A) Course Code : 2039671(039)

B) Course Title : Mine Hazards

C) Pre- requisite Course Code and Title :

D) Rationale : Mining industry is one of the industries causing environmental pollution and chances of severe accidents. Certain bindings are imposed through regulations on mining industry for safe workings and to control hazards associated with mines. Diploma student are required to be more acquainted with the major problems associated for mine worker in connection with comfortable working conditions and various sources of problem creating agents. This course is designed to fulfill the required level knowledge of mine hazards for safe mining.

E) Course Outcomes :

CO-1 Execute relevant fire fighting method for different types of fire in mines.

CO-2 Identify the conditions of presence of firedamp and prevent firedamp explosions in underground mines.

CO-3 Prevent the coal dust explosions in underground mines.

CO-4 Prevent inundation and control water logging conditions in mines.

CO-5 Perform rescue and recovery work under the given conditions in 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		
2039671(039)	2	1	2	70	20	30	40	60	220	4

G) Distribution of Hours and Marks :

S.No	Chapter Name	Hours	Marks
1	Mine Fires	08	10
2	Firedamp Explosion	08	10
3	Dust Explosion	10	15
4	Inundation	12	20
5	Mine Rescue and Recovery	10	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.

CO-1 Execute relevant fire fighting method for different types of fire in mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Analyze factor responsible for mine fire in a given situation. SO1.2 Use appropriate fire extinguisher under the given conditions SO1.3 Identify the conditions of spontaneous heating in mines. SO1.4 Select different types of fire stopping under the given conditions. SO1.5 Describe incubation period, crossing point and ignition point.	LE1.1 Measure Graham Index of given mine air sample. LE1.2 Prepare a plan for firefighting organization.	**Unit1.0 Mine Fires** 1.1Factors responsible for mine fire, 1.2 Classification of fire, 1.3 Fire Extinguisher, 1.4 Causes of mine fire, 1.5 Preventive measures against Surface and underground mine fires. 1.6 Spontaneous heating; 1.6.1 Factors responsible for spontaneous heating, 1.6.2 Graham index and stages of spontaneous heating, 1.6.3 Preventive measures against spontaneous heating 1.7 Fire stopping 1.7.1 Purpose of fire stopping 1.7.2 Types of fire stopping- 1.7.2.1 Preparatory fire stopping 1.7.2.2 Emergency fire stopping 1.7.2.3 Permanent fire stopping 1.8 Opening of a sealed of area. 1.9 Fire fighting organizations. 1.10 Incubation period, crossing point temperature, ignition point temperature.	• Study of different fire using websites and related videos. • Study of different fire stopping using websites and related videos. • Visit nearby underground mines and find the condition of spontaneous heating

SW-1 Suggested Sessional Work (SW):

a) Assignments:

1. Describe different types of fire and fire extinguisher.
2. Prepare a graph highlighting the condition of ignition point and crossing point under laboratory conditions.

b) Mini Project:

1. Prepare a model of appropriate type of fire stopping under the given conditions.

c) Other Activities (Specify):

1. Study the safety measures used for prevention of fires in underground coal mine.

CO-2 Identify the conditions of presence of firedamp and prevent firedamp explosions in underground mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 2.1 Identify various conditions responsible for firedamp	LI2.1 Use flame safety lamp for detection and measurement of quantity of methane including	**Unit 2.0 Firedamp Explosion** 2.1 Types of explosion- 2.1.1 Fire damp explosion	• Study various methods for detection of firedamp in

Session Outcomes	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
explosion. SO 2.2 Apply required safety measures for prevention of firedamp explosion. SO 2.3 Identify limits of inflammability of various gases in mines.	accumulation and percentage test. LI2.2 Prepare a graph and represent coward's diagram under different condition of presence of methane.	2.1.2 Dust explosion 2.1.3 Water gas explosion 2.2 Causes of fire damp explosion. 2.3 Precaution against fire damp explosion 2.4 Upper and lower limit of fire damp explosion. Coward's diagram. 2.5 Limit of inflammability and Le Chatelier's principle for its measurement. 2.6 History of Anjan hill gas explosion 2.7 Study of other important gas explosion in Indian coal mines.	underground mines. • Visit nearby underground mines and study the safety measures applied for prevention of explosions.

SW-2 Suggested Sessional Work (SW) :

a) Assignments:

1. Analyze different situation of presence of methane in underground mines and precautions to be taken according to the situation.

b) Mini Project:

1. Prepare a report comprises of i) location ii) causes iii) severity iv) preventive measures taken for latest firedamp explosion incident in Indian underground mines.

c) Other Activities (Specify):

1. Find the safety measures taken against firedamp explosion in nearby mines.

CO- 3 Prevent the coal dust explosions in underground mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO 3.1 Identify various conditions responsible for firedamp explosion. SO 3.2 Apply required safety measures for prevention of coal dust explosion. SO 3.3 Measure dust concentration in general body of mine air. SO 3.4 Use stone dust barriers, water barriers and chemical foam	LI3.1 Use Polish /German type stone dust barriers to control stone dust. LI3.2 Analyze qualities of available sample of stone dust. LI3.3 Measure dust concentration in given air sample.	**Unit 3.0 Dust Explosion** 3.1 Coal dust- 3.1.1 Causes of coal dust 3.1.2 Precaution against coal dust 3.2 Coal dust explosion and its mechanism. 3.2.1 Causes of coal dust explosion. 3.2.2 Precautions & preventive measures against coal dust explosion 3.3 Stone dust 3.3.1 Qualities of stone dust; 3.3.2 Handling of stone	• Study the reason of production of coal dust in underground coal mines. • Visit nearby mines and find the measures taken for prevention of coal dust explosion.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning
method for prevention of coal dust explosion.		dust, 3.3.3 Stone dust barriers 3.4 Water barriers, 3.5 Chemicals and chemical foams to prevent coal dust hazards 3.6 Threshold value, 3.7 Measurement of coal dust concentration in general body of air.	

SW-3 Suggested Sessional Work (SW) :

a) Assignments:

1. Analyze various precautions to be taken under different conditions of coal dust concentration in underground mines.
2. Write Short Note on some important dust explosion cases in Indian coal mines.

b) Mini Project:

1. Prepare a detailed report of recent coal dust explosion in Indian mines.

c) Other Activities (Specify):

1. Study various safety measures taken in nearby mines to prevent coal dust generation.

CO- 4 Prevent inundation and control water logging conditions in mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Identify the sources of dangerous accumulation of water. SO4.2 Select suitable preventive measures against inundations in mines. SO4.3 Operate various dams to prevent water logging inside mines.	LI4.1 Prepare a model of flat and spherical dam in laboratory. LI4.2 Prepare a model of bulkhead door in laboratory. LI4.3 Perform all the procedure taken during major inundation accident under given condition.	**Unit 4.0 Inundation** 4.1 Causes of inundation in mines. 4.2 Sources of dangerous accumulation of water in mines. 4.3 Preventive measures for inundation. 4.4 Precautions for approaching water logged areas. 4.5 Burnside drilling machine. 4.6 Dams – 4.6.1 Purpose of dam 4.6.2 Site of dam, 4.6.3 Types of dam and their constructional details. 4.7 Bulkhead door.	• Find the measures taken to prevent water logging in nearby mines. • Study different types of pumps used to control inundation in mines.

