Chhattisgarh Swami Vivekanand Technical University, Bhilai

Diploma in Mining Engineering **Semester -V**

A) Course Code : 2039571(039)

B) **Course Title** : **Advanced Mining Geology**

C) Pre- requisite Course Code and Title :

D) Rationale :

After acquiring the basic knowledge of contents covered in applied geology of this diploma programme, it is essential for a diploma student to know about the depositions of various modes of coal and other metal deposits which are significant for mining operations. In final year student will be made acquainted with the various method of prospecting of mineral deposits, their mode of formation, common deposits of mineral in India ; various economical sources of deposits like petroleum and coal; for a mining student it is a very much essential to go through the technical aspect of the deposits in the Earth before its extraction to cope-up with the problems associated for mining extraction methods. This course is designed to fulfill the necessary advanced level knowledge of mining geology for economical mining.

E) Course Outcomes :

CO-1 Analyze rock formation and their distribution using principles of stratigraphy.

CO-2 Examine the formation and control of ore deposition.

CO-3 Select suitable ore and mineral with their occurrence & distribution in India.

CO-4 Analyze the formation of coal and petroleum resources in India.

CO-5 Use various prospecting methods to search suitable mineral & rock.

F) Scheme of Studies and Examination :

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+T+(P/2)
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
2039571(039)	2	1	2	70	20	30	40	60	220	4

G) Distribution of Hours and Marks:

S.No	Chapter Name	Hours	Marks
1	Indian Stratigraphy	10	15
2	Ore Deposit	08	10
3	Ores and Mineral Deposits of India	10	15
4	Coal and Petroleum	10	20
5	Prospecting and Remote Sensing	10	10
Total		**48**	**70**

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

CO-1 Analyse rock formation and their distribution using principles of stratigraphy.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Explain different physiological features of India. SO1.2 Explain geographical distribution of rock formation in India. SO1.3 List different types of minerals found in rock formations SO1.4 Sketch and describe Gondwana system. SO1.5 Describe mode of occurrence and use of fossils.	LI1.1 Find out important detail from geological time scale. LI1.2 Find out and enlist importance of given location in map with their ore deposit. LI1.3 Identify the different fossils at given hand specimen.	**Unit 1.0 Indian Stratigraphy** 1.1 Principles of stratigraphy, Principle of correlation, Geological units, 1.2 Geological Time scale, 1.3 Physiographic division of India general geological information. i. Peninsular India, ii. Indo-gangetic plan and iii. Archaean system – iv. Cuddapah system – vindhyan system 1.4 Gondwana system - A brief account of the gondwana rocks. 1.4.1 Fossil contents and economic importance of gondwana rocks. 1.5 Fossils – Definition, 1.5.1 Index fossils, 1.5.2 Mode of occurrence and preservation, 1.5.3 Fosssilisation and use of fossils.	• Arrange in chronological order of different formation of rocks as per geological time scale and mention their period/ age. • Effects of stratigraphy on formation of soils.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Write physiographic division of India.
ii. Explain formation of Gondwana/cuddapah/ Archaean group of rocks.
iii. Describe occurrence, preservation and use of fossils.

b. Mini Project:

i. Prepare tectonic map of India.
ii. Prepare a model of different geological formations.

CO-2 Examine the formation and control of ore deposition.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Define ore and minerals. SO2.2 Enlist the classification of ore deposit. SO2.3 Describe process of placer deposit. SO2.4 Explain control of ore deposition.	LI2.1 Identify ore minerals in hand specimen. LI2.2 List important ores tenor of minerals as per Indian economic and availability.	**Unit 2.0 Ore Deposit** 2.1 Definition of ore, mineral, Gangue and Tenor of ores, 2.2 Classification of ore deposits- 2.2.1 Magmatic ore deposit 2.2.2 Pegmatic ore deposits,	• Study of path finder/ geobotanical/geochemical guide(gossan/cap rock)of ore mineral. • Study the types of ore found in nearby mines

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
		2.2.3 Hydrothermal ore deposits classification 2.2.4 Mechanical concentration deposits (Placer deposits) 2.2.5 Oxidation and super gene sulphide enrichment ore deposits, 2.3 Control of ore deposition 2.3.1 Structural controls, 2.3.2 Physical and chemical controls.	and their mode utilization in those mines.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

i. List syngenetic and epigenetic ore deposit.
ii. Write down the monograph on Mineral wealth of CG.
iii. List of some metallic and non metallic ore minerals.

b. Mini Project:

i. Visit nearby metallic/nonmetallic mines and prepare a brief report on it.
ii. Prepare a chart of cavity filling structure with suitable mineral deposit.

CO-3 Select suitable ore and mineral with their occurrence & distribution in India.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Identify of different ores of minerals SO3.2 Explain different type of ores . SO3.3 List the industrial use of ore .	LI 3.1 Locate different important ore deposit mines on Indian maps. LI 3.2 Identify and arrange different minerals according to their hardness from a given set of minerals.	**Unit 3.0 Ores and Mineral Deposits of India** 3.1 A brief account of the origin, occurrence and distribution of ores and minerals in India 3.2 Economic use of the following ores and minerals – Iron Copper Alumi 3.3 Mohr's scale of hardness. 3.4 Application of different minerals based on hardness.	• Brief study on ore and mineral deposit in CG. • Study of hardness of minerals of nearby mines.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

i. Write the distribution of mineral wealth in Chhattisgarh
ii. Write the economic importance of gold and iron ore.

b. Mini project

iii. Collect different samples of minerals from nearby mines and arrange them in increasing order according to Mohr's scale of hardness.

c. Other Activities (Specify):

i. Visit geology laboratory of nearby mine.

CO-4 Analyze the formation of coal and petroleum resources in India.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Explain Origin of coal. SO4.2 Describe process of formation of coal. SO4.3 Enlist classification of coal. SO4.4 Explain the favorable geological structures for petroleum oil pool. SO4.5 Enlist the petroleum deposit in India.	LI4.1 Draw a map to locate onshore and offshore petroleum and natural gas deposits. LI4.2 Collect samples of coal from different mines dump yard to analyse the quality. LI4.3 Draw a map to locate different coal areas in Chhattisgarh.	**Unit 4.0 Coal and Petroleum** 4.1 Coal- definition, Origin of coal – In situ theory, Drift theory, 4.1.1 Formation of coal 4.1.2 Classification of coal – Peat, Lignite, Bituminous and Anthracite, 4.1.3 Chemical properties of coal, 4.1.4 Occurrence of coal in India with special reference to C.G. 4.2 Petroleum , 4.2.1 Origin of petroleum, 4.2.2 Oil traps, types of oil, 4.2.3 Petroleum deposits of India.	• Collect information regarding different grade of bituminous coal found in CG. • Study of alternative sources of energy emerging to replace coal and petroleum in future.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

i. List captive coal mines of Chhattisgarh.
ii. Describe the theories of coal formation.
iii. Write a note on Bombay high.

b. Mini Project:

i. Prepare a report on prospective coal areas in Chhattisgarh.
ii. Prepare a model of migration of petroleum deposit.

c. Other Activities (Specify):

i. Visit a nearby petroleum mines and prepare a report on it.

CO-5 Use various prospecting methods to search suitable mineral & rock.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning. (SL)
SO5.1 List different prospecting methods. SO5.2 Select appropriate method of prospecting at given situation. SO5.3 Explain process of GPS and GIS. SO5.4 List hydrological	LI5.1 Draw a electrical resistivity prospecting method. LI5.2 Prospecting through study of subsurface core in laboratory.	**Unit5.0 Prospecting and Remote Sensing** 5.1 Prospecting, Various prospecting methods 5.2 Application of remote sensing in various fields (GPS,GIS).	• Study different prospecting methods used in nearby mining project. • Study the application of GPS and GIS in nearby mining activities.

Session	Laboratory Instruction	Class room Instruction	Self Learning.
properties of rock.			

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

i. Prepare a sectional view of an area from three given bore hole data to determine reserve.
ii. Describe surface prospecting method.
iii. Write application of GPS and GIS in mining field.

b. Mini Project

iv. Perform prospecting work using electrical resistivity method inside institution campus area.

c. Other Activities (Specify):

i. Visit a nearby mines where have GPS/GIS application. Study the uses of application and prepare a brief repo.

I) Suggested Specification Table (For ESA of Laboratory Instruction*):

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
01	Find out important detail from geological time scale.	15	15	30
02	Find out and enlist importance of given location in map with their ore deposit	15	15	30
03	Identify the different fossils at given hand specimen.	15	15	30
04	Identify ore minerals in hand specimen.	15	15	30
05	List important ores tenor of minerals as per Indian economic and availability	15	15	30
06	Locate different important ore deposit mines on Indian maps.	15	15	30
07	Identify and arrange different minerals according to their hardness from a given set of minerals.	15	15	30
08	Draw a map to locate onshore and offshore petroleum and natural gas deposits.	15	15	30
09	Collect samples of coal from different mines dump yard to analyse the quality.	15	15	30
10	Draw a map to locate different coal areas in Chhattisgarh.	15	15	30
11	Draw a electrical resistivity prospecting method.	15	15	30
12	Prospecting through study of subsurface core in laboratory	15	15	30

*Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

Legend : PRA: Process Assessment, PDA : Product Assessment

***Note** : Above experiment has to performed at the end semester examination of **40 Marks** as per assessment scheme*

J) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Study Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1.	Principles of Engineering geology.	K. M. Bangar	Standard Publishers and Distributors.	2nd , 2009
2.	Engineering and general geology	Prabin singh	S.K. Kataria and sons	2013
3.	The Principles of petrology	G.W. Tyrell	Aitbs Publishers and Distributors.	2012

(b) Open source software and website address

1. https://en.wikipedia.org/wiki/List_of_free_geology_software#Well_logging_&_Borehole_visualisation .
2. https://en.wikipedia.org/wiki/List_of_free_geology_software#Geographic_information_systems_(GIS)
3. http://chhattisgarhmines.gov.in/en

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Fossil specimens.	Dated by competent suthority	3
2	Samples of tenor minerals.	Relevant to Indian economic conditions.	5
3	Mineral samples.	According to mohr's scale of hardness	8
4	Subsurface core samples	Relevant for prospecting study	13

M) Mapping of POs & PSOs with COs:

Course Outcomes (COs)	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	PO-1 Basic knowledge	PO-2 Discipline knowledge	PO-3 Experiments and practice	PO-4 Engineering Tools	PO-5 The engineer and society	PO-6 Environment and sustainability	PO-7 Ethics	PO-8 Individual and team work	PO-9 Communication	PO-10 Life-long learning	PSO-1	PSO-2
CO-1 Analyze rock formation and their distribution using principles of stratigraphy.	2	1	1	1	2	2	1	1	1	2	-	2
CO-2 Examine the formation and control of ore deposition.	2	2	2	1	1	2	1	3	2	3	-	3
CO-3 Select suitable ore and mineral with their occurrence & distribution in India.	3	2	2	1	2	3	2	2	2	3	1	2
CO-4 Analyze the formation of coal and petroleum resources in India.	3	3	2	1	2	3	1	2	2	3	2	3
CO-5 Use various prospecting methods to search suitable mineral & rock.	2	2	3	1	1	2	2	2	2	3	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,9,10 PSO -	CO-1 Analyze rock formation and their distribution using principles of stratigraphy.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LI1.1 LI1.2 LI1.3	Unit 1.0 Indian Stratigraphy 1.1,1.2,1.3,1.4,1.5	As mentioned in relevant page numbers
PO-1,2,3,4,5,6,7,8,9,10 PSO -	CO-2 Examine the formation and control of ore deposition.	SO2.1 SO2.2 SO2.3 SO2.4	LI2.1 LI2.2	Unit 2.0 Ore Deposit 2.1,2.2,2.3	
PO-1,2,3,4,5,6,7,8,9,10 PSO -	CO-3 Select suitable ore and mineral with their occurrence & distribution in India.	SO3.1 SO3.2 SO3.3	LI3.1 LI3.2	Unit 3.0 Ores and Mineral Deposits of India 3.1,3.2,3.3	
PO-1,2,3,4,5,6,7,8,9,10 PSO -	CO-4 Analyze the formation of coal and petroleum resources in India.	SO4.1 SO4.2 SO4.3 SO.4.4 SO4.5	LI4.1 LI4.2 LI4.3	Unit 4.0 Coal and Petroleum 4.1,4.2	
PO-1,2,3,4,5,6,7,8,9,10 PSO -	CO-5 Use various prospecting methods to search suitable mineral & rock.	SO5.1 SO5.2 SO5.3 SO5.4	LI5.1 LI5.2	Unit 5.0 Prospecting and Remote Sensing 5.1,5.2	

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others), LI: Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning.

A) Course Code : 2039572(039)

B) Course Title : Mine Legislation

C) Pre- requisite Course Code and Title :

D) Rationale :

To impart basic knowledge of the Mines Act, Mine Rules, and Mining Regulations applicable in the mining industry with regards to conservation of mineral deposit, safe mining operations, and safety of the persons working in the industry. To enable the students to acquire knowledge of latest laws applicable to mining industry to control the incidences of accidents. Awareness of statutory framework on mining industry will be imparted to the students through various instructional methods, field visits, projects and case studies.

E) Course Outcomes:

CO-1 Use relevant Principles of Mining Legislation in Indian mines.

CO-2 Apply knowledge of Mines Act-1952 for the implementation of rules and regulations during their job.

CO-3 Apply the knowledge of mine rules 1955 for the social benefit of mine workers.

CO-4 Implement the regulations to provide a safe working atmosphere to the workers.

CO-5 Apply the statutory concepts of ventilation and illumination in proper functioning of Metalliferous mines.

F) Scheme of Studies and Examination:

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+T+(P/2)
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
2039572(039)	2	1	-	70	20	30	-	-	120	3

G) Distribution of Hours and Marks:

S.No	Chapter Name	Hours	Marks
1	General Principles of Mining Law, Development of Mining Legislation	08	10
2	Mines Act – 1952	10	15
3	Mine Rules 1955	10	15
4	Mine V.T Rules, Mine Rescue Rules ,I.E.R	10	20
5	Metalliferous Mines Regulations-1961	10	10
Total		**48**	**70**

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

CO-1. Use relevant Principles of Mining Legislation in Indian mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Differentiate between rules, regulations, byelaws and circulars. SO1.2 Identify different terms related to mining legislation. SO1.3 Select relevant rule/ regulations/ bye-laws in a given situation.		**Unit-1.0 General Principles of Mining Law, Development of Mining Legislation** 1.1 Preliminary Definitions. 1.2 Development of mining legislation in India, 1.3 Mining Boards and committees, 1.4 Regulations, Rules & bye- laws and circulars.	• Study the latest circulars issued by DGMS.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Write a note on historical development of mining legislation in India.
2. Take any circular and summaries the advises mentioned in it.

b. Mini Project:

1. Prepare a historical report on development of mining laws in India

CO-2. Apply knowledge of Mines Act-1952 for the implementation of rules and regulations during their job.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1 Identify the structure, powers and functions of committees formed under the Act. SO 2.2 Identify the importance of implementing health and safety provisions.		**Unit 2.0 Mines Act – 1952** 2.1 Preliminary Definitions, general provisions of Mines Act 1952, 2.2 Various Committees. 2.3 Provisions to health and safety, 2.4 Hours and Limitations of employment, 2.5 Leave with wages,	• Study the applicability of provisions of mines act in nearby mine.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Write a report on salient features of Mines Act 1952
2. Write a note on importance of enacting Mines Act 1952.

b. Mini Project:

1. Prepare a report on implementation of provisions of mines act 1952 in Indian mines.

CO- 3. Apply the knowledge of mine rules 1955 for the social benefit of mine workers.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1 Identify the importance of initial medical examination and periodical medical examination. SO 3.2 Explain different legal acts related to workmen in mines. SO 3.3 Explain different measures taken for health and sanitation.		**Unit 3.0 Mine Rules 1955** 3.1. Medical Examination of persons employed in mines, 3.2 Workmen's inspector, 3.3 Health and sanitation, 3.4 First aid and medical appliances, 3.5 Welfare amenities and welfare officer, 3.6 Registers, Notices & Returns.	• Study the registers, notices and reports maintained in office of any nearby mine.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Prepare a draft on appointment and duties of workmen's inspector.
2. Enlist the welfare amenities provided in any nearby mine.

b. Mini Project:

1. Prepare a report on implementation of mine rules 1955 in Indian mines.

c. Other Activities (Specify):

1. Use case study method to understand organizational structure in mines.

CO- 4 Implement the regulations to provide a safe working atmosphere to the workers.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 4.1 Describe the importance of vocational training. SO 4.2 Explain the provisions related to rescue and recovery operations.		**Unit 4.0 Mine V.T Rules, Mine Rescue Rules ,I.E.R** 4.1. Preliminary definitions, 4.2 General Vocational Training, Refresher training, 4.3 Training of special category of employees, Training , centre and arrangements. 4.4 Rescue Stations and rescue Rooms, 4.5 Duties and responsibilities of Superintendents, 4.6 Rescue Organisation and Equipment, 4.7 Provisions of I.E.R related to mining activities.	• Study the necessity of imparting vocational training.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Enlist the equipments required to be maintained at rescue stations and rescue rooms.
2. Write the provisions of I.E.R related to mining activities.

b. Mini Project:

1. Prepare a report on implementation of V.T rules and I.E.R in Indian mines.

CO- 5 Apply the statutory concepts of ventilation and illumination in proper functioning of Metalliferous mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 5.1 Describe safe working practices using MMR-1961. SO 5.2 Suggest preventive measures against various accidents. SO 5.3 Improve ventilation efficiency by adhering to the Regulations.		**Unit 5.0 Metalliferous Mines Regulations-1961** 5.1 Preliminary definitions. 5.2 examinations and certificates of competency. 5.3 Duties and responsibilities of workmen, competent persons and officials. 5.4 provisions related to plans and sections, ladders, transport of men and mine workings.	• Study the causes of accidents in a mine.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

1. Prepare power point presentations to show the steps taken in order to avoid accidents.
2. Draw a layout of lamp room for a mine with 1000 employees.

b. Mini Project:

1. Prepare a plan showing the system of ventilation in a mine.

c. Other Activities (Specify):

1. Visit a nearby mine and study the safety features being used.

I) Suggested Specification Table (For ESA of Laboratory Instruction*): N/A

J) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training

7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1.	METALLIFEROUS MINE REGULATIONS	DGMS	Lovely Prakashan	2016
2.	Mine rules-1955	DGMS	Lovely Prakashan	Latest
3.	Mines Act-1952	DGMS	Lovely Prakashan	Latest
4	Indian Electricity Rule	DGMS	Lovely Prakashan	

(b) Open source software and website address :

1.www.dgms.net
2.www.dgms.gov.in

L) List of Major Laboratory Equipment and Tools: N/A

M) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	**Discipline knowledge PO-2**	**Experiments & Practice PO-3**	**Engineering Tools PO-4**	**The Engineer & Society PO-5**	**Environment & Sustainability PO-6**	**Ethics PO-7**	**Individual & Team work PO-8**	**Communication PO-9**	**Life Long learning PO-10**	PSO-1	PSO-2
CO-1 Use relevant Principles of Mining Legislation in Indian mines.	2	3	-	1	3	3	3	3	3	3	1	2
CO-2 Apply knowledge of Mines Act-1952 for the implementation of rules and regulations during their job.	2	3	-	1	3	3	3	3	3	3	2	3
CO-3 Apply the knowledge of mine rules 1955 for the social benefit of mine workers.	1	2	-	1	2	3	3	2	3	3	1	2
CO-4 Implement the regulations to provide a safe working atmosphere to the workers.	2	3	-	1	3	3	3	2	3	3	1	2
CO-5 Apply the statutory concepts of ventilation and illumination in proper functioning of Metalliferous mines.	3	3	-	1	3	3	3	3	3	3	2	3

1=low, 2= medium, 3= high

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,9,10 PSO---	CO-1 Use relevant Principles of Mining Legislation in Indian mines.	SO 1.1 SO 1.2 SO1.3		Unit 1.0 General Principles of Mining Law, Development of Mining Legislation. 1.1,1.2,1.3,1.4	As mentioned in relevant pages
PO-1,2,3,4,5,6,7,8,9,10 PSO------	CO-2 Apply knowledge of Mines Act-1952 for the implementation of rules and regulations during their job.	SO 2.1 SO 2.2		Unit 2.0 Mines Act – 1952 2.1,2.2,2.3,2.4,2.5	
PO-1,2,3,4,5,6,7,8,9,10 PSO---------	CO-3 Apply the knowledge of mine rules 1955 for the social benefit of mine workers.	SO.3.1 SO 3.2 SO 3.3		Unit 3.0 Mine Rules 1955 3.1,3.2,3.3,3.4,3.5,3.6	
PO-1,2,3,4,5,6,7,8,9,10 PSO------	CO-4 Implement the regulations to provide a safe working atmosphere to the workers.	SO 4.1 SO 4.2		Unit 4.0 Mine V.T Rules, Mine Rescue Rules ,I.E.R 4.1,4.2,4.3,4.4,4.5,4.6,4.7	
PO-1,2,3,4,5,6,7,8,9,10 PSO------	CO-5 Apply the statutory concepts of ventilation and illumination in proper functioning of Metalliferous mines.	SO 5.1 SO 5.2 SO 5.3		Unit 5.0 Metalliferous Mines Regulations-1961 5.1,5.2,5.3,5.4,5.5	

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

A) Course Code : 2039573(039)

B) Course Title : Mine Machinery

C) Pre- requisite Course Code and Title :

D) Rationale :

Modern trend towards mining industry is to achieve higher productivity with employment of winning machineries in mines, with this regard various mining machines for drilling, Extraction, Loading, Transport and other mining operation are being used in mines; thus the knowledge of operation, maintenance and main features of the machines is very essential for a mining student for proper management . This course covers all basic aspects of different machineries and their accessories. The subject also reveal with maintenance part of the machines.

E) Course Outcomes:-

CO-1 Select the appropriate wire rope in a given situation.

CO-2 Apply various measures to safely operate winding system in underground mines.

CO-3 Operate various types of coal face machineries used in bord and pillar mining.

CO-4 Select and operate various types of coal face machineries used in longwall mining.

CO-5 Apply the basic knowledge power generated by compressed air in mine machineries.

F) Scheme of Studies and Examination :

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+T+(P/2)
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
2039573(039)	3	1	2	70	20	30	40	60	220	5

G) Distribution of Hours and Marks:

S.No	Chapter Name	Hours	Marks
1	Wire Rope	12	20
2	Winding	10	15
3	Coal Face Mechanisation I	08	15
4	Coal Face Mechanisation II	08	10
5	Compressed Air Machine	10	10
Total		**48**	**70**

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

CO-1 Select the appropriate wire rope in a given situation.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Differentiate the constructional feature of various wire ropes. SO1.2 Select appropriate type of wire rope at given situation. SO1.3 Perform the procedure of rope splicing including safety measures.	LE1.1 Classify given rope samples based on given criteria. LE1.2 Perform rope capping operation. LE1.3 Perform recapping of rope operation. LE1.4 Demonstrate procedure of rope splicing.	**Unit 1.0 Wire Rope** 1.1 Classification of wire ropes- based on construction, laying and use. Their construction and use, 1.2 Testing of wire ropes, strength of wire ropes, factor of safety, rope troubles, 1.3 Capping and recapping of ropes, 1.4 Rope splicing of haulage ropes, 1.5 Care and maintenance of wire ropes, its use and its storage.	• Visit a nearby mine and study the procedure applied for capping ,recapping and splicing of rope. • Collect unused samples of wire ropes and perform the capping, recapping and splicing on it.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Describe the method of testing wire ropes.
2. Draw sectional views of different types of wire rope used in mines.
3. Describe procedure of wire rope maintenance.

b. Mini project:

1. Prepare a model for capping and recapping of wire ropes.

c. Other activities

1. Prepare an account of Care and maintenance of wire ropes, its use and its storage.

CO-2 Apply various measures to safely operate winding system in underground mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1Identify different type of winding systems used in mines. SO2.2 Draw a flow chart showing Maintenance schedule of winding system of a mine. SO2.3 Assemble various units of different winding system.	LE2.1 Draw a layout about the winding drum. LE2.2 Prepare a simple model of head gear arrangements. LE2.3 Prepare a plan for installation of suspension gear arrangements and arrangement of rope guide suspension. LE2.4 Prepare a layout of	**Unit 2.0 Winding** 2.1 Different types of winding system and winder, 2.2 Head gear arrangement Head gear frame, Head gear sheave, fleet angle, different type of rope caples, suspension gear, safety hooks, 2.3 Cage and its fitting- keps, gears, rigid & flexible rope guides: suspension of rope guides, skip and its fittings, 2.4 Braking system on winders. Over winding & over speed prevention,	• Visit nearby mines and study the working of the winding system there. • • Study the working of some world's largest winding system.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.4 Apply various safety measures in winding system.	different winding system.	2.5 Factors governing height of the head gear: dead load: live load and wind pressure, Power torque diagram and its calculation.	

SW-2 Suggested Sessional Work (SW):

a. Assignments:

1. Write the steps to be taken to prevent over winding.
2. Sketch and describe different types of winding drums.

b. Mini Project:

1.Prepare a model of head gear frame showing all details

c. Other Activities (Specify):

1. Collect photographs of winding installation from different mines.

CO-3 Operate various types of coal face machineries used in bord and pillar mining.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Enlist different machineries used in bord and pillar face mechanisation. SO3.2 Operate various machineries like LHD, SDL, shuttle cars, CCM etc. SO3.3 Install and operate Gate End Box in mines.	LE3.1 Prepare a layout of face mechanization with respect to application of Coal cutting drill, CCM and corresponding loading machines like LHD, SDL, mine tubs,shuttle cars etc. Prepare a plan for installation and operation of Gate End Box in a mine.	**Unit 3.0 Coal Face Mechanisation I** 3.1 Face mechanisation in Bord and Pillar Mining- Electric coal drill, CCM, Powers loaders- L.H.D. and S.D.L, mine tub, shuttle car. Their Construction operation and use. 3.2 Gate end box- Purpose of remote control General Principle of working of gate end box. Use of GEB in mine.	• Collect maintenance schedule of ECD, LHD, SDL by visiting nearby mines.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Draw a circuit diagram of a Gate-end-box and explain the functions of each unit.
2. Differentiate SDL and LHD.

b. Mini Project:

1. Prepare a model of gate end box showing its circuit.
2. Prepare a model of SDL and SDL.

c. Other Activities (Specify):

1. Enumerate the problems observed during mine visit and propose possible solution for that.

CO-4 Select and operate various types of coal face machineries used in longwall mining.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Enist different machineries used in longwall face mechanization. SO4.2 Apply working principles of shearer and coal plough in long wall mines. SO4.3 Carryout maintenance works of machineries used in longwall face mechanization. SO4.4 Adopt various safety measures for safe working in longwall mines.	LE4.1 Prepare a layout of Single drum shearer. LE4.2 Demonstrate working of double drum shearer with simple model. LE4.3 Prepare a layout about the application of various longwall machineries in longwall face.	**Unit 4.0 Coal Face Mechanisation II** 4.1 Longwall face mechanization- Stage loader, AFC, powered supports and Shearer(Single ended and double ended ranging drum shearer), coal plough, 4.2 Components and operation of shearer. 4.3 Flame proof and intrinsic safe apparatus. 4.4 Concept of preventive maintenance of machineries and its important.	• Collect maintenance schedule of AFC and SRD/DRD from nearby visited mine.

SW-4 Suggested Sessional Work (SW):

a. Assignments:

1. Differentiate single and double drum shearer.
2. List the flame proof and intrinsically safe equipments used in mines and write their importance.

b. Mini Project:

1. Prepare a model of Shearer.

c. Other Activities (Specify):

1. Visit a mine to observe the functions of each unit of coal cutting system there.

CO-5 Apply the basic knowledge power generated by compressed air in mine machineries.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 5.1 Apply the principles of compression of air in mechanical operation of machineries. SO 5.2 Operate compressed air machineries in mines. SO5.3 Carryout comparative analysis between compressed air power and electrical power.	LE5.1 Demonstrate the principle of compression of air. LE5.2 Prepare a plan about different conditions of applicability of various compressed air machineries used in mines like air leg drills , pneumatic picks etc.	**Unit 5.0 Compressed Air Machine** 5.1 Principle of Compression of air. 5.2 Advantage and limitation of compressed air power over electrical power. 5.3 Compressed air machines used in mines drills: air leg, pneumatic picks etc. and their mechanism.	• Visit nearby mines and find the machineries based on air compression which are used there and find possibility of further application of compressed air machineries there.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others), LI : Laboratory Instruction (Includes Practical performance.s in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW):

a. Assignments:

1.Compare the applicability of machines operated by compressed and electricity under the given conditions.

b. Mini Project:

2. Prepare a model of air leg drills/pneumatic drills.

c. Other Activities (Specify):

1.Collect data about other machineries based on air compression which are used in industries other than mining.

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

I) Suggested Specification Table (For ESA of Laboratory Instruction*):

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
1	Classify given rope samples based on given criteria.	15	15	30
2	Perform rope capping operation.	15	15	30
3	Perform of rope recapping operation.	15	15	30
4	Demonstrate procedure of rope splicing.	15	15	30
5	Draw a layout about winding drum	15	15	30
6	Prepare a simple model of head gear arrangements	15	15	30
7	Prepare a plan for installation of suspension gear arrangements and arrangement of rope guide suspension.	15	15	30
8	Prepare a layout of different winding system.	15	15	30
9	Prepare a layout of face mechanization with respect to application of Coal cutting drill, CCM and corresponding loading machines like LHD, SDL, mine tubs ,shuttle cars etc.	15	15	30
10	Prepare a plan for installation and operation of Gate End Box in a mine.	15	15	30
11	Prepare a layout of Single drum shearer.	15	15	30
12	Demonstrate working of double drum shearer with simple model.	15	15	30
13	Prepare a layout about the application of various longwall machineries in longwall face.	15	15	30
14	Demonstrate the principle of compression of air.	15	15	30
15	Prepare a plan about different conditions of applicability of various compressed air machineries used in mines like air leg drills , pneumatic picks etc.	15	15	30

* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments/practices.

Legend : PRA: Process Assessment, PDA : Product Assessment

***Note**: Only one experiment has to performed at the end semester examination of **40 Marks** as per assessment scheme*

J) Suggested Instructional/Implementation Strategies:

a) Improved Lecture
b) Tutorial
c) Case Method
d) Group Discussion
e) Industrial visits
f) Industrial Training
g) Field Trips
h) Portfolio Based Learning
i) Role Play
j) Demonstration
k) ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
l) Brainstorming
m) Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Elements of Mining Technology	D.J. Deshmukh	Lovely Prakashan	latest
2	Science and Art of Mining Digest	C.M.P.D.I. Pub	C.M.P.D.I. Pub	2011
3	Mine Transport	Karelin	Orient longman	latest

(b)Open source software and website address:

1. https://www.youtube.com/watch?v=DPZCkqyyoQw
2. https://www.youtube.com/watch?v=c-rf8oiT2JE
3.https://www.kghmzanam.com/images/Foldery/KGHM_ZANAMs_Undergound_Mining_Machine_catalogue.pdf

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Rope samples.	Lang's lay type , locked coil type, stranded type and other relevant ropes used in mines.	1,2,3,4,5
2	Model of head gear arrangement.	Working model	5,6
3	Model of loading machines.	Including machines like LHD,SDL	9
4	Model of shearer	Double ended and single ended ranging drum shearer.	11

M) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	**Discipline knowledge PO-2**	**Experiments & Practice PO-3**	**Engineering Tools PO-4**	**The Engineer & Society PO-5**	**Environment & Sustainability PO-6**	**Ethics PO-7**	**Individual & Teamwork PO-8**	**Communication PO-9**	**Life Long learning PO-10**	PSO-1	PSO-2
CO-1 Select the appropriate wire rope in a given situation.	3	2	2	3	2	3	2	3	2	3	1	2
CO-2 Apply various measures to safely operate winding system in underground mines.	3	3	3	3	2	2	2	3	2	3	-	3
CO-3 Apply the knowledge of working principles to operate various types of coal face machineries used in bord and pillar mining.	3	3	3	2	2	2	2	3	2	3	2	3
CO-4 Select and operate various types of coal face machineries used in longwall mining.	3	3	3	2	2	2	2	3	2	3	2	3
CO-5 Apply the basic knowledge power generated by compressed air.	3	3	3	3	2	2	2	3	2	3	-	2

1=low , 2= medium, 3= high.

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-1 Select appropriate wire rope under a given condition.	SO1.1 SO1.2 SO1.3	LE1.1 LE1.2 LE1.3 LE1.4	Unit 1.0 Wire Rope 1.2,1.2,1.3,1.4,1.5	As mentioned in Relevant Pages.
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-2 Apply various measures to safely operate winding system in underground mines.	SO2.1 SO2.2 SO2.3 SO2.4	LE2.1 LE2.2 LE2.3 LE2.4	Unit 2.0 Winding 2.1,2.2,2.3,2.4,2.5	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-3 Operate various types of coal face machineries used in bord and pillar mining.	SO3.1 SO3.2 SO3.3	LE3.1 LE3.2	Unit 3.0Coal Face Mechanisation I 3.1,3.2	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-4 Select and operate various types of coal face machineries used in longwall mining.	SO4.1 SO4.2 SO4.3	LE4.1 LE4.2 LE4.3	Unit 4.0Coal Face Mechanisation II 4.1,4.2,4.3,4.4	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-5 Apply the basic knowledge power generated by compressed air in mine machineries.	SO5.1 SO5.2 SO5.3	LE5.1 LE5.2	Unit 5.0 Compressed Air Machine 5.1,5.2.5,3	

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning.

A) Course Code : 2039574(039)

B) Course Title : Strata Control and Roof Support

C) Pre- requisite Course Code and Title :

D) Rationale :

Strata control is one of the most important aspects of safety in open cast as well as underground mines. This requires to understand the basic concept of strata control mechanism and principle of supports in Mining. It is also important for the students to be fully aware of different strata control techniques by applying different type of support adopted in different situations in the field. This course will enable students to comprehend the essential requirements in this area to function effectively.

E) Course Outcomes:

CO-1 Identify and Select appropriate type of support system in different conditions.

CO-2 Operate appropriate type of powered support.

CO-3 Apply the concepts of Stowing to reduce the damage caused by subsidence.

CO-4 Apply the techniques to measure and reduce the ground movement.

CO-5 Control surface subsidence and its effects.

