strata: Recent Advances, Blackwell Scientific Publications.
- Singh, M.P. (1998): Coal and organic Petrology, Hindustan Publishing Corporation, New Delhi.
- G.H., Teichmuller, M., Davis, A., Diessel, C.F.K., Littke, R. and Robert P. (1998): Organic Petrology, Gebruder Borntraeger, Stuttgart.
- Thomas, Larry (2002): Coal Geology, John Wiley and Sons Ltd., England.
- Van Krevelen Stach, E., Mackowsky, M-Th., Taylor, G.H., Chandra, D., Teichmuller, M. and Teichmuller R. (1982): Stach Textbook of Coal Petrology, Gebruder Borntraeger, Stuttgart.
- Taylor, D. W. (1993): Coal : Typology-Physics-Chemistry-Constitution), Elsevier Science, Netherlands



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Dr. Somesh Sengupta



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Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

B. SEDIMENTOLOGY-II

Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

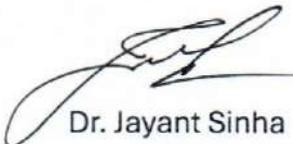
Concept of basin analysis; Tectonic classification and evolution of sedimentary basins; Plate tectonics in relation to type and evolution of basins.

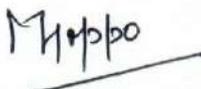
Unit 2

Sedimentary facies and facies models with Indian analogues; Paleocurrent analysis and its applications

Unit 3

Processes and characteristics of depositional environments such as fluvial, estuarine, deltaic, lagoonal, barrier beach, tidal flats, deep-sea environments, lacustrine, aeolian, glacial etc.


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Unit 4

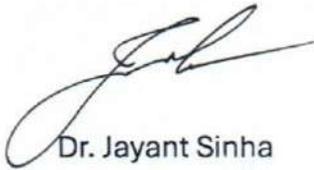
Sedimentary basins of India. Plate tectonics in relation to type and evolution of basins.

Unit 5

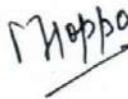
Concept of sequence stratigraphy, regional unconformities, systems tracts and parasequences.

Suggested Books:

- Blatt, H., Middleton, G.V. and Murray, R.C. (1980): Origin of Sedimentary Rocks, Prentice-Hall Inc.
- Collins, J.D., and Thompson, D.B. (1982): Sedimentary Structures, George Allen and Unwin, London.
- Lindholm, R.C. (1987) A Practical Approach to Sedimentology, Allen and Unwin, London.
- Pettijohn, F.J. (1975): Sedimentary Rocks (3rd Ed.), Harper and Row Publ., New Delhi.
- Reading, H.G. (1997): Sedimentary Environments and facies, Blackwell Scientific Publication.
- Reineck, H.E. and Singh, I.B. (1973): Depositional Sedimentary Environments, Springer-Verlag.
- Selley, R. C. (2000) Applied Sedimentology, Academic Press.
- Tucker, M.E. (1981): Sedimentary Petrology: An Introduction, Wiley and Sons, New York.
- Tucker, M.E. (1990): Carbonate Sedimentology, Blackwell Scientific Publication



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

C. HYDROGEOLOGY-II

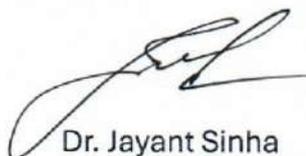
Theory: 60 Hours; Tutorial: 15 Hours

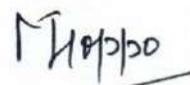
Unit 1

Occurrence of groundwater in different rock types; Geologic structures favouring groundwater occurrence; Occurrence of groundwater in various hydrostratigraphic units of India; Groundwater provinces of India.

Unit 2

Components of Groundwater basin characterization: slope characteristics, lithology and associated geological structures, soil type and thickness, etc.; Geomorphic controls for groundwater accumulation; Drainage pattern, their relationship with lithology and geologic structure; tools.


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Unit 3

Groundwater basin characterization and prioritization by Remote Sensing and GIS

Unit 4

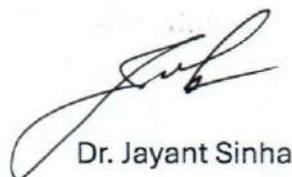
Surface and subsurface geological and geophysical methods of groundwater exploration; Identification of groundwater potential zones by various Remote sensing techniques, Application of GPR in groundwater exploration, Use of radio isotopes in hydrogeological studies.