SW-4 Suggested Sessional Work (SW) :

a) Assignments:

1. Write various sources of accumulation of water in your nearby mining areas.
2. Describe the procedure to approach waterlogged areas in underground mines.

b) Mini Project:

1. Prepare case study of some important inundation accidents in Indian mines.

CO- 5 Perform rescue and recovery work under the given conditions in mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Identify various rescue apparatus used for rescue operation in mines. SO5.2 Operate rescue and reviving apparatus used for rescue and recovery operations. SO5.3 Maintain the equipment used in rescue stations. SO5.4 Prepare rescue plan and rescue organization in case of emergency.	LI5.1 Operate various rescue apparatus and equipments used in mines. LI5.2 Prepare a rescue plan for the given conditions.	**Unit 5.0 Mine Rescue and Recovery** 5.1 Rescue apparatus- 5.1.1 SCBA- drager BG-174,Protomark IV and V, 5.1.2 Escape apparatus-Gas mark, Self rescuer 5.1.3 Reviving apparatus - pulmometer 5.2 Rescue stations – equipments used in rescue station, 5.3 Rescue and recovery work during mine fires, explosion, inundation. 5.4 Emergency organization and rescue plan 5.5 Fresh airbase, 5.6 Sealing off fire area (u/g fire) and opening of sealed off areas 5.7 Occupational diseases in mining industry.	• Study different types of rescue apparatus used in nearby mines. • Visit rescue station of nearby 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. Study the sealed off areas of some Indian mines and procedure adopted for their opening.
2. Describe the rescue and recovery operations used during

b. Mini Project:

1. Prepare a non working model of rescue stations.

c. Other Activities (Specify):

1. Study major rescue operation carried out during last 5 years in Indian mining industry.

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	Measure graham index of given mine air sample.	15	15	30
02	Prepare a plan for fire fighting organization.	15	15	30
03	Operate flame safety lamp for detection and measurement of quantity of methane.	15	15	30
04	Prepare a graph and represent coward's diagram under different condition of presence of methane.	15	15	30
05	Use Polish /German type stone dust barriers to control stone dust.	15	15	30
06	Analyze qualities of available sample of stone dust.	15	15	30
07	Measure dust concentration in given air sample.	15	15	30
08	Prepare a model of flat and spherical dam in laboratory.	15	15	30
09	Prepare a model of bulkhead door in laboratory.	15	15	30
10	Perform all the procedure taken during major innundation accident under given condition.	15	15	30
11	Operate various rescue apparatus and equipments used in mines.	15	15	30
12	Prepare a rescue plan under given conditions.	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 /practical

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. Demonstration
10. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
11. Brainstorming

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Elements of Mining Technology Vol.2	D. J. Deshmukh	Denett & Co Nagpur	9TH Edition 2016
2	Mine disasters and mine rescue	M.A. Ramlu	Universities Press	2nd Edition 2006
3	Mine Ventilation vol 2	S.K Ghatak	Lovely Prakshan	3rd Edition 2008

(b) Open source software and website address:

1. **Occupational health hazards**
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2395565/
2. **Mine fires , Inundation, Roof Collapse**
https://www.thebalancesmb.com/specific-and-non-specific-hazards-in-underground-mines-2367338
3. **Case Study of Mine Disasters.**
https://www.researchgate.net/publication/309691264_Lessons_Learnt_from_Indian_Inundation_Disasters_An_Analysis_of_Case_Studies

(c) Others:

1. **Mine Fires**
https://www.youtube.com/watch?v=daXeesa5LDI

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Multi gas detector	Equipment should be Capable of detection of flammable, toxic and poisonous gases having following specifications- LCD display Rechargeable battery Audio visual alarm Water resistant Simple, automatic calibration.	01
2	Fire Extinguisher	Dry powder type capable of dealing class A, B and C fires. foam type capable of dealing with A and B class of fires. carbon-di-oxide type capable of dealing with B and C class of fire Vapourising liquid type to deal with class A,B,C and live electrical equipment fires.	02
3	Flame safety lamp	*Approved by DGMS. A mechanical pin indicator is provided with the lamp for clearly indicating percentage of methane (less than 1% to 4%) which can be measured vividly with the attaching measuring scale. Instant reaction during oxygen deficiency. No periodical calibration is required. Simple to operate, dismantle, testing both at roof level and general	03

		atmosphere. Instant relighting the burner of wick through hot wire filament. Consumption of battery for filament unit is very nominal. Snuffer device is provided to cover extra safety. The lamp is most reliable, safest and dependable than any other gas detectors. The lamp can be used for continuous monitoring purpose	
4	Dust sampler	Gravimetric and electrostatic type. Capable of detecting multiple sized particles like 2.5ppm ,10 ppm.	05,06
5	Self breathing appratus	Dragger BG 174, proto mark 4 and proto mark 5	11
6	Gas mask	Capable of prevention from CO,H2S and other poisonous gases and specifications as per Approved by DGMS. Capable	11,12

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 Execute relevant fire fighting method for different types of fire in mines	2	2	1	1	3	3	2	2	1	2	1	2
CO-2 Identify the conditions of presence of firedamp and prevent firedamp explosions in underground mines.	2	2	1	1	3	3	2	3	2	2	1	2
CO-3 Prevent coal dust explosions in underground mines.	1	2	1	1	2	2	2	2	1	1	-	3
CO-4 Prevent inundation and control water logging conditions in mines.	2	1	1	2	3	3	2	2	1	2	-	2
CO-5 Perform rescue and recovery work under the given conditions in mines.	2	2	3	3	2	1	2	3	2	2	2	-

O) 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 Execute relevant fire fighting method for different types of fire in mines	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5	LE1.1 LE1.2	Unit 1.0 **Mine fires** 1.1,1.2,1.3,1.4,1.5,1.6,1.6.1,1.6.2,1.6.3,1.7,1.7.1,1.7.2,1.7.2.1,1.7.2.2,1.7.2.3,1.8,1.9,1.10	As mentioned in relevant Pages
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-2 Identify the conditions of presence of firedamp and prevent firedamp explosions in underground mines**.**	SO.2.1 SO.2.2 SO2.3	LE2.1 LE2.2	Unit 2.0 **Firedamp Explosion** 2.1,2.1.1,2.1.2,2.1.3,2.2,2.3,2.4,2.5,2.6,2.7	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-3 Prevent the coal dust explosions in underground mines.	SO.3.1 SO3.2 SO3.3 SO3.4	LE3.1 LE3.2 LE3.3	Unit 3. **Dust explosion** 3.1,3.1.1,3.1.2,3.2,3.2.1,3.2.2,3.3,3.3.1,3.3.2,3.3.3,3.4,3.5,3.6,3.7	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-4 Prevent inundation and control water logging conditions in mines.	SO4.1 SO4.2 SO4.3	LE4.1 LE4.2 LE4.3	Unit 4.0 **Inundation** 4.1,4.2,4.3,4.4,4.5,4.6,4.6.1,4.6.2,4.6.3,4.7	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-5 Perform rescue and recovery work under the given conditions in mines.	SO5.1 SO5.2 SO5.3 SO5.4	LE5.1 LE5.2	Unit 5.0 **Mine rescue and recovery** 5.1,5.1.1,5.1.2,5.1.3,5.2,5.3,5.4,5.5,5.6,5.7	

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 : 2039672(039)

B) Course Title : Surface Mining

C) Pre- requisite Course Code and Title :

D) Rationale : The techniques of extracting minerals from the earth are changing rapidly with recent developments in mining industry. Emphasis is being given for winning of deposits by removing overlying strata as compared to underground mining by employment of heavy machineries. It is essential to study the technology applied in mining field for extraction of mineral completely by introducing heavy machines & comfortable natural conditions. Open cast mining and problems of mined out area is one of the important field of mining/Industry. This course is designed to fulfill the necessary knowledge of surface mining.

E) Course Outcomes:

CO-1 Apply basic knowledge of surface mining for understanding, formulating and solving problems related with the surface mine.

CO-2 Design a layout of opencast mines under the given conditions.

CO-3 Select appropriate type of drills and explosives under the given conditions in opencast mines.

CO-4 Select appropriate type of surface mining machinery under the given conditions in opencast mines.

CO-5 Select appropriate method of land reclamation under the given conditions in opencast 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		
2039672 (039)	2	1	-	70	20	30	-	-	120	3

G) Distribution of Hours and Marks:

S.No	Chapter Name	Hours	Marks
1	Introduction to Surface Mining	08	10
2	Pit Design and Layouts	10	15
3	Drilling and Blasting in Surface Mining	10	15
4	Different Mining Machinery (HEMM) Employed in Surface Mine	12	20
5	Land Reclamation	08	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 Apply basic knowledge of surface mining for understanding, formulating and solving problems related with the surface mine.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Apply basic terminology in surface mining operations. SO1.2 Identify factors affecting the planning and design of surface mining. SO1.3 Design boxcut and access trenches. SO1.4 Enlist major surface coal surface metal mines in India. SO1.5 Analyze advantages and disadvantages of surface mining under the given conditions.		**Unit 1.0 Introduction to Surface Mining** 1.1Definition of terms related to surface mining –Opencast mining, Outcrop, overburden, stripping ratio, break even stripping ratio, economic cut off Ratio, quarriable limit, angle of repose. 1.2 Factors for effective planning and designing of a surface mining. 1.3 Opening up of deposit-1.3.1 Box cut -internal and external box cut, location of Box cut, 1.3.2 Access trenches, 1.4 Methods of Surface Mining based on degree of mechanization- 1.4.1 Mechanised method 1.4.2 Semi-mechanised method 1.4.3 Manual method 1.5 Advantages and disadvantage of surface mining. 1.6 Major surface coal mines and surface metal mines in India.	• Visit nearby mines and study mine plans and design. • Find out the share of opencast mining in total mining economy of India.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Prepare a layout of mechanization in nearby opencast mine.
2. Describe the factors responsible for planning and designing of opencast mines.