F) Scheme of Studies and Examination :

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+T+(P/2)
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
2039574(039)	2	1	-	70	20	30	-	-	120	3

G) Distribution of Hours and Marks:

S.No	Chapter Name	Hours	Marks
1	Supports	10	15
2	Powered Support	08	15
3	Stowing	10	20
4	Strata Control	10	10
5	Subsidence	10	10
Total		**48**	**70**

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

CO-1 Identify and Select appropriate type of support system in different conditions.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Classify different types of support used in mines. SO1.2 Identify different types of roof and their behavior. SO1.3 Use roof bolting and cable bolting in underground mines. SO1.4 Use different support system at different places in underground mines. SO1.5 Frame Systematic support rules. SO1.6 Describe support withdrawal of prop.		**Unit-1.0 Supports** 1.1 Classification of Supports, 1.1.1 Timber support, 1.1.2 Steel supports and its behavior with change in stress condition. 1.2. Types of roof, 1.3 Examination of Roof, 1.4 Roof Bolting and Cable Bolting, 1.5 Roof stitching and side stitching, 1.6 Supporting under different Conditions 1.6.1 Roadways, 1.6.2 Crossing , 1.6.3 Junctions, 1.6.4 Depillaring area. 1.7 Systematic Support Rules(SSR) and Support plan, 1.8 Sylvester support withdrawal.	• Visit a nearby mine and study the different types of supports used therein.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Given an account of comparison between timber and steel supports.
2. Describe roof bolting and roof stitching.
3. Describe the method of support withdrawal using Sylvester prop withdrawer.

b. Mini Project:

1. Prepare a support plan for Roadways/Junctions/Crossings/Depillaring areas/Longwall face.
2. Prepare a model of Roadways/Junctions/Crossings/Depillaring areas/Longwall face supported area.

c. Other Activities (Specify):

1. Make a model of different types of support used in mines.

CO.2 Operate appropriate type of powered support.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1. Identify different types of powered support used in mines SO2.2. Select suitable type of powered support used in underground mines. SO2.3.Differentiate various types of powered support.		**Unit 2.0 Powered Support** 2.1 Introduction, 2.2 Principle of Operation of Power support, 2.3 Classification of Power support- 2.3.1 Frame support, 2.3.2 Chock support, 2.3.3 Shield support, 2.3.4 Chock Shield support, 2.4 Characteristic curves and performance of powered support. 2.5 Power pack system and hydraulic fluids. 2.6 Merits and demerits of Powered Support.	• Watch videos of working operation of powered support used in mines.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe principle of operation of powered support.
2. Differentiate types of powered support on the basis of constructional features.
3. Give an account of comparison between different types of powered support on the basis of their merits and demerits.

b. Mini Project:

1. Make a model of any type of powered support.

c. Other Activities (Specify):

1. Prepare a case study of the powered supports used in nearby underground mine.

CO.3. Apply the concepts of Stowing to reduce the damage caused by subsidence.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Enlist different types of stowing methods. SO3.2 Explain the working procedure of various stowing methods. SO3.3 Identify the problems related to stowing methods and suggest methods to resolve them.		**Unit 3.0 Stowing** 3.1 Classification of stowing- 3.1.1 Hand Packing, 3.1.2 Hydraulic stowing, 3.1.3 Pneumatic Stowing, 3.1.4 Mechanical Stowing, 3.2 Relative merits and demerits of different types of stowing methods, 3.3 Hydraulic profile ,	• Find alternate materials which may be used for packing the goaf. • Find alternate materials which can be used in barricading.

Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self Learning (SL)
SO3.4 Suggest measures to reduce cost incurred due to Pipe wear and Pipe jams		3.4 Face arrangements, 3.5 Pipe wear, pipe jams and Pipe joint.	

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe hydraulic stowing/mechanical stowing method.
2. Write various arrangements made for the Hydraulic stowing method.
3. Write an account about the problems of pipe wear and pipe jams with their solutions.

b. Mini Project:

1. Make a Model of Hydraulic Stowing Method.
2. Make a working model of mechanical stowing (either by belt conveyor (at face) or by Blast Stower).

c. Other Activities (Specify):

1. Visit a nearby mine where stowing methods are adopted.

CO.4 Apply the techniques to measure and reduce the ground movement.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Apply the concepts of ground movement to reduce accidents caused due to strata movement. SO4.2 Describe rock pressure due to narrow and wide excavation. SO4.3 Explain causes of roof and floor failure. SO4.4 Define rock burst, bump and gas outburst SO.4.4 Classify Rock mass and estimate the proneness of collapse for any kind of rock mass.		**Unit 4.0 Strata Control** 4.1. Basic concepts of ground movement and its theories. 4.2 Rock Pressure due to narrow and wide excavation, 4.3 Failure of roof and floor, 4.4 Measurement of Strata movement- 4.4.1 Wire extensometer, 4.4.2 Load cell, 4.4.3 Convergence indicator 4.4.4 Stress meter, 4.5 Rock mass Classification, 4.6 Effect of Mining Parameters on Strata Control 4.7 Rock burst, Bumps, Gas outbursts, Pot holes.	• Study Strata behavior due to mining activity.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe Pressure arch theory for narrow and wide excavations.
2. Identify the reasons for failure of roof and floor and procedure to maintain the workings in a safe condition.

b. Other Activities (Specify):

1. Study various theories of strata movement.

CO- 5 Control surface subsidence and its effects.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Explain theory of subsidence. SO5.2 Identify lateral and vertical movement of strata due to subsidence. SO5.3 Identify safe zone of mines from angle of draw and angle of fracture. SO5.4 Explain the factors affecting subsidence. SO5.5 Apply techniques to protect surface features from subsidence.		**Unit 5.0 Subsidence** 5.1 Theory of subsidence, 5.2 Damage and loss due to Subsidence, 5.3 Vertical and lateral movements and their estimation, Estimation of horizontal and vertical stress. 5.4 Angle of fracture and angle of draw., 5.5 Area of extraction- 5.5.1 Critical, 5.5.2 Sub critical and 5.5.3 Super critical, 5.6 Factors affecting subsidence, 5.7 Subsidence Control, 5.8 Protection of surface Structures.	• Study causes of subsidence. • Obtain the report of subsidence occurred in the Nearby mines and study the methods adopted for its control.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe the effect of subsidence on surface structures.
2. Explain the factors affecting the subsidence.

b. Mini Project:

1. Carry out subsidence survey.

c. Other Activities (Specify):

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

I) Suggested Specification Table (For ESA of Laboratory Instruction*): N/A

J) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits

6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Modern Coal Mining Practices	R.D. Singh	New age international	2005
2	Strata Control in Mines Chang and Peng	Chang and Peng		latest
3	Mine Subsidence,	B. Singh,	Parijat Mudranalaya Publications	latest
5	Subsidence: occurrence prediction and control	B.N Whittaker & D.J Reddish, Elsevier		latest
6	Advance in coal mine ground control	Syd peng	Woodhead publisher	June 2017
7	Elements of mining technology vol 3	D.J. Deshmukh	Denett& co. Nagpur	Latest

(b) Open source software and website address :

1. https://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0003/543945/NSW-code-of-practice-Strata-control-in-undergound-coal-mines.pdf
2. https://scienceandtech.cmpdi.co.in/PDF%20Files/Strata%20Control.pdf

L) List of Major Laboratory Equipment and Tools: N/A

M) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	**Discipline knowledge PO-2**	**Experiments & Practice PO-3**	**Engineering Tools PO-4**	**The Engineer & Society PO-5**	**Environment & Sustainability PO-6**	**Ethics PO-7**	**Individual & Teamwork PO-8**	**Communication PO-9**	**Life Long learning PO-10**	PSO-1	PSO-2
CO-1 Identify and Select appropriate type of support system in different conditions.	2	3	2	2	1	2	2	2	2	3	2	1
CO-2 Operate appropriate type of powered support.	3	3	2	2	1	3	2	2	2	3	2	3
CO-3 Apply the concepts of Stowing to reduce the damage caused by subsidence	3	3	1	1	3	3	3	2	2	3	2	3
CO-4 Apply the techniques to measure and reduce the ground movement.	3	3	1	1	3	3	3	2	2	3	2	3
CO-5 Control surface subsidence and its effects.	3	2	2	1	2	3	3	2	1	3	1	3

1=low , 2= medium, 3= high.

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,9,10 PSO---	CO-1 Identify and Select appropriate type of support system in different conditions.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6		Unit 1.0 Supports. 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8	• Visit a nearby mine and study the different types of supports used in that mine.
PO-1,2,3,4,5,6,7,8,9,10 PSO---	CO-2 Operate appropriate type of powered support.	SO.2.1 SO.2.2 SO2.3		Unit 2.0 Powered Support 2.1,2.2,2.3,2.4,2.5,2.6	• Watch videos of working operation of powered support used in mines.
PO-1,2,3,4,5,6,7,8,9,10 PSO---	CO-3 Apply the concepts of Stowing to reduce the damage caused by subsidence.	SO3.1 SO3.2 SO3.3 SO3.4		Unit 3.0 Stowing 3.1,3.2,3.3,3.4,3.5	• Find alternate materials which may be used for packing the goaf. • Find alternate materials which can be used in barricading.
PO-1,2,3,4,5,6,7,8,9,10 PSO---	CO-4 Apply the techniques to measure and reduce the ground movement.	SO4.1 SO4.2 SO4.3 SO4.4		Unit 4.0 Strata Control 4.1,4.2,4.3,4.4,4.5,4.6,4.7	• Study Strata behavior due to mining activity.
PO-1,2,3,4,5,6,7,8,9,10 PSO---	CO-5 Control surface subsidence and its effects.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5		Unit 5.0 Subsidence 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	• study causes of subsidence. • Obtain the report of subsidence occurred in the Nearby mines and study the methods adopted for its control.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning.

A) Course Code : 2039575(039)

B) Course Title : Drilling and Blasting Practice in Mines

C) Pre- requisite Course Code and Title :

D) Rationale :

Working knowledge of drilling and blasting practice carried out in mines is very important for mining engineers. Drilling and blasting are the controlled use of explosives to break rock for excavation. Drilling and blasting currently utilizes many different varieties of explosives with different compositions and performance properties as per requirement. This course provides required knowledge, practical information and practices adopted in mines.

E) Course Outcomes

CO-1 Select appropriate type of explosive at different strata condition.

CO-2 Apply appropriate type of initiation system under the given condition.

CO-3 Use appropriate type of drilling pattern and blasting techniques at different conditions in open cast mines.

CO-4 Adopt appropriate type of drilling pattern and cut blasting at different condition in U/G Mine.

CO-5 Apply the knowledge of mechanism of rock fragmentation for preventing problems related to back break, over break, fly rock, air blast, and ground vibration.

F) Scheme of Studies and Examination :

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+T+(P/2)
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
2039575(039)	2	1	2	70	20	30	40	60	220	4

G) Distribution of Hours and Marks:

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S.No	Chapter Name	Hours	Marks
1	Explosive	14	20
2	Blasting accessories	08	15
3	Surface Blasting	10	10
4	Underground Blasting	08	10
5	Rock fragmentation and environmental impact of blasting	08	15
Total		**48**	**70**

H) Course-Curriculum Detailing:

This course curriculum detailing depicts learning outcomes at course level and session level and their attainment by the students through Classroom Instruction (CI), Laboratory Instruction (LI), Sessional Work (SW) and Self

Learning (SL). Students are expected to demonstrate the attainment of Session Outcomes (SOs) and finally Course Outcomes (COs) upon the completion of course.

Convert unit of the given physical quantity from one unit system to other.

CO-1 Select appropriate type of explosive at different strata condition.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Identify different types of Explosive and its related terms. SO1.2 Compare the properties of different explosives used in mines. SO1.3 Differentiate the composition of ANFO, Slurry, Emulsion. SO1.4 Identify the conditions for application of different kinds of explosives used in mines. SO1.5 Feed and load the bulk explosives under given conditions.	LE1.1 Calculate relative weight strength and relative bulk strength of different explosive with respect to ANFO. LE1.2 Prepare a comparative analysis of different types of explosives with respect to ANFO, Slurry, Emulsion, LOX, OCG.	**Unit 1.0 Explosive** 1.1 Definition, Properties and Composition of explosive. 1.2 Classification Of Explosive 1.2.1 Low and High Explosive 1.2.2 Permitted and Non permitted 1.2.3 ANFO, Slurry, Emulsion, LOX, OCG. 1.3 Bulk Explosive system 1.3.1. Site Mixed Slurry 1.3.2. Site Mixed Emulsion 1.4. Calculation of Powder factor and detonating factor.	• Collect and watch Videos/ Animations of various explosives and their feeding techniques. • Find the conditions present and explosives used accordingly in nearby mines through mine visit.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Describe properties and basic composition of explosives.
2. Compare characteristics of ANFO, Slurry, Emulsion.
3. Calculate amount of explosive required per hole for given hole data.

b. Mini Project:

1. Make a working/non-working model of Bulk explosive system.

c. Other Activities (Specify):

1. Visit nearby mine for watching preparation of blasting operation.

CO-2 Apply appropriate type of initiation system under the given condition.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1 Identify blasting accessories. SO 2.2 Use different types of detonators according to the given initiation system. SO 2.3 Apply Shock-tube initiation system. SO 2.4 Connect detonators as per given condition. SO 2.5 Describe the functions of Exploder circuit tester and crimper.	LE2.1 Calculate current passing through the blasting circuit for a given condition. LE2.2 Test the connection of blasting circuit. LE2.3 Prepare a layout of series and parallel connection of detonator.	**Unit 2.0 Blasting accessories** 2.1 Detonators, types of detonators- 2.1.1 Plain 2.1.2 Electric and delay detonator. 2.2 Initiation system: direct and inverse initiation. 2.2.1 Safety Fuse, Detonating fuse/detonating cord system. Cord relay 2.2.2 Electric initiation- Connection of detonator: Series and parallel connection and its calculation. 2.2.3 Shock Tube System, NONEL, Raydet 2.3. Blasting equipments - Exploder, Circuit tester, Crimper.	• Study the initiation system used in nearby mine through mine visit.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Classify various types of Detonators.
2. Describe Shock-tube initiation system such as NONEL or Raydet.

b. Mini Project:

1. Make a model of blasting connection showing series /parallel connection.

c. Other Activities (Specify):

1. Visit nearby mine for watching various blasting accessories and their functions.

CO- 3 Use appropriate type of drilling pattern and blasting techniques at different conditions in open cast mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1 Identify various blasting parameters. SO 3.2 Select different drill patterns. SO 3.3 Describe blasting cycle with respect to given parameters. SO 3.4 Deal misfire and carryout safety precautions to be taken during surface blasting. SO 3.5 Calculate the powder and detonating factor.	LE3.1 Prepare a layout of various drilling patterns used in blasting LE3.2 Prepare a blast design assuming suitable data and conditions and calculate the following- a) Powder factor b) Detonating factor c) Quantity of explosives used per round of blast.	**Unit 3.0 Surface Blasting** 3.1 Factor affecting blast design- Burden, Spacing, Stemming Height, Subgrade Drilling, Bench Height, Depth of hole, Diameter of Hole. 3.2 Various Drill patterns used in surface blasting. 3.3 Cycle of Blasting i.e. drilling, charging, stemming, connection, exploding and removal of blasted Material/Mineral. 3.4 Special type of surface blasting technique i.e. controlled blasting, muffle blasting, cushion blasting, Air decking, coyote blasting, Cast blasting etc. 3.5 Secondary Blasting: Pop shooting, Plaster shooting . 3.6 Surface blast design and Calculation of Power and detonating factor. 3.7 Misfire : Dealing and precautions 3.8 Precaution during blasting	• Study the surface blasting procedure.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. prepare a blast design plan according to given condition.
2. Compare the various drill patterns used in surface blast design.
3. Describe any one special blasting technique known to you.

b. Mini Project:

1. Prepare a model showing any one type of drilling pattern for surface blasting.

CO- 4 Adopt appropriate type of drilling pattern and cut blast at different conditions in U/G mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 4.1 Draw plans and sections of different drill patterns. SO 4.2 Prepare a plan for cycle of operation of Blasting Process. SO 4.3 Take safety precautions during underground blasting. SO 4.4 Calculate the powder and detonating factor for a given condition. SO 4.5 Take necessary steps for the transportation and storage of explosive.	LE4.1 Calculate the powder factor for given data in U/G blasting. LE4.2 Prepare a layout of BOS.	**Unit 4.0 Underground Blasting** 4.1. Various drill patterns and their applicable condition. 4.2. Process of Blasting: i.e. drilling, charging, stemming, connection, exploding and removal of blasted Material/Mineral. 4.3. Cut Blasting. 4.4. Blasting of Solid (BOS) 4.5 Calculation of Powder and detonating factor. 4.6 Misfire: Dealing and precautions. 4.7. Precaution during blasting. 4.8. Transportation and storage of explosive for U/G and Open cast mining.	• Visit nearby underground mines and study the blasting. • Watch videos of underground coal and metal mine blasting and carryout a comparative analysis.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Compare the various drill patterns used in U/G blast design.
2. Describe Solid Blasting Practice in U/G mines.
3. Calculate the Powder factor of a blast in u/g mines assuming your own data.

b. Mini Project:

1. Prepare a model showing any one type of drilling pattern for U/G blasting.

c. Other Activities (Specify):

1. Prepare a comparative account of difference between underground coal and metal mine.

CO- 5 Apply the knowledge of mechanism of rock fragmentation for preventing problems related to back break, over break, fly rock, air blast, and ground vibration.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 5.1 Explain mechanism of rock fragmentation in blasting. SO 5.2 Solve the problems occurring during blasting. SO 5.3 Use controlled blasting measures for prevention of harmful environmental impact. SO 5.4 Measure peak particle velocity and ground vibration.		**Unit 5.0 Rock fragmentation and environmental impact of blasting** 5.1 Rock fragmentation: Mechanism and factors affecting rock fragmentation. 5.2 Environmental impact of blasting : Back break, Over break, fly rock, Ground vibration, air blast & its factor affecting and controlling measures. 5.3 Peak particle velocity and Procedure for measurement of ground vibrations.	• Visit a nearby mine and study the blast controlling measures adopted there. On the basis of- 1 ground vibration 2 back break 3 over break 4 fly rock

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others) , LI : Laboratory Instruction (Includes Practical performances in Laboratory, Workshop, field or other locations using different instructional strategies) SL: Self Learning

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

1. Briefly describe mechanism of rock fragmentation.
2. Describe fly rock problem. Write its controlling measures.
3. Distinguish Back break, over break and air blast.

b. Mini Project:

1. Prepare a plan of controlling measures which can be adopted for ground vibrations.

c. Other Activities (Specify):

1. Measure ground vibration with respect to your own assumed data.

Note: Performance under Laboratory and Sessional work may appear in more than one COs/SOs.