Unit 5

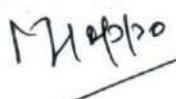
Groundwater problems and management related to foundation work, mining, reservoirs, tunnels and effects of water in landslides; Environmental effects of over-exploitation of groundwater; Water logging problems;

Suggested Books

- C.F. Tolman (1937): Groundwater, McGraw Hill, New York and London.
- D.K. Todd (1995): Groundwater Hydrology, John Wiley and Sons.
- F.G. Driscoll (1988): Groundwater and Wells, UOP, Johnson Div. St. Paul. Min. USA.
- H.M. Raghunath (1990): Groundwater, Wiley Eastern Ltd.,
- H.S. Nagabhushaniah (2001): Groundwater in Hydrosphere (Groundwater hydrology), CBS Publ.
- K. R. Karanth (1989): Hydrogeology, Tata McGraw Hill Publ.
- S.N. Davies and R.J.N. De Wiest (1966): Hydrogeology, John Wiley and Sons, New York.
- Patra, H. P., Adhikari, Shyamal Kumar, Kunar, Subrata (2016) Groundwater Prospecting and Management, Springer
- Jakeman, A.J., Barreteau, O., Hunt, R.J., Rinaudo, J.-D. Ross, A. (2016) Integrated Groundwater Management: Concepts, Approaches and Challenges, Springer
- Ramanathan, A., Johnston, S., Mukherjee, A., Nath, B. (Eds.) 2015, Safe and Sustainable Use of Arsenic- Contaminated Aquifers in the Gangetic Plain
- A Multidisciplinary Approach; Springer
- C.W. Fetter Jr. (2016) Applied Hydrogeology (4th Edition) 4th Edition Pearson Education Ltd.
- Kevin M. Hiscock (2009) Hydrogeology: Principles and Practice, Wiley-Blackwell
- Singhal, B.B.S. Gupta R.P. (2010) Applied Hydrogeology of Fractured Rocks, Springer



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Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Instruction to Question Setter:

Mid Semester Examination (MSE):

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End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

D. ORE GEOLOGY-II

Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

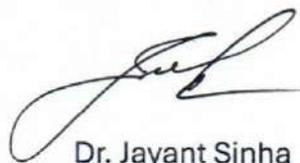
Non-magmatic processes of mineralization, Occurrence and distribution in India of iron and base metal deposits.

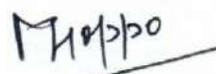
Unit 2

Occurrence and distribution in India of manganese, aluminium, chromium, nickel and gold deposits. Energy and fuel minerals, PGE and associated ores.

Unit 3

Indian deposits of non-metals: mica, asbestos, gypsum, graphite and apatite. Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries.


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Ms. Mable M. Toppo


Dr. Somesh Sengupta


Dr. Melvin A. Ekka

Unit 4

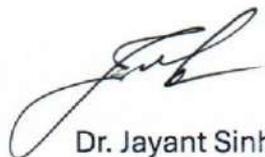
Strategic, critical and essential mineral. India's status in mineral production. National Mineral Policy. Marine mineral resources and Laws of Sea. Mineral concession rules.

Unit 5

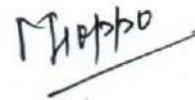
Various methods of sampling. Surface and sub-surface explorations. Definition and outline of UNFC classification of mineral reserves and resources. Grade and recovery of ores. Methods of ore reserves estimation.

Suggested Books

- Edwards, R. and Atkinson, K. (1986) Ore Deposit Geology. Chapman and Hall, London.
- Craig, J.M. and Vaughan, D.J. (1981) Ore Petrography and Mineralogy. John Wiley.
- Evans, A.M. (2012) Ore Geology and Industrial Minerals. Third Edition (Reprint), Blackwell Publishing and Wiley India Pt. Ltd.
- Sawkins, F.J. (1984) Metal Deposits in relation to Plate Tectonics. Springer Verlag.
- Stanton, R.L. (1972) Ore Petrology. McGraw Hill.
- Torling, D.H. (1981) Economic Geology and Geotectonics. Blackwell Sci. Publ.
- Barnes, H.L (1979) Geochemistry of Hydrothermal Ore Deposits. John Wiley.
- Klemm, D.D. and Schneider, H.J. (1977) Time and Strata Bound Ore Deposits. Springer Verlag.
- Guilbert, J.M. and Park, Jr. C.F. (1986) The Geology of Ore Deposits. Freeman.
- Mookherjee, A. (2000) Ore genesis -a Holistic Approach. Allied Publishers.
- Wolf, K.H. (1981) Hand book of Strata Bound and Stratiform Ore Deposits. Elsevier.
- Jensen, M.L. and Bateman, A.M. (1981) Economic Mineral Deposits. John Wiley and Sons, New York.
- McKinstry, H.E. (1972) Mining Geology. Prentice-Hall Inc.
- Arogyaswamy, R.N.P. (1995) Courses in Mining Geology. Oxford and IBH Publishing Co., New Delhi. Thomas, L.J. (1978) An Introduction to Mining. Methuen, Brisbane.
- Clark, G.B. (1967) Elements of Mining. Asia Publishing House.
- Sinha, R.K. & Sharma, N.L. (1993) An Introduction to Mineral Economics, Wiley Eastern
- Chatterjee, K.K. (1993) An Introduction to Mineral Economics, Wiley Eastern.



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

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(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

A. ENVIRONMENTAL GEOLOGY-II

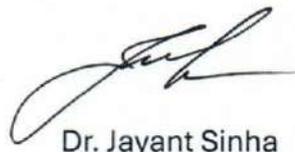
Theory: 60 Hours; Tutorial: 15 Hours

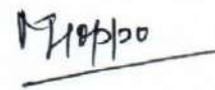
Unit 1

Natural resources and its conservation. Concept of ecosystem and its biotic and abiotic factors. Types of resources – conservation of soil, forest, minerals. Mineral resources in India and environmental issues. Alternative energy resources.

Unit 2

Desert and Desertification; Impacts of global warming on surface water, groundwater resources and Glaciers; Mass movement-types, Factors influencing slope stability. Solid Waste management.


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Unit 3

Human impact on soil, water, climate and atmosphere. Impact assessment of degradation and contamination of surface water and groundwater quality due to industrialization and urbanization; organic and inorganic contamination of groundwater and its remedial measures; Water logging problems due to the indiscriminate construction of canals, reservoirs and dams

Unit 4

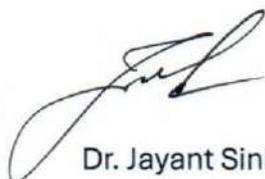
Geogenic and anthropogenic causes of water contamination; Issues of Arsenic and Fluoride contamination in groundwater, Methods for amelioration of Arsenic and Fluoride contamination in groundwater, Problems of Arsenic and Fluoride contamination in Jharkhand; Application of Remote Sensing for Water resources, Snow and Glacier and Wetland management

Unit 5

Global initiatives for mitigation of environmental issues; Indian Constitution and Environment; Environmental protection and conservation laws in India viz. The Prevention and Control of pollution Act, 1974, Water (Prevention & Control) Act 1974, The Forest (Conservation) Act, 1980, Air (Prevention and Control of Pollution) Act 1981, Environmental (Protection) Act, 1986, Hazardous Waste Handling and management act 1989, Ozone Depleting Substances (Regulation and Control) Rules, 2000, National Green Tribunal Act 2010 etc.

Suggested Books

- Abhijit Dutta. Environmental Issues and Challenges
- B. K. Sharma Environmental Pollution
- Bell, F.G. (1999): Geological Hazards, Routledge, London.
- Bryant, E. (1985): Natural Hazards, Cambridge Univ. Press.
- Keller, E.A. (1978) Environmental Geology
- Rekha Ghosh and D. S. Chatterjee : Environmental Geology
- Valdiya, K.S. (1987) Environmental Geology- Indian Context
- Patwardhan, A.M. (1999) The Dynamic Earth System
- Smith, K. (1992) Environmental Hazards
- Subramaniam, V. (2001) Textbook of Environmental Hazards
- Strahler and Strahler: Environmental Geology



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Dr. Melvin A. Ekka

II. GENERIC/DISCIPLINE CENTRIC ELECTIVE

[ECGLG402A]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

A. FOSSIL FUEL GEOLOGY-III

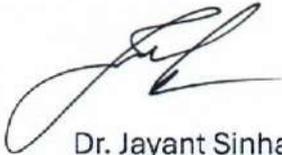
Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

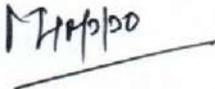
Origin and nature of oil and gas; Amount, type and maturation of organic matter; Migration of Petroleum.

Unit 2

Reservoir rocks - petrology of reservoir rocks, porosity and permeability; Reservoir traps – structural, stratigraphic and combination traps.



Dr. Jayant Sinha



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Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Unit 3

Identification and characterization of petroleum source rocks, Oil and source rock correlation; Palaeodepositional and palaeoenvironmental models with the help of microfossils and Palynology.

Unit 4

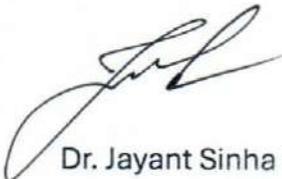
Quantitative evaluation of oil and gas, Geological, Geochemical and Geophysical exploration of Petroleum.

Unit 5

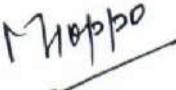
Petroleum basins of India, important oil fields of India; Brief idea about global occurrence of Petroleum; Position of oil and natural gas in India, Future prospects and economic scenario.

Suggested Books:

- Barker, C. (1996): Thermal Modeling of Petroleum Generation, Elsevier Science, Netherlands.
- Holson, G.D. and Tiratso, E.N. (1985): Introduction of Petroleum Geology, Gulf Publishing, Houston, Texas.
- Hunt, J.M. (1996): Petroleum Geochemistry and Geology (2nd Ed.), Freeman, San Francisco.
- Jahn, F., Cook, M. and Graham, M. (1998): Hydrocarbon exploration and production, Elsevier Science.
- Makhous, M. (2000): The Formation of Hydrocarbon Deposits in North African Basins, Geological and Geochemical Conditions, Springer-Verlag.
- North, F.K. (1985): Petroleum Geology, Allen Unwin.
- Selley, R.C. (1998): Elements of Petroleum Geology, Academic Press.
- Tissot, B.P. and Welte, D.H. (1984): Petroleum Formation and Occurrence, Springer-Verlag
- R.C. Chapman (1973) Petroleum Geology, Elsevier Scientific Pub. Co.



Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

III. GENERIC/DISCIPLINE CENTRIC ELECTIVE

[ECGLG402B]:

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:

Mid Semester Examination (MSE):

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

A. SEDIMENTOLOGY-III

Theory: 60 Hours; Tutorial: 15 Hours

Unit 1

Concept of soil, components of soil, soil profile; Process of soil formation, pedogenic processes, Factors of soil formation.

Unit 2

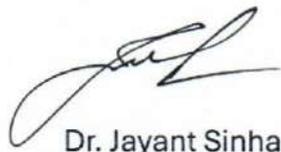
Classification of soil, mineral and chemical composition of soils, mineral stability during weathering; Soil organic matter form and function.

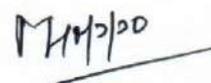
Unit 3

Fabric analysis - size and shape, concepts of size and shape, grade scale, methods of analysis, presentation of data, analysis and field grading; Concepts of structure fabric: Soil fabric, soil structure, soil texture and field grading units.

Unit 4

Paleosols - field recognition, description, origin and causes; Paleosol in stratigraphic records; Significance of paleosol study; Paleosols and human evolution.


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Dr. Somesh Sengupta


Dr. Melvin A. Ekka

Unit 5

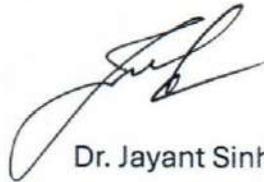
Calcrete - definition, classification, calcrete formation, pedogenic calcrete soil profile, macro features in calcretes, micromorphology (petrography), calcretes from Quaternary and ancient sedimentary sequences; significance of calcretes; Laterite - characteristics, genesis, Indian occurrences.

Unit-6

Causes of Soil erosion and degradation, A brief introduction to methods of soil conservation.

Suggested Books

- Boul, S.W., Hole, F.D., Mc Craken, R.J. and South, R.J. (1997): Soil Genesis and classification. 4th Edn, State University Press.
- Braddy, N.C. (2002): Nature and Properties of Soils.
- Govinda Rajan, S.V. and Gopala Rao, K. H.G. (1979): Studies of Soils of India.
- Sposito, Garrison. (1989): The Chemistry of Soils, Oxford Univ. Press.
- Terzaghi, K. and Pock, R.G. 1996): Soil Mechanics in Engineering (3rd Ed.), John Wiley.
- Wright; V. Paul (1992): Paleosols: their recognition and interpretation, Blackwell Scientific Publ.
- Wright, V. Paul and Tucker, M.E. (1991): Calcretes. Blackwell Scientific Publ..



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Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

Instruction to Question Setter:**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

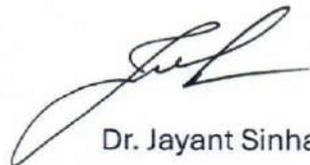
(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

B. HYDROGEOLOGY-III**Theory: 60 Hours; Tutorial: 15 Hours****Unit 1**

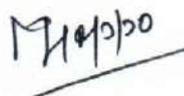
Watershed- concept, classification; Components of watershed; rainfall, temperature, topography, natureof soil and depth, lithology and geological structures, drainage pattern, land use pattern Valley to basinconcept in water management

Unit 2

Natural and artificial recharge of groundwater, Rainwater harvesting techniques for rural and urban areas; Physical structures for water resource management in Rural areas; Use of Remote sensing and GIS in Watershed Management.



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Unit 3

Water management physical structures and their characteristics such as Ridge area treatment, gully plug, contour bunding, check dams, gabion structure, percolation tanks etc. Traditional methods for water resource management in India.

Unit 4

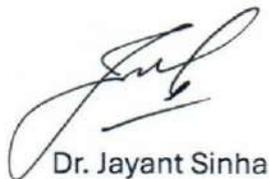
Basic components of Watershed Guidelines of India, Participatory approach for programme implementation of watershed. Water management and Panchayati Raj Acts.

Unit 5

Legislations related to water resources: Basic Constitutional provisions, Water Pollution Acts, National Water Policy

Suggested Books

- Isobel W. Heathcote (2009) Integrated Watershed Management: Principles and Practice, Wiley
- J V S Murty (2008) Watershed Management New Age Int.
- K. R. Karanth (1989): Hydrogeology, Tata McGraw Hill Publ.
- Watershed Guidelines: Govt. of India
- Rao, K. L.; India's water wealth C.G.W.B. Publications
- Constitution of India
- Jharkhand Panchayati Raj Act



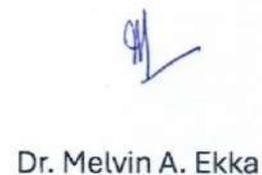
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Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be veryshort answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **GroupB will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best ofTwo**" shall be applicable for computation of marks for SIA.

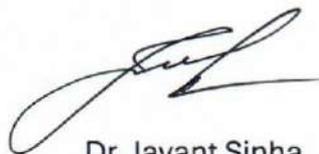
(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

C. ORE GEOLOGY-III**Theory: 60 Hours; Tutorial: 15 Hours****Unit 1**

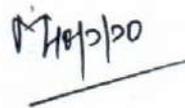
Geological prospecting of minerals. Different types of geophysical methods for exploration-gravity, magnetic, electrical, seismic. Geochemical exploration-nature of sample anomaly, strength of anomalyand controlling factors.

Unit 2

Ore beneficiation, basic principles and importance, Criteria for selecting different ore dressing mechanism. Surface and underground mining methods factors in selection of open cast and undergroundmining methods, room and pillar method, longwall method. Environmental aspect of mining activities.



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Unit 3

Different varieties and ranks of coal, origin of coal, maceral analysis of coal, concept of coal maturity, peat, lignite, bituminous and anthracite coal. Proximate and Ultimate analysis, Application of coal petrography, Gondwana and tertiary coalfields of India, Uses of coal for various industries.

Unit 4

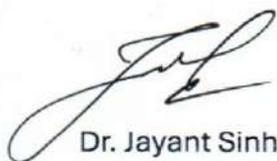
Origin of petroleum, migration and entrapment of oil, character of source and reservoir rocks, structural, stratigraphic and mixed traps. Geographical and geological distribution of onshore and offshore petroliferous basins of India.

Unit 5

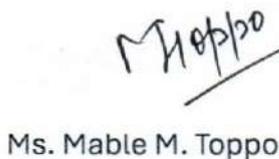
Mineralogy and geochemistry of radioactive minerals. Radioactive methods for prospecting of mineral deposits. Occurrence and distribution of radioactive minerals in India. Radioactive methods in petroleum exploration-well logging techniques.

Suggested Books

- Edwards, R. and Atkinson, K. (1986) Ore Deposit Geology. Chapman and Hall, London.
- Craig, J.M. and Vaughan, D.J. (1981) Ore Petrography and Mineralogy. John Wiley.
- Evans, A.M. (2012) Ore Geology and Industrial Minerals. Third Edition (Reprint), Blackwell Publishing and Wiley India Pvt. Ltd.
- Sawkins, F.J. (1984) Metal Deposits in relation to Plate Tectonics. Springer Verlag.
- Stanton, R.L. (1972) Ore Petrology. McGraw Hill.
- Torling, D.H. (1981) Economic Geology and Geotectonics. Blackwell Sci. Publ.
- Barnes, H.L. (1979) Geochemistry of Hydrothermal Ore Deposits. John Wiley.
- Klemm, D.D. and Schneider, H.J. (1977) Time and Strata Bound Ore Deposits. Springer Verlag.
- Guilbert, J.M. and Park, Jr. C.F. (1986) The Geology of Ore Deposits. Freeman.
- Mookherjee, A. (2000) Ore genesis -a Holistic Approach. Allied Publishers.
- Wolf, K.H. (1981) Hand book of Strata Bound and Stratiform Ore Deposits. Elsevier.
- Jensen, M.L. and Bateman, A.M. (1981) Economic Mineral Deposits. John Wiley and Sons, New York.
- McKinstry, H.E. (1972) Mining Geology. Prentice-Hall Inc.
- Arogyaswamy, R.N.P. (1995) Courses in Mining Geology. Oxford and IBH Publishing Co., New Delhi.
- Clark, G.B. (1967) Elements of Mining. Asia Publishing House.
- Sinha, R.K. & Sharma, N.L. (1993) An Introduction to Mineral Economics, Wiley Eastern
- Chatterjee, K.K. (1993) An Introduction to Mineral Economics, Wiley Eastern.



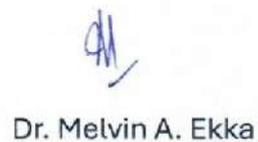
Dr. Jayant Sinha



Ms. Mable M. Toppo



Dr. Somesh Sengupta



Dr. Melvin A. Ekka

(Credits: Theory-04, Tutorial-01)

Marks: 30 (MSE: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs)=100

Pass Marks (MSE:17 + ESE:28)=45

Instruction to Question Setter:**Mid Semester Examination (MSE):**

There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type** five questions of five marks each, out of which any three are to be answered.

End Semester Examination (ESE):

There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** six questions of fifteen marks each, out of which any four are to be answered.

Note: There may be subdivisions in each question asked in Theory Examinations

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "**Best of Two**" shall be applicable for computation of marks for SIA.

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

D. ENVIRONMENTAL GEOLOGY-III**Theory: 60 Hours; Tutorial: 15 Hours****Unit 1**

Natural Hazards: Its causes, prediction and forecasting, control measures and its proper management. Problems of urbanization, human population and their impact on environment

Unit 2

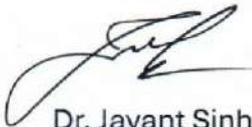
Distribution, magnitude and intensity of earthquakes; Seismic hazard zones; Neotectonics in seismic hazard assessment; volcanic hazards, their causes and control.

Unit 3

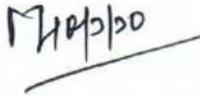
Landslide, soil creeping, mass movements; Coastal erosion, coastal inundations, cyclones, Tsunamis its causes and mitigation measures. Application of Remote Sensing techniques for Natural Hazards management.

Unit 4

Floods, causes of floods, flood hazard, management of floods; Water logging, problems of water logging in India; Consequences of developments in flood plain areas.



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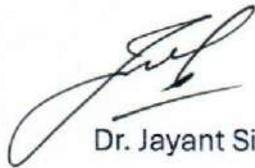
Dr. Melvin A. Ekka

Unit 5

Concept of Environmental Impact Assessment (EIA). Environmental Impact Assessment of mining on air, water, noise, land and soil; Hazards related with mining activities in India; Pollution in the mining areas and mitigation measures Land degradation in mining areas; Stabilisation of overburden in open cast mining areas; Management of underground mining areas. Impacts of mining on water availability.

Suggested Books

- Bell, F.G. (1999): Geological Hazards, Routledge, London.
- Bryant, E. (1985): Natural Hazards, Cambridge Univ. Press.
- Keller, E.A. (1978) Environmental Geology
- Valdiya, K.S. (1987) Environmental Geology- Indian Context
- Patwardhan, A.M. (1999) The Dynamic Earth System
- Smith, K.(1992) Environmental Hazards
- Subramaniam,V.(2001) Textbook in Environmental Hazards
- Tank, R.W. Focus on Environmental Hazards
- Strahler and Strahler: Environmental Geology
- Truk and Truk: Environmental Geology



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Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:

End Semester Practical Examination (ESE Pr):

The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

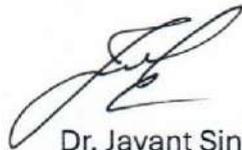
Note:

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

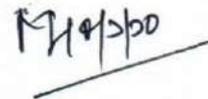
A. PRACTICAL - FOSSIL FUEL GEOLOGY-IV

Practical: 60Hours

- Megascopic study of Coal and Coal bearing strata
- Proximate analysis of coal
- Drawing and labelling of parts of Gondwana Plant Fossils from different coalfields.
- Identification of different palynomorphs
- Microscopic examination of coal macerals
- Microscopic study of Heavy minerals
- Borehole problems and calculation of reserves from borehole
- Study of Geological Maps and Sections of important oil fields of India



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Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:

End Semester Practical Examination (ESE Pr):

The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

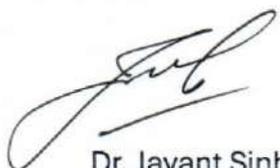
Note:

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

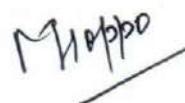
B. PRACTICAL - SEDIMENTOLOGY-IV

Practical: 60Hours

- Graphic plot of size data and calculation of statistical parameters.
- Study of Mechanical, Chemical and Biogenic Sedimentary structures and their sedimentological significance
- Megascopic and microscopic study of clastic and non-clastic rocks.
- Study of vertical profile sections of selected sedimentary environments;
- Study of Heavy Minerals.
- Graphic representation of Trace Element data and Heavy Minerals
- Recognition of marine fossil groups in assorted assemblage and identification of their classes



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Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:

End Semester Practical Examination (ESE Pr):

The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

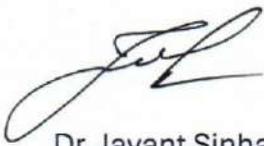
Note:

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

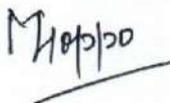
C. PRACTICAL - HYDROGEOLOGY-IV

Practical: 60Hours

- Determination of porosity of aquifer materials.
- Determination of temperature, pH, T.D.S., conductivity TSS, alkalinity, dissolved oxygen, hardness etc.
- Construction of Water Table and piezometric surface maps and their interpretations.
- Interpretations of geological cross sections for locating water bearing horizons.
- Pumping test for evaluation of aquifer parameters.
- Construction of litholog and their interpretations.
- Graphical representation of hydrochemical data on Piper Trilinear diagram.
- Plotting and interpretation of resistivity data.
- Delineation of watershed on topographical and satellite imageries.



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Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:

End Semester Practical Examination (ESE Pr):

The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

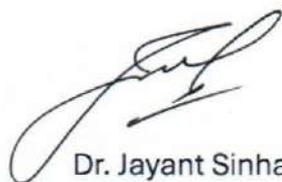
Note:

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

D. PRACTICAL - ORE GEOLOGY-IV

Practical: 60Hours

- Megascopic study of important ores and their textures.
- Megascopic study of important industrial, metallic and non-metallic, precious and semi-precious stones.
- Ore petrographic study of ore minerals and establishment of paragenetic sequence
- Exercises on ore reserve calculations.
- Estimation of grade of ores.
- Flowchart analysis of ore beneficiation techniques.



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Dr. Somesh Sengupta



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Marks: 30 (ESE: 20 Viva + 5Attd. + 5 Record) + 70 (ESE Pr: 6Hrs)=100

Pass Marks =45

Instruction to Question Setter:

End Semester Practical Examination (ESE Pr):

The questions in practical examination will be of equal to 70 marks and will be so framed that the students are able to answer them within the stipulated time. 20 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

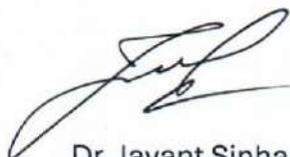
Note:

(Attendance Upto 75%, 1 mark; 75 < Attd. < 80, 2 marks; 80 < Attd. < 85, 3 marks; 85 < Attd. < 90, 4 marks; 90 < Attd, 5 marks).

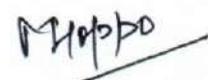
E. PRACTICAL - ENVIRONMENTAL GEOLOGY-IV

Practical: 60Hours

- Analyses of alkalinity, acidity etc. in water samples.
- Analyses of pH and Electrical Conductivity in water.
- Preparation of ocean and atmospheric circulation maps.
- Preparation of seismic and volcanic zonation maps of India and world.
- Demarcation of flood prone areas in the outline map of India
- Presentation of chemical analyses data
- Plotting of chemical classification diagram
- Demarcation of landslide prone areas.



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II. CORE COURSE (PROJECT)

[PRGLG404]:

(Credits: 05)

Marks : 100 (ESE: 3Hrs)=100

Pass Marks =45

Guidelines to Examiners for

End Semester Examination (ESE):

Overall project dissertation may be evaluated under the following heads:

- Motivation for the choice of topic
- Project dissertation design
- Methodology and Content depth
- Results and Discussion
- Future Scope & References
- Participation in Internship programme with reputed organization
- Application of Research technique in Data collection
- Report Presentation
- Presentation style
- Viva-voce

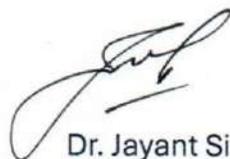
PROJECT WORK

Each student must submit **two** copies of the dissertation work duly forwarded by the Supervisor and Head of Department concerned. The forwarded copies will be submitted in the Department of Geology, St. Xavier's College, Ranchi for evaluation.

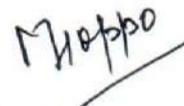
The paper will consist of

- (a) Field work/Lab work related to the Elective Paper.
- (b) Preparation of dissertation based on the work undertaken.
- (c) Presentation of project work in the seminar on the assigned topic in the P.G.Department of Geology, Ranchi University, Ranchi & open viva there on.

NB:- The students will select topics for the project work in consultation with a teacher of the department..



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**DISTRIBUTION OF CREDITS FOR P.G. PROGRAMME (SEMESTER-WISE) FOR
POSTGRADUATE 'P.G. Voc./M.Sc./M.A./M.Com' PROGRAMME**

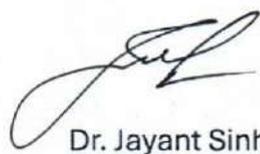
Table B-1: Semester wise distribution of 80 Credits for Subjects with Practical Papers.

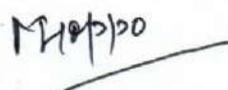
Semester	CC	FC	GE/DC	AE	Total credits
Semester I	15	05			20
Semester II	20				20
Semester III	15			05	20
Semester IV	5		15		20
	55	05	15	05	80

Table B-1: Semester wise distribution of 80 Credits for Subjects without Practical Papers.

Semester	CC	FC	GE/DC	AE	Total credits
Semester I	15	05			20
Semester II	20				20
Semester III	15			05	20
Semester IV	10		10		20
	60	05	10	05	80

CC=Core Course; FC=Foundation Compulsory/Elective Course; GE=Generic Elective; SE=Skill Enhancement Course;
DC=DisciplineCentric Elective


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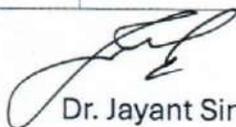

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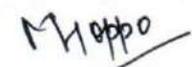

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**SAMPLE CALCULATION FOR SGPA & CGPA FOR POSTGRADUATE 'P.G.
Voc./M.Sc./M.A./M.Com' PROGRAMME**

Table B-2: Sample calculation for SGPA for M.Sc./M.A./M.Com Programme

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit X Grade)	SGPA (Credit Point/Credit)
Semester I					
FC	05	A	8	40	
C-1	05	B+	7	35	
C-2	05	B	6	30	
C-3/CP	05	B	6	30	
Total	20			135	6.60 (135/20)
Semester II					
C-4	05	B	6	30	
C-5	05	C	5	25	
C-6	05	B+	7	35	
C-7/CP	05	A+	9	45	
Total	20			135	6.60 (135/20)
Semester III					
EC-1	05	A+	9	45	
C-8	05	O	10	50	
C-9	05	A	8	40	
C-10/CP	05	A	8	40	
Total	20			175	8.75 (175/20)
Semester IV					
EC-2/EC-2	05	B	6	30	
EC-3/EC-3	05	A+	9	45	
C11/EP	05	B	6	30	
Project	05	A+	9	45	
Total	20			150	7.50 (150/20)
CGPA					
Grand Total	80			595	7.44 (595/80)


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Table B-3: Sample calculation for CGPA for P.G. Vocational M.Sc./M.A./M.Com Programme

Semester I	Semester II	Semester III	Semester IV
Credit:20; SGPA:6.60	Credit:20; SGPA: 6.60	Credit:20; SGPA: 8.75	Credit:20; SGPA: 7.50

Thus CGPA= (20x6.60+20x6.60+20x8.75+20x7.50) /80=7.36

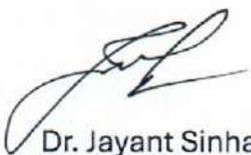
DISTRIBUTION OF MARKS FOR EXAMINATIONS AND FORMAT OF QUESTION PAPERS

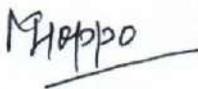
Distribution of Marks for Mid Semester Evaluation:

Table No. 15: Distribution of marks of Theory Examinations of Mid Semester

Topic	Code	Full Marks	Pass Marks	Time	Group-A (Very short answer type Compulsory Questions) No. of Questions x Marks = F.M.	Group-B (Descriptive Questions) No. of Questions x Marks = F.M.	Total No. of Questions to Set	
							Group A	Group B
Mid Sem*	T30*	30 (20+5+5)	17	1 Hr	5 x1 =5	3 (out of 5) x5 =15	05	5

*There shall be 20 marks theory examination for mid-sem, 05 marks for attendance/ regular interactions & 05 marks for seminar/ assignment/ term paper given by faculty concerned in classrooms.


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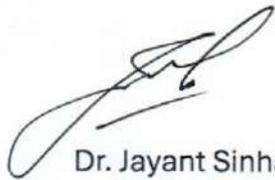
Distribution of Marks for End Semester Theory Examinations:

Table No. 16: Marks distribution of Theory Examinations of End Semester

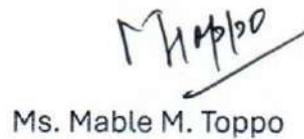
Topic	Code	Full Marks	Pass Marks	Time	Group-A [#] (Very short answer type Compulsory Questions) No. of Questions x Marks = F.M.	Group-B (Descriptive Questions) No. of Questions x Marks = F.M.	Total No. of Questions to Set	
							Group A [#]	Group B
End Sem	T50	50	--	3 Hrs	2 x 5 = 10	2 (out of 3) x 20 = 40	2	3
	T70	70	28	3 Hrs	Q.No.1 (5x1) + 1x5 = 10	4 (out of 6) x 15 = 60	2	6

Question No.1 in Group-A carries very short answer type questions of 1 Mark

Note: There may be subdivisions in each question asked in Theory Examinations.



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