b. Mini Project:

1. Prepare a report on future prospects of opencast mining in India.
2. Prepare a model of box cut in India.

CO-2 Design a layout of opencast mines under the given conditions.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Identify the required parameters of designing ultimate pit. SO2.2 Design benches, haul roads and ramps under the given conditions. SO2.3 Prepare a layout of open pits and waste dumps. SO2.4 Adopt measures for slope stability under given conditions.		**Unit 2.0 Pit Design and Layouts** 2.1 Important parameters of Open pit design; Ultimate pit design 2.2 Bench parameters- 2.2.1 Bench height 2.2.2 Bench width 2.2.3 Length of blast 2.2.4 Bench slope angle and overall slope angle. 2.3 Statutory provisions for benches, 2.4 Haul Road- design & maintenance 2.5 Ramp design, 2.6 Layout of open pits; 2.7 Layout of waste dumps 2.8 Overcasting, side casting, 2.9 Slope stabilization. Numerical based on slope stabilization. 2.10 Slope failures-different types of slope failures. 2.11 Pumping & drainage system, acidic mine drainage, 2.12 Unit operations in opencast mining.	• Visit nearby opencast mine and find out the details of various parameters used in design of that mine. • Find the measures used for slope stability in civil construction projects.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe statuary provisions according to CMR 2017 and MMR 1956 for design of benches in opencast mines.
2. Describe acid mine drainage and provisions for its mitigation.

b. Mini Project:

1. Prepare a model of opencast mines with reference to given parameters.

c. Other Activities (Specify):

1. Find the alternate use of waste dumps of opencast mines.

CO- 3 Select appropriate type of drills and explosives under the given conditions in opencast mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Select different types of drill machines under the given conditions.		**Unit 3.0 Drilling and Blasting in Surface Mining** 3.1 Different Types of Drill Machines Used in Surface mining-	• Visit nearby mines and find out the drill machines and explosives

Session Outcomes (SOs)	Laboratory	Class room Instruction (CI)	Self Learning
SO3.2 Select different types of explosives under the given conditions. SO3.3 Design drill pattern as per the requirement in opencast mines. SO3.4 Prepare accident enquiry report in opencast mines.		3.1.1 Rotary, 3.1.2 Percussive and Rotary Percussive Drilling 3.2 Selection of Drill Machines 3.3 Inclined drilling, 3.3.1 Advantages and disadvantages of inclined drilling. 3.4 Basic objective of blasting in surface mining. 3.5 Controllable and uncontrollable variables of blast design. 3.6 Explosive used in surface mining 3.6.1 ANFO 3.6.2 Slurry 3.6.3 Emulsion 3.6.4 LOX 3.6.5 Bulk Explosive system 3.7 Storage and Transportation of Explosives 3.8 Drill pattern 3.8.1 Square grid 3.8.2 Rectangular or staggered grid 3.9 Shot firing- 3.9.1 Firing with detonator and safety fuse 3.9.2 Firing with electric detonator 3.10 Single and multiple row firing pattern 3.11 Efficiency and Cost of drilling and blasting 3.12 Blasting shelter. 3.13 Accident in Surface mining and its remedial measures. 3.13.1 Accident enquiry report. 3.14 Fires in Surface Mining and its remedial measures.	used in that mine. • Find the statutory requirements about storage and transportation of explosives according to regulations.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe about various types of detonators used in opencast mines.
2. Describe special techniques of controlled blasting in opencast mines

b. Mini Project:

1. Prepare a model of drilling pattern in opencast mining.

CO- 4 Select appropriate type of surface mining machinery under the given conditions in opencast mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Select appropriate mining machineries under the given condition in opencast mines. SO4.2 Prepare a plan for application of different machineries for excavation and loading and transportation in opencast mines. SO4.3 Calculate output with shovel- dumper combination, dragline and bucket wheel excavator under the given conditions in opencast mines.		**Unit 4.0 Different Mining Machinery (HEMM) Employed in Surface Mine** 4.1 Site preparation by- 4.1.1 Dozers, 4.1.2 Scrapers, 4.1.3 Front-End Loaders; Their Construction, Operation, and Applicability; 4.2 Loading and Excavation- 4.2.1 Shovel, 4.2.2 Dragline, 4.2.3 Multi Bucket Excavators, Their Construction, Operation, and Applicability. 4.3 Surface Miner 4.4 Calculation of out-put with shovel- dumper combination, bucket wheel excavator & dragline. 4.5 Transport in open pits- 4.6 Automobile Transport, 4.7 Rail Transport and Conveyors: Their applicability, limitation& Computation of Their Productivity.	• Find out the machineries used in nearby opencast mines. • Find out about the biggest shovel and draglines used in India.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe the construction, operation and applicability of shovel , dragline ,surface miner and bucket wheel excavator.
2. Describe transportation machineries used in opencast mines.

b. Mini Project:

1. Prepare a model of complete cycle of machinery operation in opencast mines.

CO- 5 Select appropriate method of land reclamation under the given conditions in opencast mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Apply land reclamation process in preparation of mine plan. SO5.2 Select appropriate method of land reclamation under the given conditions. SO5.3 Identify essential features of Environment Management Plan.		**Unit 5.0 Land Reclamation** 5.1 Land Reclamation and its process. 5.2 Physical restoration of mined out areas. 5.3 Various methods for land reclamation , afforestation, crop cultivation etc. 5.4 Necessity of Environment Management Plan - Essential features of EMP. 5.5 Application of GPS in surface mining 5.6 Illumination in Surface Mine	• Study the land reclamation process used in nearby opencast mines. • Collect relevant data about Environment Management Plan from nearby mines.

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 application of GPS in opencast mines.
2. Write the statutory provision of illumination in opencast mines as per the regulation.

b. Mini Project:

1. Prepare a land reclamation plan for given conditions.

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

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Surface Mining	G.B. Mishra	Dhanbad Publishers	Revised edition, 1994
2	A Handbook on Surface Mining Technology	Dr. Samir K Das	Sagardeep Prakashan, Kharagpur	3rd edition ,2006
3	Opencast Mining	R.T. Deshmukh	M. Publications, Nagpur.	Revised edition, 2006
4	Elements of Mining Technology, Vol. – I	D.J.Deshmukh	Denet and co. Nagpur	16th edition 2016

(b) Open source software and website address :

1. Slope stabilization
   https://www.sciencedirect.com/science/article/pii/S1877705811029997
2. Land reclamation
   https://www.worldcoal.org/returning-mined-land-productivity-through-reclamation
3. Explosives used in mines
   https://www.cdc.gov/niosh/mining/userfiles/works/pdfs/acobo.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 Apply basic knowledge of surface mining for understanding, formulating and solving problems related with the surface mine.	3	2	-	1	2	2	1	2	2	2	1	2
CO-2 Design a layout of opencast mines under the given conditions**.**	2	2	-	3	2	2	1	2	1	2	2	1
CO-3 Select appropriate type of drills and explosives under the given conditions in opencast mines .	2	1	-	3	2	3	2	2	2	2	-	3
CO-4 Select appropriate type of surface mining machinery under the given conditions in opencast mines.	2	2	-	2								
CO-5 Select appropriate method of land reclamation under the given conditions in opencast mines .	1	2	-	1	2	3	3	2	1	2	2	-