I) Suggested Specification Table (For ESA of Laboratory Instruction*):

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
01	Calculate relative weight strength and relative bulk strength of different explosive with respect to ANFO.	15	15	30
02	Prepare a comparative analysis of different types of explosives with respect to ANFO, Slurry, Emulsion, LOX, OCG.	15	15	30
03	Calculate current passing through the blasting circuit for a given condition.	15	15	30
04	Test the connection of blasting circuit.	15	15	30
05	Prepare a layout of series and parallel connection of detonator.	15	15	30
06	Prepare a layout of various drilling patterns used in blasting	15	15	30
07	Prepare a blast design assuming your own data and conditions and calculate the following – a) Powder factor b) Detonating factor c) Quantity of explosives used per round of blast.	15	15	30
08	Calculate the powder factor for given data in U/G blasting.	15	15	30
09	Prepare a layout of BOS.	15	15	30

* Assessment rubric, process and product check list with rating scale need to be prepared by the course wise teachers for each experiment for conduction and assessment of laboratory experiments /practicals

Legend : PRA: Process Assessment, PDA : Product Assessment

Note : *Only one experiment has to performed at the end semester examination of **40 Marks** as per assessment scheme*

J) Suggested Instructional/Implementation Strategies:

1. Improved Lecture
2. Tutorial
3. Case Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)

12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Explosives and blasting practices in mines.	G.K Pradhan	Lovely Prakashan	2016
2	Explosives and blasting practices in mines.	Sameer Kumar Das	Lovely Prakashan	2014
3	Engineering Rock Blasting Operations	Sushil Bhandari	Rotterdam/Bookfield	1997

(b) Open source software and website address :

1. https://www.youtube.com/watch?v=G2Hs51QDszc
2. https://www.youtube.com/watch?v=m6k26jMcEko
3. https://www.scribd.com/document/372783108/Engineering-Rock-Blasting-Operation-by-Sushil-Bhandari-pdf
4. https://scholarsmine.mst.edu/cgi/viewcontent.cgi?article=8295&context=masters_theses

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Circuit tester	With relevant current carrying capacity.	3
2	Electric circuit	With relevant potential difference and current carrying capacity.	3,4,5

M) Mapping of POs & PSOs with COs:

Course Outcomes (COs) Titles	Programme Outcomes (POs)										Programme Specific Outcomes (PSOs)	
	Basic knowledge PO-1	**Discipline knowledge PO-2**	**Experiments & Practice PO-3**	**Engineering Tools PO-4**	**The Engineer & Society PO-5**	**Environment & Sustainability PO-6**	**Ethics PO-7**	**Individual & Team work PO-8**	**Communication PO-9**	**Life Long learning PO-10**	PSO-1	PSO-2
CO-1 Select appropriate type of explosive at different strata condition.	3	3	2	3	2	3	2	2	2	3	2	3
CO-2 Apply appropriate type of initiation system under the given condition.	3	2	3	2	2	3	2	2	2	3	-	2
CO-3 Use appropriate type of drilling pattern and blasting techniques at different conditions in surface/ open cast mines.	3	3	3	3	2	3	3	2	2	3	2	3
CO-4 Adopt appropriate type of drilling pattern and cut blasting at different condition in U/G Mine.	3	2	3	2	2	3	2	2	2	3	2	3
CO-5 Apply the knowledge of mechanism of rock fragmentation for preventing problems related to back break, over break, fly rock, air blast, and ground vibration.	3	3	3	3	2	3	3	2	2	3	1	3

1=low, 2= medium, 3= high.

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-1 Select appropriate type of explosive at different strata condition.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LE1.1 LE1.2	Unit 1.0 Explosive- 1.1,1.2,1.3,1.4	As mentioned in relevant Pages.
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-2 Apply appropriate type of initiation system under the given condition.	SO.2.1 SO.2.2 SO2.3 SO2.4 SO2.5	LE. 2.1 LE. 2.2 LE 2.3	Unit 2.0 Blasting Accessories- 2.1,2.2,2.3	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO- 3 Use appropriate type of drilling pattern and blasting techniques at different conditions in surface/ open cast mines.	SO.3.1 SO3.2 SO3.3 SO3.4 SO3.5	LE 3.1 LE 3.2	Unit 3.0 Surface Blasting- 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-4 Adopt appropriate type of drilling pattern and cut blasting at different condition in U/G mine.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5	LE4.1 LE4.2	Unit 4.0 Underground Blasting- 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-5 Apply the knowledge of mechanism of rock fragmentation for preventing problems related to back break, over break, fly rock, air blast, and ground vibration.	SO5.1 SO5.2 SO5.3 SO5.4		Unit 5.0 Rock Fragmentation and Environmental Impact Of Blasting- 5.1,5.2,5.3	

A) Course Code : 2039564(039)

B) Course Title : Industrial Training

C) Pre- requisite Course Code and Title :

D) Rationale :

With the advancement in technology and industry 4.0, we need to prepare our young Indian technical talent to meet the present demand. Our diploma passouts are either supposed to work as supervisor in the industries or start their own enterprise, hence upon the completion of diploma programme, they need to be adequately equipped with knowledge, skills and attitude required by the world of work in their relevant field. To attain this, students need to be sent for industrial visit and industrial training during the course of study. With these provision of industrial exposures relevant practical and professional skills are developed in the students and as a result of this students are readily employed and widely accepted by cross section of the industries, even sometimes during such training itself.

Series of continues interactions with the industry personnel are required to be done for planning and arranging and also effectively implementing such exposures.

E) Course Outcomes: After undergoing the industrial visit, industrial training and internship the students will be able to -

CO-1 Appreciate the importance of industrial training for gaining direct practical skills on their relevant domain area.

CO-2 Comprehend the comprehensive view of industry or world of work in terms of its layout, management, culture, hierarchy, discipline, safety norms, different department/sections, quality control/assurance in processes, services and products, demonstration and operation of specific equipment/machinery, rules and procedures etc.

F) Scheme of Studies and Examination:

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+T+(P/2)
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
2039564(039)	-	-	2	-	-		40	60	100	1

G) Distribution of Hours and Marks:

S.No	Chapter Name	Hours	Marks
1	Industrial Training	16	40
Total		**16**	**40**

Guidelines to teachers for Industrial Training is given below:

H) Guidelines to Teachers for arranging Industrial Training :

1. Rationale :

Apart from arranging industrial visit, organizing industrial training of students is essentially required to be done during implementation of the curriculum to improve the quality of our young diploma engineering students and to enhance the prospects of employability, After undergoing industrial training, students get the direct exposure to the world of work in their relevant field. They get hands on experience in the industries. The need to be given opportunity to undergo training in relevant industry for minimum two weeks and it is recommended that it should be mandatory for all the programmes running in the institute. The industrial training period may vary from 2 weeks to 6 months depending upon the requirement of that programme.

The programmes, where there is provision of industrial training during the semester are termed as sandwich programmes. Many of the programmes have industrial training at the end of last semester or sometimes a full semester is dedicated for industrial training.

2. Planning for Industrial Training :

Following points need to be planned and briefed by the teachers to the students before proceeding for industrial training. Student should take into consideration these points and carry the relevant format/data/log book with them.

- Objectives /Purposes of the industrial training
- Outcomes targeted before proceeding to industrial training.
- Pre-requisite knowledge or skills required to be developed in the students in the form of demonstration or classroom sessions.
- Identification and planning for demonstration of any equipment or experiments, concepts, under the content beyond syllabus.
- Preparation of database of nearby relevant industries.
- Good rapport need to be developed and maintained with the industries by the teachers, so that the students are ultimately benefitted by the industrial training.
- Industrial policy of the state also need to be taken care of while planning of industrial training
- For assessing the students on various dimensions of industrial training, assessment rubric may be prepared by the implementing teachers in advance.
- Following formats need to be developed by the teachers and briefed to the students before proceeding to industrial training –
  - Formats of observations on layout, ambience, and work culture to be developed, and briefed to the students.
  - Formats of outcome attainment, related to observation on relevant technical area also need to be developed by the teachers and briefed to the students.
  - Formats and contents of report writing and presentation.
  - Formats and contents on assessment of industrial training.
  - Continuous observation formats on many points such as behavioral aspects related to soft skills development such as initiativeness, observation, notes taking skills, inquisitiveness, obedience, sincerity, follow the instructions, positive attitude and many other aspects.
  - Formats of Assessment Rubric on different parameters of both behavioral aspects and technical aspects of the programme.

