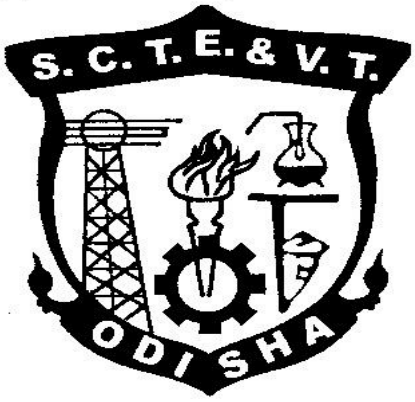
CURRICULLUM OF 4TH SEMESTER
For
DIPLOMA IN MINING ENGINEERING

(Effective FROM 2019-20 Sessions)



STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING,ORISSA

TEACHING AND EVALUTION SCHEME FOR 4th Semester Mining Engg.(wef 2019-20)

SUBJECT NUMBER	SUBJECT CODE	SUBJECT	Periods/Week			Evalution Scheme			
			L	T	P	Internal assessment/Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th .1		Underground Coal Mining	4			20	80	3	100
Th .2		Mine Survey -II	4			20	80	3	100
Th .3		Mine Ventilation	4			20	80	3	100
Th. 4		Electrical Equipment in Mines	4			20	80	3	100
		Total	16			80	320		400
		Practical							
Pr .1		Mine Survey -II LAB			06	50	50		100
Pr .2		Mine Ventilation LAB			06	50	50		100
Pr .3		Electrical Equipment in Mines LAB			06	50	50		100
Pr .4		Technical Seminar			02	50	-		50
		Student Centered Activities(SCA)			3				
		Total			23	200	150		350
		Grand Total	16		23	280	470		750

Abbreviations: L-Lecturer ,T-Tutorial ,P-Practical .Each class is of minimum 55 minutes duration.

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/Personality Development/Environmental issues/Quiz/Hobbies/Field Visits/cultural activities/Library studies/Classes on MOOCS/SWAYAM etc., Seminar and SCA shall be conducted in a section.

There shall be 1 Internal Assessment done for each of the Theory subject. Sessional Marks shall be total of the performance of individual different jobs/experiments in a subject throughout the semester.

Industry/Mines Exposure Training can be conducted during semester break after 4th semester.

Th .1. UNDERGROUND COAL MINING

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	60	Examination	3 hrs
Theory Periods:	4P/week	Internal Assessment	20
Maximum Marks:	100	End Semester Examination	80

Topic- wise distribution of periods

CHAPTER	TOPIC	PERIODS
1	Introduction to Method of working	4
2	Bord & Pillar Method	15
3	Long wall Mining Method	10
4	Thick seam Mining Method	8
5	Horizon Mining Method	3
6	Hydraulic & Pneumatic Stowing Method	3
7	Support system & Roof control	10
8	Subsidence due to Mining	3
9	Shaft sinking	4
	Total	60

RATIONALE

As a Mining Engineer, one should know different methods of underground working in coal mining and operational principles.

OBJECTIVES

On completion of the course, students will be able to :

- Explain different mining methods and their selection.
- Describe details working of B.P. method and its development & depillaring, precautions against fire and water and B.P. layout.
- Explain long wall working.
- Describe elementary idea about thick seam mining.
- Describe horizon mining.
- Explain various practices of filling of goaf and their layout.
- Describe roof behaviors and support required in Mines.
- Identify causes of subsidence and its prevention.
- Describe various methods of shaft sinking.

COURSE CONTENTS

1. Introduction to Underground Coal Mining
    - Define mine and different methods of mining.
    - Classify Undergound Coal Mining Methods.
2. Bord and Pillar Method
    - Describe the various application of Bord & Pillar method.
    - Describe various layouts of Bord & Pillar method.
    - Describe depillaring method with stowing and caving.
    - State precautions against fire and water during and after depillaring.
    - State and describe various machineries used in working face.
    - Define contigeous seam.
    - Describe working of contiguous seams.
    - Describe working of seams above and below goaved out area.
    - State advantages and disadvantages of Bord & Pillar method.
3. Longwall Method
    - Describe Longwall advancing and retreating methods.
    - Define single unit and double unit face.
    - Describe cyclic and non-cyclic L/W layouts.
    - Describe mechanized longwall working with armoured flexible conveyor, shield support and shearer loader.
4. Thick seam Mining
    - Define Thick seams.
    - Classify Thick seam Mining.
    - Describe layouts of horizontal slicing, incline slicing, blasting gallery and sublevel caving.
5. Horizon Mining
    - State conditions, advantages, disadvantages and limitations of Horizon Mining.
    - Describe the layout of Horizon Mining.
6. Hydraulic and Pneumatic stowing
    - Describe hydraulic stowing.
    - Describe Pneumatic stowing.
7. Support and roof control in Mines
    - State properties of various types of roof & roof behavior, Pressure arch theory in B&P
    - and longwall working.
    - Describe testing of roof.
    - Classify support system in Mines construction, principle of operation application and load bearing capacity assessment.
8. Subsidence due to Mining
    - Define angle of draw
    - State factors of subsidence, critical area of extraction
    - Describe the factors affecting subsidence
    - State & describe precautionary measures against damage due to subsidence
    - Define shaft pillar.
9. