

DEPARTMENT OF GEOLOGY

Choice Based Credit System Under NEP 2020

Proposed Scheme Of Undergraduate Programme From 2022-23

Programme Outcomes :- After completion the degree, the student will be able to demonstrate:-

- PO 1 - A comprehensive knowledge of Geology and Earth System. Develop the conceptual and theoretical aspects of geology, student will also be able to demonstrate geomorphic process.
- PO 2 - Enhancing their knowledge in geological work as a professional field worker .
- PO 3 - They will able to demonstrate solar system and internal structure of earth, origin and age of the earth .
- PO 4 - Develop a thorough understanding of crystallography and mineralogy.
- PO 5 - Demonstrate the various kinds of silicate , composition, they will also be able to evaluate the laws of crystallography.
- PO 6 - student will also be able to describe physical properties and optical characteristics of various minerals .

DEPARTMENT OF GEOLOGY

B.Sc. Semester 1st

Paper – Geodynamics & Geo-morphology

Semester System

2021-24

Course Outcomes :-After successfully completing this course , the students will be able to -

- CO 1 - Understand basics of geology, solar system and internal structure of the earth, origin and age of the earth .
- CO 2 - understand the theories of continental drift and plate tectonics.
- CO 3 - understand causes and effects of earthquakes and explain weathering and its products.
- CO 4 - Describe concepts of geom-morphology and land forms developed by various agencies.
- CO 5 - Explain about the physiographic and tectonic divisions of India .

GEOLOGY (B.Sc.)		SEMESTER – I	
COURSE Code- GEOL-101			
COURSE TITLE : Geodynamics & Geomorphology			
CREDIT: 03		HOUR:45	
THEORY: 03	PRACTICAL: 00	THEORY: 80	PRACTICAL:50
MARKS			
THEORY:100(80+20)		PRACTICAL: 50	
Unit – 1 11 Hours	<p>Introduction to Geology:</p> <ul style="list-style-type: none"> • Introduction to Geology and its branches and importance, Introduction to solar system: Star, Planet, Satellite, Asteroid and meteorite. Earth in the solar system; size, shape, mass and density, Origin of Earth, Internal structure of Earth, Crust, Mantle and Core, Age of Earth: Various methods of determination of age of the earth. 		
Unit – 2 11 Hours	<p>Dynamic Earth:</p> <ul style="list-style-type: none"> • Concept and theories of continental-drift, Sea floor spreading and evidences, Concept of plate tectonics, tectonic plates, types and plate boundaries, Introduction to paleomagnetism and polar wandering, Mid-oceanic ridges, trenches and island arcs. 		
Unit – 3 11 Hours	<p>Geomorphic Processes:</p> <ul style="list-style-type: none"> • Earthquakes: Causes and effects, Earthquake Belts, measurement of Earthquakes. Seismic zones of India, Volcanoes: Types and distribution, Fundamental concepts of geomorphology, Geomorphical agents and processes of rock weathering. 		
Unit – 4 12 Hours	<p>Geological Work:</p> <ul style="list-style-type: none"> • Geological work of rivers; Fluvial landforms, Geological work of ground water and karst topography, Geological work of wind; Aeolian landforms, Geological work of Glaciers; glacial land forms. Geological work of oceans; coastal landforms, Volcanic landforms, Physiographic and tectonic divisions of India. 		

SUGGESTED READINGS	<ol style="list-style-type: none"> 1. Holmoes, A. Doris L Holmes Edit., Principles of Physical Geology, Van Nostrand Reinhold, 1978. 2. Mahapatra, G.B., Text book of Physical Geology, CBS, India, 2018. 3. Mathur, S.M., Physical Geology of India, NBT India, 1991. 4. Miller, William J., Physical Geology : An Introduction. D Van Nostrand Co., 5thEd., 1949. 5. Mukerjee, P.K., Text Book of Geology. World Press Private Ltd, 2013. 6. Thornbury, W.D., Principles of Geomorphology. New Age International. 2nd Edition,196. 7. Principles of Geomorphology : A.F. Ahmad.
E-RESOURCES	<ol style="list-style-type: none"> 1. https://opentextbc.ca/physicalgeology2ed/front-matte/rdownload-a-pdf/ 2. https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up 3. https://egyankosh.ac.in/ 4. https://sites.google.com/ignou.ac.in/bscgeology 5. SWAYAM – https://swayam.gov.in/explorer?searchtext 6. National digital library – https://ndl.iitkgp.ac.in 7. e-PG pathshala (MHRD) portal, https://egpg.inflibnet.ac.in

PO- CO Mapping

Paper – (Geodynamics and Geomorphology)

CO	CO-01	CO-02	Co-03	CO-04	CO-05
PO					
PO-01	✓				
PO-02					✓
PO-03		✓			
PO-04					
PO-05				✓	
PO-06	✓				

DEPARTMENT OF GEOLOGY

B.Sc. Semester 2nd

Paper – Mineralogy & Crystallography

Semester System

2021-24

Course Outcomes :-After successfully completing this course , the students will be able to -

- CO-1:- Explain about the basics of crystallography, various crystal forms, crystallographic axes and symmetry elements.
- CO-2:- Describe various forms of normal classes of various crystal systems
- CO-3:- Classify the minerals in various silicate group and explain their varieties
- CO-4:- Describe the physical properties of various minerals.
- CO-5:- Describe the optical characteristics of various minerals.

GEOLOGY (B.Sc.)		SEMESTER – II	
COURSE CODE: GEOL-102			
COURSE TITLE : Mineralogy and Crystallography			
CREDIT: 03		HOUR:45	
THEORY: 03	PRACTICAL: 00	THEORY:	PRACTICAL:50
MARKS			
THEORY:100(80+20)		PRACTICAL:	
Unit – 1 11 Hours	<p>Introduction to Crystallography:</p> <ul style="list-style-type: none"> • Definition of Mineral and Crystal: Rock forming and ore minerals, Crystal Structures, Unit cells, Elements of crystal. Crystal forms, Crystallographic axes and axial angles, Weiss’s Parameters and Miller’s Indices systems of crystal notations. 		
Unit – 2 11 Hours	<p>Crystallography:</p> <ul style="list-style-type: none"> • Interfacial angle and its measurement, Laws of Crystallography, Crystal symmetry: Plane, axis and center of symmetry, Classification of crystals into systems and classes, Symmetry and forms of normal classes, Twinning in crystals. 		
Unit – 3 11 Hours	<p>Mineralogy:</p> <ul style="list-style-type: none"> • Silicate structures and classification of silicates, Bonding in Minerals, Isomorphism and Solid solution, Polymorphism and Pseudomorphism, Physical properties of minerals. 		
Unit – 4 12 Hours	<p>Optical Mineralogy:</p> <ul style="list-style-type: none"> • Nature of light: reflection and refraction of light, Refractive index, Critical angle. Total internal reflection and Becke’s effect, Double refraction. Nicol prism – it’s construction and working, Polarizing Microscope- its parts & functions, Optical properties of minerals. <p>Mineralogy:</p> <ul style="list-style-type: none"> • Study of Composition, Classification, physical and optical properties of the following Mineral groups – Olivine, Garnet and Mica groups, Pyroxenes and Amphiboles, Feldspars and Feldspathoids, Silica. 		
SUGGESTED READINGS	<ol style="list-style-type: none"> 1. Gribble,C.D.;Rutley’sElementsofMineralogy.CBS,2005. 2. FordW.E.;Dana’sTextBookofMineralogy.CBS,2006. 3. Perkins,D.;Mineralogy,PrenticeHallIndia,3rded.2012. 4.Rathore,B.S.;BasicsofCrystallography,MineralogyandGeochemistry.NotionPressIndia,2020. 5. Sharma,R.S.andSharma,Anurag;CrystallographyandMineralogy-ConceptandMethods.Geol.Soc.Ind.,Bengaluru,2013. 		

E-RESOURCES

1. <https://www.mindat.org>
2. <https://www.mooc-list.com/tags/minerals>
3. <https://eggp.inflibnet.ac.in/Home>
4. <https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up>
5. <https://egyankosh.ac.in/>
6. <https://sites.google.com/ignou.ac.in/bscgeology>
7. SWAYAM-<https://swayam.gov.in/explorer?searchtext>
8. National digital library- <https://ndl.iitkgp.ac.in>
9. e-PG pathshala (MHRD) portal, <https://eggp.inflibnet.ac.in>

PO- CO Mapping
Paper – (Mineralogy and Crystallography)

PO \ CO	CO-01	CO-02	Co-03	CO-04	CO-05
PO-01	✓				
PO-02					✓
PO-03					
PO-04		✓			
PO-05				✓	
PO-06	✓				

DEPARTMENT OF GEOLOGY (Semester 3rd)

Paper – Petrology

Semester System

2021-24

Course Outcomes :- After successfully completing this course , the students will be able to -

- CO-1:- Explain about the basics of magma, various phase, I forms of magma .also able to demonstrate texture structure and classification of igneous rocks.
- CO-2:- Describe various kinds of sedimentary and metamorphic rocks.
- CO-3:- Demonstrate the projective analysis of A.C.F. & A.K.F. also able to describe metamorphic facies and grades.
- CO-4:- Describe the rock associations in time & spaces , concept of rock kindred's.
- CO-5:- Evaluate the petro graphic provinces of India.

GEOLOGY (B.Sc.)		SEMESER – III	
COURSE CODE: -GEOL-103			
COURSE TITLE : Petrology			
CREDIT: 6		HOUR:90	
THEORY: 6	PRACTICAL: 00	THEORY: 90	PRACTICAL:00
MARKS			
THEORY:100(70+30)		PRACTICAL: 00	
Unit – 1 18 Hours	<ul style="list-style-type: none"> • Magma: Definition, origin and composition. • Bowen’s reaction series, magmatic differentiation & assimilation. • System, phases & component, principles of thermodynamics, Bi-component magma: Albite-Anorthite and Diopside-Anorthite, Tri-component magma: Diopside-Albite-Anorthite. • Texture, structure and classification of igneous rocks. • Forms of igneous rocks. 		
Unit – 2 18 Hours	<ul style="list-style-type: none"> • Rock association in Time & Space, concepts of rock kindreds. • Petrographic studies of Acid igneous rocks. • Petrographic studies of Alkaline igneous rocks. • Petrographic studies of Basic igneous rock. • Petrographic studies of Ultrabasic igneous rocks. 		
Unit – 3 18 Hours	<ul style="list-style-type: none"> • Origin, transportation & deposition of sediments. • Dynamics of sedimentary depositional environment: Aeolian, Fluvial, coastal and abyssal environment. • Concepts of sedimentary facies. • Concept of diagenesis. • Textures and structures of sedimentary rocks. 		
Unit – 4 18 Hours	<ul style="list-style-type: none"> • Classification of sedimentary rocks. • Petrography of sedimentary rock; rudaceous, argillaceous, calcareous sedimentary rocks. • Metamorphism; definition, agents, facies & grade. • Textures, structures & classification of metamorphic rocks. • Equilibrium & non-equilibrium reactions in metamorphism. 		
Unit – 5 18 Hours	<ul style="list-style-type: none"> • Paragenetic diagrams; projective analysis A.C.F. & A.K.F. diagrams. • Progressive metamorphism of Argillaceous rocks. • Progressive dynamo-thermal metamorphism of impure lime-stone. • Progressive dynamo-thermal metamorphism of basic igneous rocks. • Petrographic provinces of India. 		

PRATICALS	<ul style="list-style-type: none"> • Diagrammatic representation of various form & structures of igneous, sedimentary & metamorphic rocks. • Megascopic studies of various sedimentary, metamorphic & igneous rocks. • Microscopic studies of various sedimentary, metamorphic & igneous rocks. • Norm calculation. • Diagrammatic representation of petrography provinces of India in outline map of India.
SUGGESTED READINGS	<ol style="list-style-type: none"> 1. Principles of petrology – G.W. Tyrell 2. Petrology – H.William, F.J. Turner & E.M. Gilbert 3. Petrology of igneous & metamorphic rocks of India – S.C. Chattarjee 4. A text book of sedimentary petrology – Verma& Prasad 5. Metamorphism & Metamorphic rocks of India – S.Ray 6. Sedimentary rocks – F.J. Pettijohn 7. Introduction of sedimentary – S.Sengupta 8. Sedimentary environment – H.G.Readings

PO- CO Mapping Paper – (Petrology)

PO \ CO	CO-01	CO-02	Co-03	CO-04	CO-05
PO-01	✓				
PO-02					✓
PO-03			✓		
PO-04					
PO-05		✓			
PO-06					✓

DEPARTMENT OF GEOLOGY (Semester 4Th)

Paper – Structural Geology

Semester System

2021-24

Course Outcomes :- After successfully completing this course , the students will be able to -

- CO-1:- Explain about the basics fundamental and scope of structural geology.
- CO-2:- Describe the concept of morphology such as fold , fault , joint and unconformity morphology.
- CO-3:- Demonstrate the concept & framework of tectonics with reference to India.
- CO-4:- Describe various kinds of foliation and lineation.
- CO-5:- Evaluate the effect of fold , faults morphology on outcrops .

GEOLOGY (B.Sc.)		SEMESTER – IV	
COURSE CODE: -GEOL- 104			
COURSE TITLE : Structural Geology			
CREDIT: 4		HOUR:75	
THEORY: 3	PRACTICAL: 1	THEORY: 45	PRACTICAL:30
MARKS			
THEORY:75(60+15)		PRACTICAL: 25	
Unit – 1	<ul style="list-style-type: none"> • Definition and scope of Structural Geology, Study of outcrops, Effects of dip and slope on outcrops. • Identification of bedding, Dip and strike measurement. • Clinometer and Brunton compass. • Recognition of top and bottom of beds. • Concept of rock deformation, Concept of stress and strain ellipsoids. 		
Unit – 2	<ul style="list-style-type: none"> • Fold morphology. • Geometric and genetic classification of folds. • Recognition of folds in the field and on geological maps. • Effects of folds on outcrops. • Elementary idea of mechanics of folding. 		
Unit – 3	<ul style="list-style-type: none"> • Fault morphology, Slip and separation. • Geometric and genetic classification of faults. • Recognition of faults in the field and on geological maps. • Effect of faults on outcrops. • Elementary idea of mechanics of faulting. 		
Unit – 4	<ul style="list-style-type: none"> • Joint morphology; geometric and genetic classification of joints. • Foliation; terminology, kinds, origin and relation to major structures. • Lineation: terminology, kind, origin and relation to major structures. • Salt domes. • Plutons: tectonics & emplacement. 		
Unit – 5	<ul style="list-style-type: none"> • Types and recognition of Unconformity. • Outlier and inlier, Overlap & offlap. • Concept of tectonics. • Tectonic framework of Peninsula, Indo-Gangetic Plains and Extra-Peninsular India • Stereographic projection & its use in Structural geology. 		
PRACTICALS	<ul style="list-style-type: none"> • Study of Natural Structures on specimens. • Study of structures with the help of models. • Completion of outcrops. • Preparation of geological section from simple to complex geological maps and its interpretation. • Application of stereographic projection in structural geology. • Geological excursion for seven days 		

SUGGESTED READINGS	1. Structural Geology – M.P. Billings 2. Theory of Structural Geology; Gokhale, N.W. CBS 3. Exercises on Geological maps and dip-Strike: Gokhale, N.W. CBS 4. Outlines of structural Geology, E.S. Hills 5. Structural Geology – Hobbs, Means and Williams 6. Geological maps – Chiplonkar and Pawar
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PO- CO Mapping Paper – (Structural Geology)

PO \ CO	CO-01	CO-02	Co-03	CO-04	CO-05
PO-01	✓				
PO-02					✓
PO-03		✓			
PO-04					
PO-05	✓				
PO-06				✓	

DEPARTMENT OF GEOLOGY (Semester 5Th)

Paper:- Palaeontology and Stratigraphy Semester System

2021-24

Course Outcomes :-After successfully completing this course , the students will
be able to -

- CO-1:- Explain about the concept of Palaeontology, Morphology and Stratigraphy.
- CO-2:- Describe various principles related to stratigraphy.
- CO-3:- Demonstrate the distribution, Stratigraphy & Economic importance of Bastar & Raoghat group of rocks (Chhattisgarh), Distribution, stratigraphy & Economic importance of Vindhya & Chhattisgarh group of rocks etc.
- CO-4:- Describe the concept of fossilization, uses of fossils.
- CO-5:- Through understanding of physiographic and tectonic divisions of India. .

GEOLOGY (B.Sc.)		SEMESER – V	
COURSE CODE:-GEOL-105			
COURSE TITLE : Palaeontology and Stratigraphy			
CREDIT: 6		HOUR:90	
THEORY: 6	PRACTICAL: 00	THEORY: 90	PRACTICAL:00
MARKS			
THEORY:100(70+30)		PRACTICAL: 00	
Unit – 1 18 Hours	<ul style="list-style-type: none"> • Palaeontology: Fossils- definition, Essentials for fossilization mode of fossilization. • Uses of fossils; Index fossils & their significance. • Application of palaeontology in the study of stratigraphy, Palaeoecology and Palaeogeography. • Micro palaeontology& their significance. • Study of plant fossils & their significance. 		
Unit – 2 18 Hours	<ul style="list-style-type: none"> • Morphology & Geologic distribution of foraminifers &Anthozoa fossils. • Morphology & Geological distribution of Gastropoda and lamellibranchia fossils. • Morphology & Geological distribution or Cephalopoda. • Morphology & Geological distribution orEchinoidae&Brachiopoda fossils. • Morphology & Geological distribution of Triobite and Graptolite fossils. 		
Unit – 3 18 Hours	<ul style="list-style-type: none"> • Principles of stratigraphy: Geological time scale. • Basic concept of lithostratigraphic, chronostratigraphic&Biostratigraphic Units. • Structural & Physical Subdivision of Indian Subcontinents. • Distribution, classification & Economic importance orArchaeozoic rocks of India (Dharwar). • Distribution, classification & Economic importance ofBastar&Raoghat group of rocks (Chhattisgarh). 		
Unit – 4 18 Hours	<ul style="list-style-type: none"> • Distribution, classification & Economic importance of Vindhya & Chhattisgarh group of rocks. • Stratigraphy, Palaeoclimate, Geographical distribution & economic aspects of Gondwana rocks. • Stratigraphy, distribution and age of Deccan Traps. • Stratigraphy, distribution and fossil contents of Bagh&Lameta Bed. • Distribution, Stratigraphy & Palaeontology of salt Range group of rocks. 		
Unit – 5 18 Hours	<ul style="list-style-type: none"> • Distribution, Stratigraphy & Economics of Palaeozoic rocks of Spiti Valley. • Stratigraphy, distribution, Fossil content of Cretaceous rocks of Trichinapalli. • Stratigraphy, distribution, Fossil content and Economics of Jurassic rocks of Kutch-Region. • Distribution, Stratigraphy & Economics importance of Tertiary rocks of Assam region. • Distribution, Stratigraphy &Palaeontological importance of Siwalik group of rocks. 		

PRATICALS	<ul style="list-style-type: none"> • Study of Morphology of Fossils belonging to various phyla. • Study of Important plant fossils. • Representation of Litho-units & Stratigraphic Units in out line map of India. • Sketching of physiographic and tectonic divisions of India. • Geological excursion for seven days.
SUGGESTED READINGS	<ol style="list-style-type: none"> 1. Invertebrate Palaeontology – H.Woods. 2. Introduction to Palaentology – A.N. Davis. 3.An introduction to Invertebrate Palaeontology – P.G. Jain & M.S. Anantha Raman. 4.Historical Geology of India – Ravindra Kumar. 5.Geology of India – R.Vidhyanathan&M.Ramkrishne (GSI Publication) 6.Geology of India & Burma – M.S. Krishnan.

PO- CO Mapping Paper – (Palaeontology and Stratigraphy)

CO	CO-01	CO-02	Co-03	CO-04	CO-05
PO					
PO-01	✓				
PO-02					✓
PO-03					
PO-04					
PO-05					
PO-06					

DEPARTMENT OF GEOLOGY (Semester 6Th)

Paper:- Earth Resources & Applied Geology Semester System

2021-24

Course Outcomes :-After successfully completing this course , the students will be able to -

- CO-1:- Explain about the Economic Geology & its perspectives: Global mineral deposit& resources. Also able to describe Distribution of mineral deposits in time & space.
- CO-2:- Describe geological, geographical distribution, mode of occurrence, mineralogy& economic importance of metallic and non-metallic deposits of India.
- CO-3:- Demonstrate the fundamental of coal petrography such as; Peat, Lignite, Bituminous & Anthracite coal deposits of Chhattisgarh.
- CO-4:- Describe the concept of Hydrologic cycle, mode of occurrence of ground water, quality of ground water, ground water provinces of India.
- CO-5:- Evaluate the environmental impacts of over exploitation of mineral resources.

GEOLOGY (B.Sc.)		SEMESTER – VI	
COURSE CODE: GEOL106			
COURSE TITLE : Earth Resources & Applied Geology			
CREDIT: 6		HOUR:90	
THEORY: 6	PRACTICAL: 00	THEORY: 90	PRACTICAL:00
MARKS			
THEORY:100(70+30)		PRACTICAL: 50	
Unit – 1 18 Hours	<ul style="list-style-type: none"> Economic Geology & its perspective: Global mineral deposit & resource, Distribution of mineral deposits in time & space. Classification of mineral deposits, Geological thermometers. Magmatic & Hydrothermal processes of mineral formation. Weathering: product & Residual deposit, Oxidation & sulphide supergene Enrichment processes. Sedimentary processes of mineral formation, Placer deposits. 		
Unit – 2 18 Hours	<ul style="list-style-type: none"> Geological, Geographical distribution, mode of occurrence, mineralogy & economic importance of following metallic & non-metallic deposits of India. (i) Iron, Manganese, Chromium, (ii) Copper, Lead, Zinc, (iii) Gold, Aluminium, (iv) Refractory and Fertilizer minerals, (v) Minerals used in cement & chemical industries. 		
Unit – 3 18 Hours	<ul style="list-style-type: none"> Coal deposit: Origin, definition & stratigraphy. Fundamentals of coal petrography, Peat, Lignite, Bituminous & Anthracite Coal deposits of Chhattisgarh. Origin of Natural-hydrocarbon, migration & accumulation, Types of oil traps: Structural, stratigraphic and composite, Offshore & onshore oil deposits of India. Radioactive mineral: Mineralogy, Geochemistry, Prospecting techniques, Geological & Geographical distribution of atomic-mineral. Principles of mineral economics, National mineral policy. 		
Unit – 4 18 Hours	<ul style="list-style-type: none"> Engineering geology & its importance, Engineering properties of rocks. Geological conditions for establishing of large Dam and Tunnels. Elementary study of Aerial photographs & satellite Imageries, Application of remote sensing in town-planning. Hydrologic cycle, Mode of occurrence of ground water, Quality of ground water. Hydrologic properties of rocks, Classification of Aquifers, Ground water provinces of India. 		
Unit – 5 18 Hours	<ul style="list-style-type: none"> Introduction to mineral exploration, Surface & subsurface methods of mineral Exploration. Prospection methods: Drilling, Sampling & Assaying. Geophysical prospecting techniques: Gravity, Electrical & Magnetic methods. Aerial and seismic prospecting methods. Environmental impacts of over exploitation of mineral resources. 		

<p style="text-align: center;">PRATICALS</p>	<ul style="list-style-type: none"> • Study of important metallic/non-metallic minerals on the basis of physical & optical properties. • Distribution of main metallic/non-metallic deposits within outline map of India. • Magasopic studies of coal & its varieties. • Exercises related with mineral exploration; Reserve calculation, Tonnage factor calculation, Exercises related with drilling. • Study of Aerial photographs with the help of stereoscopes. • Study of satellite imageries. • Study of hydrologic properties of rocks, Preparation of hydrological maps. • Geological excursion for ten days.
<p style="text-align: center;">SUGGESTED READINGS</p>	<ol style="list-style-type: none"> 1. Economic mineral deposits– A.Bateman. 2. Economic mineral deposits of India – Umeshwar Prasad. 3. Ore-deposit of India – Gokhale&Rao. 4. India’s Mineral Resource – S.Krishnaswami. 5. Principle of Engineering Geology & Geotechniques – Krynine& Judd. 6. Groundwater Hydrology – D.K.Todd. 7. Courses in mining Geology – R.N.P.Arogyaswami. 8. Principle& Application of photogeology – S.N. Pandey. 9. Ground water – Assessment, Development & Management – K.R.Karant. 10. Geophysical methods in Geology – P.V.Sharma. 11. Environmental Geology – K.S. Valdiya (1987).

PO- CO Mapping
Paper – (Earth Resources & Applied Geology)

PO \ CO	CO-01	CO-02	Co-03	CO-04	CO-05
PO-01	✓				
PO-02					✓
PO-03		✓			
PO-04					
PO-05				✓	
PO-06					