3. Actions to be taken by the Students and Teachers :

Students are sent to Industrial training after briefing on various aspects. During industrial training, observational skills in students are required to a great extent -

- Students need to be alert, meticulous and record the data, as briefed to them before the industrial training.
- Record of observations on safety precaution to be followed, any special point during performance and handling of equipment, performance on technical aspects and other related aspects need to be taken care of.
- Continuous observation, monitoring and assessment on various behavioral and performance of technical aspects of each student need to be critically observed and recorded by the teachers using different assessment tools.

4. Post Training Assessment :

The students need to be assessed on report writing, presentation and interpretation of data recorded, on various dimensions, planned and performed, after the industrial training. The actions are required to be taken for assessment during report writing, analysis, interpretation, presentation of data and its assessment.

5. Major outcomes expected to be attained and assessed :

The following learning outcomes are expected to be developed during the industrial training. This will lead to attainment of COs, POS and PSOs.

- Development and Reinforcement of Basic Knowledge/concepts
- Development and Reinforcement & Engineering Knowledge i.e operations, performance, maintenance, demonstrations of specific skills relevant to the content of the programme.
- Experiment and practice – Development of experimental practical skills and technical skills relevant to the course programme.
- Development of learning to learn skills and life long teaching skills for latest advancement in technology.
- Development of positive attitude, professional ethics and etiquettes.
- Development of skills for individual and team work during performance and otherwise.
- Maintaining Business Secrecy
- Development of Communication Skills
- Ability to follow the instructions
- Ability to follow the safety precautions
- Ability to supervise the task
- Ability to coordinate with subordinates and higher ups
- Development of Interpersonal skills
- Environmental Consciousness and Sustainability
- Development of Observational Skills
- Time Management
- Self discipline
- Integrity
- Development of generic skills such as pro-activeness, commitment
- Development of Problem Solving abilities
- Achievement of target

I) Initiatives by Govt. of India and other Agencies :

1. Initiatives by Govt. of India, GOI

a. Initiatives by Ministry of Skills Development and Entrepreneurship

Many efforts are initiated by different agencies in this direction as per our Prime Minister's Skills Development Mission. Make in India, Skills India etc are such initiatives taken by ministry for the benefit of the students.

b. Initiatives by Ministry of HRD, Govt. of India

I. Ministry of HRD, Government of India is providing students a platform to inculcate a culture of product innovation and a mindset of problem solving to solve some of pressing problems solving to solve some of pressing problems we face in our daily lives through Smart India Hackathon (SIH) 2019.

In SIH-2019, the students would also have the opportunity to work on challenges faced within the private sector organizations and create world class solutions for some of the top companies in the world, thus helping the private sector hire the best minds from across the nation. The team size for participation in one team will be 8 (6 Students + 2 Mentors). 50 Teams will be selected for the final Hackathon. The prize will be a cash prize for each rank with following distribution criteria for the top three teams ranging from Rs. 50,000 to 1,00,000/-.

II. **Internshala :** Internshala is India's largest internship and training platform where more than 80,000 companies look for interns in various profiles (Engineering, management, media, arts etc.) AICTE has also partnered with Internshala for providing internship opportunities to every students in AICTE approved colleges. This facility is created to provide a platform for hands on experience to the our future technicians on the relevant industries. With this experience, they are updated with the latest advances in their field of work.

Government of India through, AICTE is engaged in promoting the concept of industrial training through its various scheme, such as Internshala. The teachers now have the responsibility to understand in depth and implement such schemes in the institution for the benefit of students. At institute level also, there is need to develop policy for sending the students for industrial training.

c. Initiatives by Ministry of Labour and Employment, Govt. of India

Ministry of Labour and Employment, Government of India launched a National ICT based job portal known as National Career Service (NCS) portal to connect the opportunities with the aspirations of youth. This portal facilitates registration of job seekers, job providers, skill providers. Career counselors, etc. The portal provides job matching services in a highly transparent and user friendly manner. These facilities along with career counseling content are delivered by the portal through multiple channels like career centres, mobile devices, CSCs, etc.

The portal provides information on over 3000 career options from 53 key industry sectors. Job seekers also have access to industry trends in a user friendly way. The NCS portal links job-seekers, employers, counselors and training providers all through Aadhaar-based authentication. Registration to NCS portal is online and free of charge. The salient feature of NCS portal includes the following :

- Career counseling and Guidance
- Enabling Skill Development
- Empowering Job seekers to find the right Job
- Enabling employers to pick the right talent
- Enhancing capabilities of students through training

Information's related to Job Fairs/Placements

d. Initiatives by Telecom Sector Skill Council (TSSC)

TSSC has taken a step towards fulfilling the emerging requirements of the industry by partnering with key stakeholders in order to bring the latest content to the forefront. TSSC have got into partnership with All India Council for Technical Education (AICTE) for summer internship programme and various other MNCs to impart Skilling in new emerging technologies. Some of the prime courses in new emerging technologies being offered by TSSC in addition to TSSC Qualification packs are as under :

- Artificial Intelligence & Data Science
- Cyber Security
- Internet of Things
- Android
- AR/VR

In addition to this certain courses on life skills/soft skills, employability related skills are also planned for the students such as

- Problem solving and analytic
- Communication skills
- Lifelong learning
- Behavioral Skills
- Professional Behavioral etc.

The main objectives of TSSC are as follows

- Bridge the gap and enhance employability of our students
- Training young minds towards 21st Century skills assisting industry cross-sector
- Meet the needs of school leavers and graduates, employers, government educational institutions and society.
- Address the need for quality, skill training for human resources to complement the large goal of accomplishing the include growth.
- Address the limited capacity of skills development facilities in India
- To develop extensive placement linkages with employers in all sectors to provide gainful entry-level employment opportunities to youth undergoing the skill training.
- Industry participation in developing the skill training solutions to address critical skill gaps by standardization of training content, delivery and assessment process o improve overall competitiveness of the industry.

2. Initiatives by other agencies

a. Initiatives by Engineering Council of India (ECI)

(ECI has also taken initiatives to organize series of interactive workshops to update and apprise the students about the products and services being offered by respective corporate house. This interaction will definitely bring the institute and industry closer and help in planning for effective implementation of industrial training.

b. Others

Many public sector and private organizations are also contributing to the course of quality improvement in technical education system by way of arranging industrial visit of providing industrial training to the students as a part of their corporate social responsibility and also for the growth of technical education system of the country.

L) Initiatives to be taken by State Technical University/Board/Institutions.

- State Technical University/Board have to sign MOU with Internshala, partner of AICTE, with the aim of providing students with professional experience in the form of internship. For registration of students at college level for Internshala platform, visit of website address internshala.com/i/register-rgpv is suggested for uploading the details (Name, e-mail address & phone number compulsory) in an excel

sheet. Internshala will create an account for all the students so that they can apply for internship. The registration is free of cost.

- Programme wise Industries Bank of nearby industries at state level and national level need to be created for useful interaction with details of content e-mail addresses phone numbers and areas of expertise.
- Institute may take initiative to facilitate the registration of students at National Career service (www.ncs.gov.in) portal and ensure the compliance of above directive in your institute.
- Institute should encourage and facilitate the registration of team of students for Smart India Hackathon-2019 at www.sih.gov.in portal and other similar websites.
- After careful curriculum analysis and also identifying the learning gaps, an action plan for effective implementation of the course need to be prepared based on the area of industries. This would help the teachers to decide the particular industry to be visited for exposing to specific content area or specific outcomes to be attained.
- Frequent Industry – Institute meet may be arranged on different topics for mutual benefit.
- List of a directory of industrial experts may be prepared for inviting them for seeking their expertise.
- Guidelines/policy for sending students to industrial training/internship must be prepared by the university for effective implementation of the industrial training/internship.
- TOT programmes on orientation of arranging industrial visit, training should be arranged for teachers implementing the same.
- MOU between University and Industry need to be signed for -
  - Industry collaboration for student/faculty empowerment
  - Partnership with industry on curriculum implementation.
  - Demonstrating and performing practical performances to students.
  - Providing technical work force for industrial production.
  - Corporate support to Academia through various resources.
- Establishment of training and placement cell at each institute level.
- Employability Enhancement initiatives need to be taken by CSVTU for arranging campus placement at CSVTU level/institute level or through open campus.

J) References:

- **What is Industrial Visit & Benefit's of Industrial's Visit**
  http://education.osrvacation.com/what-is-industrial-visit-benefits-of-industrials-visit/
- **Importance of Industrial visit**
  http://industrialtour.com/importance-of-industrial-visit/
- **Difference Between Training and Internship**
  https://keydifferences.com/difference-between-training-and-internship.html
- **INTERNSHIP VS INDUSTRIAL TRAINING – ANY DIFFERENCE?**
  http://www.careerhubafrica.com/blog/internship-vs-industrial-training-any-difference/
- **What is an Internship?**
  https://www.wikijob.co.uk/content/internships/advice/what-internship
- **5 Elements to Include in any Post Training Evaluation Questionnaire**
  https://www.efrontlearning.com/blog/2017/12/element-post-evaluation-training-questionnaire.html