O) 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 Apply basic knowledge of surface mining for understanding, formulating and solving problems related with the surface mine.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit 1.0 Introduction to Surface Mining 1.1,1.2,1.3,1.3.1,1.3.2,1.4,1.4.1,1.4.2,1.4.3,1.5,1.6	As mentioned in relevant page
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-2 Design a layout of opencast mines under the given conditions.	SO2.1 SO2.2 SO2.3 SO2.4		Unit 2.0 Pit Design and Layouts 2.1,2.2,2.2.1,2.2.2,2.2.3,2.2.4,2.3,2.4,2.5, 2.6,2.7,2.8,2.9,2.10,2.11,2.12	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-3 Select appropriate type of drills and explosives under the given conditions in opencast mines .	SO.3.1 SO3.2 SO3.3 SO3.4		Unit 3.0 Drilling and Blasting in Surface Mining 3.1,3.1.1,3.1.2,3.2,3.3,3.3.1,3.4,3.5,3.6,3.6.1,3.6.2,3.6.3,3.6.4,3.6.5,3.7,3.8,3.8.1,3.8.2,3.9,3.9.1,3.9.2,3.10,3.11,3.12,3.13,3.13.1,3.14.	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-4 Select appropriate type of surface mining machinery under the given conditions in opencast mines	SO4.1 SO4.2 SO4.3		Unit 4.0 Different Mining Machinery (HEMM) Employed in Surface Mine 4.1,4.1.1,4.1.2,4.1.3,4.2,4.2.1,4.2.2,4.2.3, 4.3,4.4,4.5,4.6,4.7.	
PO-1,2,3,4,5,6,7,8,9,10 PSO-	CO-5 Select appropriate method of land reclamation under the given conditions in opencast mines .	SO5.1 SO5.2 SO5.3		Unit 5.0 Land Reclamation 5.1,5.2,5.3,5.45.5,5.6	

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 : 2039673(039)

B) Course Title : Mine Surveying-II

C) Pre- requisite Course Code and Title :

D) Rationale : After understanding the Importance, procedure and carrying out mining surveying project individually in the curriculum of fourth semester. A student has acquired a level of knowledge of which he will now be made equated with the surveying for mines with the help of more sensitive and accurate surveying equipments. This skill will be developed with the theoretical and practical coaching of the following subjects:

E) Course Outcomes:

CO-1 Apply the knowledge of Rectangular Co-ordinate System in Preparing Mine plans and Sections.

CO-2 Use Total station to Measure Co- ordinates, distance and reduced level.

CO-3 Apply the knowledge of Setting out Curves in Ranging Surface and Underground Curves.

CO-4 Apply the Knowledge of Triangulation Survey to locate Features and to calculate area of a given mine.

CO-5 Apply the knowledge Correlation survey in determining the relative positions of surface and underground features.

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		
2039673 (039)	3	1	2	70	20	30	40	60	220	5

G) Distribution of Hours and Marks:-

S.No	Chapter Name	Hours	Marks
1	Rectangular Coordinate System	08	10
2	Total Station	10	15
3	Curve	10	15
4	Triangulation Survey	10	15
5	Correlation Survey	10	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 Apply the knowledge of Rectangular Co-ordinate System in Preparing Mine plans and Sections.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO.1.1 Describe Rectangular co-ordinate system SO1.2 Calculate partial and Total co-ordinates from given length and bearings. SO1.3 Plot points of given co-ordinates.	LI1.1 Prepare a grid of given size by calculating area by partial coordinates. LI1.2 Plot the given points on a map with a particular scale by measuring latitude and departure of the given points.	**Unit1.0 Rectangular Coordinate System** 1.1 Definitions; latitudes & departures. 1.2 Partial latitude and partial departures. 1.3 Calculation of Partial latitude and partial departures. 1.4 Total latitude and total departures 1.5 Calculation of Total latitude and total departures 1.6 Calculation of length & bearing from total coordinates. 1.7 Calculation of Area by Partial coordinate 1.8 Calculation of Area by total coordinates Methods 1.9 National grid system. 1.10 To join colliery survey with N.G.	• To collect a mine plan from nearby mines and study the grid pattern, scale, true north showed in the plan.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

1. Prepare a chart showing name of plans and their scale.
2. Study a given map and determine it' s scale and find out shrinkage.

b. Mini Project:

1. Collect a map from nearby mine and calculate the total area of the mine.

CO-2 Use Total station to Measure Co-ordinates ,distance and reduced level.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1. Demonstrate the features of a given total station. SO2.2 Setting a total station at given point and	LI.2.1 To perform temporary adjustment of Total station and determine the co-ordinate of the given points. LI.2.2 To measure the distances, co-ordinates	**Unit 2.0 Total Station** 2.1 Constructional details. 2.2 Features of total station and related definitions. 2.3 Setting of instrument 2.4 Temporary adjustments	• Study the latest total station used in Indian mines. • Find the application of total station in civil

measure Co-ordinates, distances and R.L. SO2.3 Perform Topographical Survey.	and reduced level(R.L.) of given points with reference to given data.	of total station. 2.5 Target and target station. 2.6 Marking of station points. 2.7 Measurement of angle, distance and elevation. 2.8 Transfer of datum. 2.9 Topographical survey-creation of file, defining occupied and target station points. 2.10 Setting of back sight station. 2.11 Measurement of foresight point, angle, distance and RL. 212 Resection procedure 2.13 Station shifting.	works.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe the constructional details of total station.
2. Describe process of transfer the datum.
3. To calculate foresight point, angle, distance and R.L. of given data.

b. Mini Project:

1. Conduct a traverse survey of a given site and to collect necessary information.

c. Other Activities (Specify):

1. Visit a nearby mine and prepare a report on various model of total station used therein.

CO- 3 Apply the basic concept of Setting out Curves in Ranging Surface and Underground Curves.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Calculate Elements of Simple Circular curve from Given data. SO3.2 Describe Procedure of Surface Curve Ranging. SO3.3 Describe Procedure of Underground	LI.3.1 To draw a Simple Circular Curve by chord and Offset Method. LI.3.2 To draw a Circular Curve by Chord and Angle Method. LI.3.3 Range a Simple Circular Curve by taking perpendicular off sets from tangents.	**Unit 3.0 Curve** 3.1 Definition 3.1.1 Elements of simple circular curve and its nomenclature and derivation of formula 3.2 Classification of methods of curve ranging. 3.3 Methods of curve ranging, surface and underground. 3.3.1. Chain and tape I .By successive bisection	• To study different types of curve. • To solve numerical problem based on simple circular curve.

Curve Ranging. SO3.4 Calculate Amount of Super – Elevation of a particular Curve.		of arc. ii. By taking perpendicular off sets from tangents. iii. By taking perpendicular off sets from long chord iv. Chord and off set method. 3.3.2. Instrumental methods. i) Chord and angle method (tangential angle method) ii) by taking angles from single station. (ranking method) iii) by taking angles from Two stations. 3.3.3. U/G curve ranging methods. i) chord and off set methods ii) Chord and angle methods 3.4 Super elevation. 3.5 Numerical Problems on simple circular curve.	

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe the procedure of Ranging a simple circular Curve by Chord and offset method.
2. Describe the procedure of U/g Curve Ranging by Chord and angle method.

b. Mini Project:

1. Design a Simple Circular curve of 50 M radius and 90^{o} Deflection angle and determine amount of Super-Elevation for 100Km/h Speed for maximum 25Tonnne Load.

CO- 4 Apply the principles of Triangulation Survey to locate Features and to calculate area of a given mine.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Determine the direction of True North at a given place. SO4.2 Select Site to establish a suitable Base line for triangulation Survey.	LI4.1 To measure All the angles of a given triangle by repetition method. LI4.2 To measure All the angles of a given triangle by repetition method LI4.3 To measure a base line of given 100 m	**Unit4.0 Triangulation Survey** 4.1 Definition & principle of Triangulation survey. 4.2 Classification of Triangulation survey 4.3 Fixing of Stations. 4.4 Selection of site for Base line.	• Find the application of triangulation survey in field of civil works. • Study Precaution taken during measurement

SO4.3 Measure the Length of Given Base line. SO4.4 Measure and adjust angles in triangulation. SO4.5 Calculate Latitude and Longitude of a survey line.	length and prolong it upto 500m.	4.5 Sequence of operation before base line measurement. 4.6 Equipments required for base line measurement. 4.7 Measurement of base line 4.8 Correction required in base line measurement. 4.9 Prolongation of a base line. 4.10 Colliery Triangulation 4.11 Truenorth determination (App. Method) 4.12 Determination of True north in day time by observing sun.	of Triangulation survey.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe the procedure of determination of true north by astronomical method.
2. Describe the complete procedure of carrying out Colliery Triangulation.

b. **Mini Project:**

1. Select an area and Conduct triangulation survey, Plot the same and show all the surface features on it.

CO- 5 Apply the Principles of Correlation survey in determining the relative positions of surface and underground features.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Classify the methods of Correlation. SO5.2 Perform Single Shaft method of Correlation. SO5.3 Transfer the given points from Surface to underground and vice-versa by Direct method of traversing.	LI5.1 To perform Correlation survey by Direct method of traversing. LI5.2 To perform Correlation survey by assumed bearing method. LI5.3 To perform Correlation survey by Weissbach Triangle method.	**Unit 5.0** **Correlation Survey** 5.1 Purpose of correlation survey. 5.2 Classification of methods of orientation. 5.3 Direct methods of traversing. 5.4 Assumed bearing method (Two shaft method). 5.5 Exact alignment method. 5.6 Approximate alignment method. 5.7 Wires quadrilateral method. 5.8 Special chain of tape method.	• Study the Direct method of correlation survey work in nearby mines. • Study the Gyro – theodolite method in mine surveying.

		5.9 Precise magnetic method. 5.10 Gyro-theodolite method. 5.11 Correlation with national grid and local scale factor. surveying for flat, moderately inclined or steeply inclined ore deposits.	

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

1. Describe the procedure of Conducting correlation Survey when a single shaft is available for surveying.

b. Mini Project:

1. Prepare a model of one/Two shaft method of orientation.

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

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	Prepare a grid of given size by calculating area by partial coordinates	15	15	30
02	Plot the given points on a map with a particular scale by measuring latitude and departure of the given points.	15	15	30
03	To perform temporary adjustment of Total station and and determine the co-ordinate of the given points.	15	15	30
04	To measure the distances, co-ordinates and R.L. of given points with reference to given data.	15	15	30
05	To draw a Simple Circular Curve by chord and Offset Method.	15	15	30
06	To draw a Circular Curve by Chord and Angle Method.	15	15	30
07	Range a Simple Circular Curve by taking perpendicular off sets from tangents.	15	15	30
08	To measure All the angles of a given triangle by repetition method	15	15	30
09	To measure All the angles of a given triangle by	15	15	30

	repetition method			
10	To measure a base line of given 100 m length and prolong it upto 500m.	15	15	30
11	To perform Correlation survey by Direct method of traversing.	15	15	30
12	To perform Correlation survey by assumed bearing method.	15	15	30
13	To perform Correlation survey by Weissbach Triangle method.	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

K) Suggested Learning Resources:

Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Surveying and levelling volume 1	T.P Kanetkar	Pune vidyarthi grih prakashan.	24th Reprint 2015
2	Surveying and levelling volume 2	T.P Kanetkar	Pune vidyarthi grih prakashan	23rd edition 2014
3	Mine Surveying and levelling vol 1, vol 2 and vol 3	S.Ghatak	Coal field publishers	5th edition 1996
4	Advanced Surveying	B.Ghosh	Tata mcgraw hill	1st 1987
5	Surveying vol 1	B.C Punamia	Laxmi Publications	seventeenth edition (2016)
6	Surveying vol 2	B.C Punamia	Laxmi Publications	seventeenth edition (2016)

(b) Open source software and website address :

1. Triangulation

https://bmsit.ac.in/system/study_materials/documents/000/000/079/original/Module_II.pdf?1498038336

2. Total station
http://www.gisresources.com/total-station-and-its-applications-in-surveying/

3. Correlation
https://www.custominsight.com/articles/correlation-sample.asp

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Total Station with stand.	1 ANGLE MEASUREMENT (b) Angle Accuracy as per DIN 18723 1" (a) Least Count 0.1" 2 TELESCOPE (a) Telescope Magnification 30X (b) Field view 1°30'(2.7 m at 100m) (c) Minimum Focussing Distance 1.7 m 3 DISTANCE MEASUREMENT WITH PRISM (a) Using Long Range EDM 5000 m with single prism (b) Accuracy 1 mm + 2 ppm (c) Least Count .1 mm WITHOUT PRISM (a) Range 100 mtr Kodak White 90% (b) Reflector Less Accuracy 3mm + 2ppm 4 ANGLE MEASUREMENT (a) Method Absolute Encoders 5 MEASURING TIME (a) Fine Mode Less than 3 Sec 6 MEMORY (a) Memory Support for 1 GB 7 PROGRAMMES INBUILT Graphical Intuitive Application Programs System should run onboard Set Station and Orientation Win CE 6.0 Setting out Free Station Remote Height Ties Distance Area Missing Line Measurement Reference Line Rapid measure code list Resection COGO Job Management Capable of attaching dxf and shape files in back ground Capable of switching the layers as ON/OFF for dxf files Zoom in and Out, Pan, Window Zoom facility 8 COMPENSATOR (a) Dual Axis Quadraple Axis (b) Compensating Range ± 4' © Setting Accuracy 0.5" 9 TEMPERATURE (a) Operating -20 °C to + 50°C (b) Storage -40 °C to + 70°C Specifications for High Precision Total Station EDM Instrument Main Feature ANNEXURE-1 TO THE TENDER ENQUIRY NO.: DPS/AMPU/MIC/2457 Page 1 of 2 10 DIGITAL LEVEL Graphical display on screen with display resolution of 1" 11 PLUMMET	03,04

		(a) Optical/Laser Plummet Inbuilt Laser/Optical Plummet from the Instrument. 12 DRIVES (a) Horizontal & Vertical Drives Should have Endless movements with friction drives. 13 DISPLAY Resolution Should have Full QVGA 340*240 pixels resolution identical display on both sides Illumination Capability to illuminate display for day and night operation 14 DATA OUTPUTS Should be capable of outputting the data In all standard formats including DXF and other customized formats directly from the total station. 15 SURVEY DATA Graphical Display of the surveyed points, Lines & Areas with Codes & Symbols 16 KEY BOARD Type Alphanumeric keyboard on instrument on both sides 19 UPLOAD OPTIONS DXF, shape files 20 POWER OPTIONS (a) Battery Lithium Ion Batteries (b) Operation Time Should be minumum of 6 - 8 hours (c) Charging Time Less than 1 hour 21 WEIGHT Less than 6 Kg	
2	Total Station target	With 3 prism set and 5 prism set.	03,04
3	Levelling staff	Bar coded type.	03,04 05,06,07
4	Chain	30 meter length .	05,06,07
5	Tape	Fibre core – 5 meter,10 meter, 15 meter, 30 meter , 50 meter	05-09
6	Arrow	Steel built.	05-09
7	Theodolite	20 second least count. Brass spindle. Erect image type, stadia diaphragm, magnification 28x/32x.	05-09
8	Piano wire	1mm/1.5 mm diameter. 200 meter length.	11,12
9	Bucket	.15 cubic meter (15 liter) capacity.	11,12
10	Dead weight	5kg and 10 kg	11,12
11	Heavy plumb bob with reflector.	2kg and 5 kg. brass built.	11,12

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 Apply the Knowledge of Rectangular Co-ordinate System in Preparing Mine plans and Sections	2	1	2	2	1	1	1	2	2	2	1	-
CO-2 Use Total station to Measure Co-ordinates , distance and R.L	2	1	3	3	1	2	1	3	2	2	2	1
CO.3 Apply the basic concept of Setting out Curves in Ranging Surface and Underground Curves.	2	2	3	2	2	1	2	2	2	1	1	3
CO-4 Apply the principles of Triangulation Survey to locate Features and to calculate area of a given mine	2	2	3	3	1	1	2	3	2	1	2	-
CO-5 Apply the principles Correlation survey in determining the relative positions of surface and underground features	3	3	2	1	1	1	2	3	2	1	1	2

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, 10PSO-	CO-1 Apply the knowledge of Rectangular Co-ordinate System in Preparing Mine plans and Sections	SO1.1 SO1.2 SO1.3	LI1.1 LI1.2	Unit 1.0 Rectangular Co-ordinate System. 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9	As Mentioned in relevant Pages
PO-1,2,3,4,5,6,7,8,9, 10PSO-	CO-2 Use Total station to Measure Co- ordinates , distance and R.L	SO.2.1 SO.2.2 SO2.3	LI2.1 LI2.2	Unit 2.0 Total station. 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10,2.11,2.12,2.13	
PO-1,2,3,4,5,6,7,8,9, 10PSO-	CO.3 Apply the basic concept of Setting out Curves in Ranging Surface and Underground Curves.	SO.3.1 SO3.2 SO3.3 SO3.4	LI3.1 LI3.2 LI3.3	Unit 3.0 Curve. 3.1,3.1.1,3.2,3.3,3.3.1,3.3.2,3.3.3,3.4,3.5	
PO-1,2,3,4,5,6,7,8,9, 10PSO-	CO-4 Apply the principles of Triangulation Survey to locate Features and to calculate area of a given mine.	SO4.1 SO4.2 SO4.3 SO4.4	LI4.1 LI4.2 LI4.3	Unit 4.0 Triangulation Survey. 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11,4.12	
PO-1,2,3,4,5,6,7,8,9, 10 PSO-	CO-5 Apply the principles Correlation survey in determining the relative positions of surface and underground features	SO5.1 SO5.2 SO5.3	LI5.1 LI5.2 LI5.3	Unit 5.0 Correlation survey. 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10,5.11	

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 : 2039674(039)

B) Course Title : Mine Management and Economics

C) Pre-requisite Course Code and Title :

D) Rationale :

The course is designed to help the student to perform managerial activities in mining practices accordingly mining rules and regulations. A mining engineer has to perform duties and responsibilities as per mining rules and regulations to manage mining activities. To help in running mining industry in economical manner to higher level management mining engineer should have knowledge of economics is required . To fulfill this requirement this subject is essential. It is necessary for a diploma pass out mining student to have the elementary knowledge of economics and mine management.

E) Course Outcomes:

CO-1 Apply the theories of management for effective working in mining industry.

CO-2 Use the theories of motivation in mining industries.

CO-3 Select appropriate method of mine valuation.

CO-4 Apply the knowledge of cash flow management in mining activities.

CO-5 Carryout sampling to obtain a representative Fraction of mineral body.

F) Scheme of Studies and Examination:

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit L+T+(P/2)
				Theory			Practical		Total Marks	
	L	T	P	ESE	CT	TA	ESE	TA		
2039674(039)	2	1	-	70	20	30	-	-	120	3

G) Distribution of Hours and Marks:

S.No	Chapter Name	Hours	Marks
1	Mine Management	10	15
2	Motivation	08	10
3	Mine Valuation	10	15
4	Cash Flow Statement	10	15
5	Sampling	10	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 Apply the theories of management for effective working in mining industry.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Explain functions of Scientific management. SO1.2 State applications of Taylor's principles of Scientific management in mining industry. SO1.3 Apply relevant Work study method in given mining operations. SO1.4 Recognize the process of Time study.		**Unit 1.0 Mine Management** 1.1 Definition and functions of management 1.2 Importance of Scientific Management 1.3 Objectives of Scientific management 1.4 Taylor's Principles of Scientific management 1.4.1 Science not rule of thumb 1.4.2 Harmony, Not discord 1.4.3 Co-Operation , Not individualism 1.4.4 Development of each and every person to His/Her Greatest efficiency and prosperity 1.5 Role and Limitations of Scientific management in mining industry. 1.6 Work study of different mining processes- a) Motion study: – 1) Shovel- Dumper combination, 2) Rope splicing , 3) Universal drill machine, 4) Coal cutting machine 5) Pillar formation. b) Time study:- 1)Shovel- Dumper combination , 2) Depillaring of a pillar 3) Different patterns of Drill hole 4) Transportation to main gate to tail gate 5) Transportation from pit bottom to pit Top .	• Study and explain various Principles of Scientific management. • Develop a monograph to show different steps in motion study.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Write principles of scientific management.

ii. Describe various steps in motion study and time study.

CO-2 Use the theories of motivation in mining industries.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Identify the objectives of motivation. SO2.2 Describe the major theories of motivation. SO2.3 Apply the concepts of motivation for development of human resources in mining industry.		**Unit 2.0 Motivation** 2.1 Objectives of motivation. 2.2 Major theories of motivation. 2.3 Application of motivational theories in mining industry. 2.4 Motivational concepts for development of human resources.	• Study the major theories of motivation. • Study and explain the motivational concepts for human resources.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Describe major theories of motivation.

ii. Write the case study of any motivational project carried out in any of the mines in India.

b. Mini Project:

i. Prepare a report on application of motivation theories on the basis of following criterion :-

- Need of such project 2. Theory of motivation used 3. Effect or outcome of the project.

c. Other Activities (Specify):

i. Visit nearby mines and observe the motivational techniques used in that particular mine.

CO-3 Select appropriate method of mine valuation.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Apply the knowledge of Method of mine valuation for solving mine valuation problems. SO3.2 Describe the Calculation of Life of mine. SO3.3 Identify to capital depreciation in given time of the project.		**Unit 3.0 Mine Valuation** 3.1 Objective of mine valuation. 3.2 Methods of valuation 3.3 Cases requiring valuation, risk in Valuation of mines 3.4 Calculation of life of a mine 3.5 Valuation reports 3.6 Mine as a wasting assets 3.7 Capital depreciation. 3.8 Redemption of capital depreciation.	• Study different method of mine valuation used in nearby mines through mine visit. • Study and find out the Life of mine in given areas.

SW-3 Suggested Sectional Work (SW):

a. Assignments:

i. To assess the present value of a given mineral property.

b. Mini Project:

i. Visit a nearby mine and prepare a report on mine valuation by taking into account its depreciation, amortization and present value of mine.

CO-4 Apply the knowledge of cash flow management in mining activities.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Perform Book Keeping Practices in mines. SO4.2 Identify various assets and liabilities of any mine. SO4.3 Identify analyze and solve financial management problems. SO4.4 Evaluate Present value of any		**Unit 4.0 Cash Flow Statement** 4.1 Meaning of Cash flow statement, 4.2 Components of Cash flow statements, 4.3 Preparation of Cash flow statement 4.4 Classification of Cash flow 4.5 Format 4.6 Advantages of Cash flow 4.7 Disadvantages of Cash flow Discounted Cash flow 4.8 Definition 4.9 Valuation	• Study of Preparation of cash flow graph. • Study and explain of Classification of cash flow system. • Study of Different Discounted cash flow method. • Study and explain of Non Discounted cash flow methods. • Study of Profitability index in any project it

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
mining project. SO4.5 Calculate internal rate of return of given mine.		4.10 Present value 4.11 Discount rate 4.12 Dividends 4.13 Discounted cash flow methods, 4.14 Non-discounted cash flow methods, 4.15 Internal rate of return, 4.16 Net Present Value. 4.17 Break even point 4.18 Calculation of Break even point.	will Accepted or Rejected.

SW-4 Suggested Sectional Work (SW):

a. Assignments:

i. Write notes on discounted cash flow methods and non-discounted cash flow methods.
ii. Explain Break even chart with diagram.

b. Mini Project:

i. Visit a nearby mine and calculate the total value of assets and liabilities of that mine.

CO-5 Carryout sampling to obtain a representative Fraction of mineral body.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Realize the importance of sampling. SO5.2 Carry out different sampling methods. SO5.3 Minimize the errors in sampling. SO5.4 Adopt Suitable precautions against salting.		**Unit 5.0 Sampling** 5.1 Methods and importance of sampling. 5.2 Size of samples. 5.3 Class of samples. 5.4 Different methods of sampling. 5.4.1 Surface sampling. 5.4.2 Underground sampling. 5.4.3 Sampling of alluvial deposits. 5.5 Errors in Sampling. 5.6 Salting 5.6.1 Method of salting 5.6.2 Safe guards against salting. 5.7 Sampling records 5.8 Computation for tonnage – - Average assay value - Average sloping width - Clear width - Willing width - Length average - Average of block and total average .	• Study the procedure to collect samples. • Study different methods of sampling.

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 Sectional Work (SW):

a. Assignments:

i. Write about different sampling methods in underground mines.
ii. Write advantages and disadvantages of sampling.

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

I) Suggested Specification Table (For ESA of Laboratory Instruction*): Not Applicable

J) Suggested Instructional/Implementation Strategies:

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

K) Suggested Learning Resources:

(a) Books :

S. No.	Titles	Author	Publisher	Edition & Year
1.	Mineral and Mine Economics	Subhash C.Ray and Indra N. Sinha	PHI Learning Pvt. Ltd.	1 jan 2016
2.	Mine Management Legislation and General Safety	G. Ghatak	Lovely Prakashan	Revised Ed.
3.	Mineral Economics	R.K. Sinha and N.L. Sharma	CBS Publishers and Distributors	4Th 2019
4.	An Introduction to Mineral Economics	Kaulir Kishor Chatterjee	New Age International	1 Jan 2004

(b) Open source software and website address:

1. Unit V Sampling - www.mindat.org
2. Unit IV Cash flow methods , Unit I Mine Management - www.slideshare.net
3. Unit III Mine Valuation - www.mineportal.com

L) List of Major Laboratory Equipment and Tools: Not Applicable

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 Apply the theories of management for effective working in mining industry	2	3	-	3	3	2	2	1	2	2	2	3
CO-2 Use the theories of motivation in mining industries.	2	2	-	3	2	2	3	3	3	2	1	3
CO-3 Select appropriate method of mine valuation.	2	3	-	2	2	3	3	3	2	1	3	2
CO-4 Apply the knowledge of cash flow management in mining activities.	2	3	-	2	3	2	2	2	1	2	3	2
CO-5 Carryout sampling to obtain a representative Fraction of mineral body.	2	2	-	1	2	2	3	3	2	2	3	3

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-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-1 Apply the theories of management for effective working in mining industry	SO1.1 SO1.2 SO1.3 SO1.4		Unit 1.0 Mine Management 1.1, 1.2, 1.3, 1.4,1.5,1.6	As mentioned in relevant pages
PO-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-2 Use the theories of motivation in mining industries.	SO2.1 SO2.2 SO2.3		Unit 2.0 Motivation 2.1,2,2,2,3,2,4.	
PO-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-3 Select appropriate method of mine valuation.	SO3.1 SO3.2 SO3.3		Unit 3.0 Mine Valuation 3.1,3.2,3.3,3.4,3.4,3.5,3.6,3.7,3.8	
PO-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-4 Apply the knowledge of cash flow management in mining activities.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit 4.0 Cash Flow Statement 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10, 4.11,4.12,4.13,4.14,4.15,4.16,4.17,4.18.	
PO-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-5 Carryout sampling to obtain a representative Fraction of mineral body.	SO5.1 SO5.2 SO5.3 SO5.4		Unit 5.0 Sampling 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8	

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 : 2039675(039)

B) Course Title : Mine Safety and Legislation

C) Pre-requisite Course Code and Title :

D) Rationale :

Mine safety practice involves the implementation of recognized hazard controls and/or reduction of risks associated with mining activities to legally, socially and morally acceptable levels .The Objective of this course "Mine safety and Legislation" is to impart basic knowledge of the Coal 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 Safe Mining Practices 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 Apply the Knowledge of basic terminology used in the mining legislature.

CO-2 Perform various duties & responsibilities as mentioned in CMR 2017.

CO-3 Apply the Knowledge of provisions of CMR 2017 to maintain safe working Conditions in Mine Workings.

CO-4 Analyze the causes and prevent the occurrence of accidents in Mines.

CO-5 Apply the knowledge of provisions to prevent various mine accidents.

F) Scheme of Studies and Examination:

Course Code	Periods/Week (In Hours)			Scheme of Examination						Credit
	L	T	P	Theory			Practical		Total Marks	L+T+(P/2)
				ESE	CT	TA	ESE	TA		
2039675(039)	2	1	-	70	20	30	-	-	120	3

G) Distribution of Hours and Marks:-

S.No	Chapter Name	Hours	Marks
1	CMR 2017	10	15
2	Duties and Responsibilities of Different Mining Personnels	08	10
3	Provisions as per CMR 2017	10	15
4	Mine Safety	10	15
5	Provisions Regarding Accidents	10	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 Apply the Knowledge of basic terminology used in the mining legislature.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Define Basic terms used in CMR 2017 SO1.2 Identify the eligibility criteria to obtain various competency certificates issued by DGMS. SO1.3 Recognize the required qualifications to be appointed as Inspector and other Mine Officials.		**Unit 1.0 CMR 2017** Preliminary 1.1 Definitions 1.2 Examinations and certificates of competency 1.3 Inspectors and mine officials 1.4 Qualifications for Mine Inspector	• Study the DGMS circulars relevant with the competency certificates, qualification and appointment of mine officials.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Enlist different Certificates of Competency along with the requirements to obtain them.

CO-2 Perform various duties & responsibilities as mentioned in CMR 2017.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Demonstrate the duties of manager/Safety Officer/Overman etc. SO2.2 Maintain and repair Flame safety lamp and other equipments used in Lamp Room.		**Unit Duties and Responsibilities of Different Mining Personnels** 2.1 Duties and responsibilities of manager 2.2 Duties of safety officer 2.3 Duties of ventilation officer. 2.4 Duties and responsibilities of overman 2.5 Duties and responsibilities of sirdar. 2.6 Duties of lamp room in-charge.	• Study circulars issued by DGMS relevant with the duties and responsibilities of mine officials.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Write Duties and responsibilities of Manager , Overman and Sirdar.

CO-3 Apply the Knowledge of provisions of CMR 2017 to maintain safe working Conditions in Mine Workings.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Prepare and interpret different Mine plans and sections. SO3.2 Explain the provisions regarding Haulage, Winding and workings as mentioned in CMR 2017 .		**Unit 3.0 Provisions as per CMR 2017** 3.1 Provisions regarding plans & sections 3.1.1 Conventions for preparing plans and sections. 3.2 Provisions regarding haulage. 3.3 Provisions regarding winding 3.4 Provisions regarding Workings. 3.5 Standards of ventilation, illumination.	• Study different plans and sections kept in nearby mine office. • Find out the standards of ventilations maintained in nearby mines

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.3 Maintain the Standards of Ventilation and Illumination as laid down in CMR 2017.			through mine visit.

SW-3 Suggested Sectional Work (SW):

a. Assignments:

i. Prepare a Mine plan Showing Support System of any particular district of a Mine.
ii. Prepare a Surface plan of a Nearby Mine.

CO-4 Analyze the causes and prevent the occurrence of accidents in Mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Classify the accidents. SO4.2 Identify the causes of Accidents. SO4.3 Suggest Remedial measures against Accidents.		**Unit 4.0 Mine Safety** 4.1 Classification of Accidents. 4.2 Causes of Accidents 4.3 Remedial measures against Accidents 4.4 Provisions in regulation. 4.5 Cost of accident 4.6 Report writing.	• Study the accident reports in nearby mines.

SW-4 Suggested Sectional Work (SW):

a. Assignments:

i. Write precautions against dangers from fire, dust, gas and water.
ii. Write an accident report based on the given information.

CO-5 Apply the knowledge of provisions to prevent various mine accidents.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Select appropriate steps to Prevent accidents in mine. SO5.2 Conduct rescue and recovery operations in mines.		**Unit 5.0 Provisions Regarding Accidents** 5.1 Precautions against dangers from fire 5.2 Precautions against dangers from dust 5.3 Precautions against dangers from gas 5.4 Precautions against dangers from water. 5.5 Conduct of Rescue work.	• Visit of any mock/demonstration rescue and recovery work carried out by Rescue team of a nearby mine.

Legend: CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and Tutorial (T) 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 Sectional Work (SW):

a. Assignments:

i. Write causes of various accidents along with their remedial measures.

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

I) Suggested Specification Table (For ESA of Laboratory Instruction*): Not Applicable.

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

K) Suggested Learning Resources:

(a) Books :

S. No.	Titles	Author	Publisher	Edition & Year
1.	Coal Mine Regulations-2017	L.C. Kaku	Lovely Prakashan, Dhanbad	2017
2.	Mine Rescue Rules-1985	DGMS	----	1985
3.	Mine Management, Legislation and General Safety.	S. Ghatak	Lovely Prakashan, Dhanbad	Revised edition 2004

(b) Open source software and website address:

1. CMR2017 - https://www.dgms.net/Coal%20Mines%20Regulation%202017.pdf
2. Mine Rescue Rules - http://www.dgms.gov.in/writereaddata/UploadFile/Mines%20Rescue%20Rules,%201985.pdf

L) List of Major Laboratory Equipment and Tools: Not Applicable

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 Apply the Knowledge of basic terminology used in the mining legislature.	2	2	-	1	3	3	2	2	2	2	1	2
CO-2 Perform various duties & responsibilities as mentioned in CMR 2017.	2	3	-	1	3	3	2	1	1	2	2	-
CO-3 Apply the Knowledge of provisions of CMR 2017 to maintain safe working Conditions in Mine Workings.	1	3	-	2	2	3	3	1	2	1	1	3
CO-4 Analyze the causes and prevent the occurrence of accidents in Mines.	1	1	-	1	3	2	3	2	2	2	-	2
CO-5 Apply the knowledge of provisions to prevent various mine accidents.	1	1	-	1	2	2	2	2	1	1	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-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-1 Apply the Knowledge of basic terminology used in the mining legislature.	SO1.1 SO1.2 SO1.3		Unit 1.0 CMR 2017 -Preliminary 1.1,1.2,1.3	As mentioned in relevant pages
PO-1,2,4,5,6, 7,8,9,10 PSO-1	CO-2 Perform various duties & responsibilities as mentioned in CMR 2017.	SO2.1 SO2.2		Unit 2.0 Duties and Responsibilities of Different Mining Personnels 2.1,2.2,2.3,2.4,2.5,2.6	
PO-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-3 Apply the Knowledge of provisions of CMR 2017 to maintain safe working Conditions in Mine Workings.	SO3.1 SO3.2 SO3.3		Unit 3.0 Provisions as per CMR 2017 3.1,3.1.1,3.2,3.3,3.4,3.5	
PO-1,2,4,5,6, 7,8,9,10 PSO-2	CO-4 Analyze the causes and prevent the occurrence of accidents in Mines.	SO4.1 SO4.2 SO4.3		Unit 4.0 Mine safety 4.1,4.2,4.3,4.4,4.5,4.6	
PO-1,2,4,5,6, 7,8,9,10 PSO-1,2	CO-5 Apply the knowledge of provisions to prevent various mine accidents.	SO5.1 SO5.2		Unit 5.0 Provisions Regarding Accidents 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 : 2039663(039)
B) Course Title : Major Project
C) Pre- requisite Course Code and Title :
D) Rationale :

Project work plays a very important role in engineering educations in developing core technical skills, soft skills and higher level of cognitive, psychomotor and affective domain skills. It encourages the thinking process in the students.

Project work is normally done when students have acquired sufficient knowledge, skills and attitude and are able to integrate all these, entirely in new situation or task to solve the problems of the industries.

Through project work, students get direct exposure to the world of work in their relevant field. They are intrinsically motivated to explore new things, new methods, new design and many more ideas.

They also develop many soft skills like confidence, communication skills, creative ability, inquisitiveness, learning to learn skills, lifelong learning skills, problem solving skills, management skills, positive attitude, ethics etc. through project work.

Normally in a curriculum document, there is a mention of project work in two different situations.

In situation one, Project work is reflected as Mini Project under each and every course curricular detailing, in the form of sessional work mentioned under different semesters. These projects are normally related to the developing skills in respective course of the specific programme.

In another situation, project work is reflected as a complete course or as a major project in the total programme structure, normally at higher semester either at 4^{th}, 5^{th} and 6^{th}, depending on the requirement of the programme. Normally.

E) Course Outcomes: After completion of the project work of a course or full semester, the students will be able to -

CO-1 Integrate the Knowledge (K), Skills (S), Attitudes (A) developed in a new task or problem identified in the form of project work.

CO-2 Develop higher level of cognitive, psychomotor and affective domain skills relevant to the course/programme.

CO-3 Integrate the generic skills/soft skills/employable skills with relevant technical skills for successful completion of the project work.

CO-4 Develop the skills of innovativeness, creativity, resourcefulness, time management, problem solving abilities, interpersonal skills, pro-activeness, cost effectiveness, environment consideration and sustainability.

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		
2039663(039)	-	-	2				40	60	100	1

G) Distribution of Hours and Marks :

S.No	Chapter Name	Hours	Marks
1	Project Work	16	40
Total		**16**	**40**

H) Guidelines to Teachers for Implementation of the Project Work :

Once the project is identified and allocated to students, teacher's role is very important. Teachers act as guide, facilitator, catalyser, motivator to promote brain storming, thinking, creatively, initiativeness and many other skills in the students. Teachers should help or guide continually to monitor whether the students are proceeding in the right direction as per outcomes to be attained.

It is also suggested that teachers are not supposed to guide and plan each and every step from the point of view of execution of the project, otherwise it will curb their creativity or thinking process. Teachers have to see that he or she is able to create think tank for this fast technological world of work for the growth of our country. Following points should be taken into consideration while planning and implementing the project work.

1. Identification of project and allocation methodology :

Though the teachers and students, both are involved in identification of project titles, but the prime responsibility of identification of project titles goes to the teachers involved in implementing the course or programme. Teachers are fully aware of course/programme curriculum. They are also aware of related industrial problems. They try to explore the possibility of identification of project titles through these problems.

These small industrial problems in the form of project titles may be brought into the laboratories or workshop of institutions of a specific programme, which are equipped with all necessary facilities and resources to carry out the project work. These labs or workshop can function as miniature industry to solve the industrial problems in the form of simulated industrial projects. These projects may be integrated problem of courses or programme.

The project identified may be application type, product type, Research type and review type.

1.1 Criteria for Identification and Implementation of Project Titles :

Identification of project title is planned to be done based on many considerations like :

- Cost effectiveness
- Safety considerations
- Ethical issues
- Environmental considerations
- Improvised process
- Improvised equipment
- Simulated industry's problem
- Application or utility in the world of work.
- Relevance to the Curriculum
- Mapping of Outcomes of Project with POs and PSOs
- Feasibility of implementation of the project

2. Implementation and Evaluation of Project Work:

Once the identification of project titles and guide allocation process is over, quality of student's project, on different criteria including the report writing need to be continually monitored.

Projects planning, design, execution and report writing is done by the students under the guidance and feedback by respective teachers for attainment of courses specific outcomes, POs and PSOs.

Continual Monitoring, feedback and assessment mechanism on weekly progress/updates on action taken on different criteria and sub-criteria of the project work need to be planned for individual and team of students. Path breaking teachers who think out of the box are required to guide, monitor and evaluate the project work.

For objective, valid and reliable assessment, teachers should use different tools of assessment such as checklist, rating scale, assessment rubric, observation schedule, portfolio assessment, incidental records etc. Even the students may be encouraged to adopt self assessment techniques using the assessment rubrics.

2.1 Criteria of Evaluation of Project:

The different criteria of evaluation of project under different sub heads of project work completion are given below :

2.2.1 Project Planning :

Project planning, its action plan, steps of realizing the projects, may be specifically planned in advance based on feasibility, resources available, time allocation, finance and manpower requirement for each and every step or activity of project work.

Under project planning, many points need to be considered like -

- Selection of relevant industry based projects as per the requirement of curriculum
- Rationale/Application
- Objectives Set
- Literature survey
  Literature survey on the project title need to be done through abstract, journals, websites, open sources and other relevant sources available.
  It need to be ensured that objectives are written properly with clear specific, measurable and attainable statements. The sample size has to be delimited and decided as per the time limit allotted, feasibility and many other considerations.
  Objectives formulated will decide the further course of action, depth and breadth of the project and implementation plan.

2.2.2 Design, Development and Execution of Project :

Following important characteristic features of project are need to be given special emphasis during the implementation of the project work-

- Innovativeness
- Creativity
- Originality
- Pro-activeness
- Initiativeness
- Cost Effectiveness
- Resourcefulness
- Development of soft skills/generic skills

There may be deviation from planning, design and implementation of the project as per the requirement.

2.2.3 Quality of Report Writing :

Following points need to be taken care of for report writing-

- Report writing as per prescribed format
- Clarity of Objectives
- Presentation of Data
- Data Analysis, Interpretation and Result
- Quality of Product

2.2.4 Presentation & Discussion :

Quality of presentation of data need to be ensured using the following criteria -

- Clarity in Communication and Presentation
- Voice Audibility
- Use of Media and methods
- Satisfying the queries of audience
- Attainment of objectives set

2.2.5 Project's Potential :

Futuristic scope and recommendation for further studies related to project may be assessed from the following criteria -

- Papers published or award received
- Exhibition or Display or showcase of project in competition or exhibition or Tech Fest
- Evaluation of working of projects or prototype
- Relevance and Applications in the world of work
- Recognition in any form
- Related areas/sub areas for further studies

The students need to be assessed continuously based on the assessment rubric prepared by the implementing teachers on different stages of project work completion.

A) Course Code : 2039664(039)
B) Course Title : Industrial Training-II
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 training 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		
2039664 (039)	-	-	2	-	-	-	40	60	100	1

G) Distribution of Hours and Marks:-

S.No	Chapter Name	Hours	Marks
1	Training Report/Presentation	16	40
Total		**16**	**40**

H) Guidelines to teachers for Industrial Training is given below:

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.

M) 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.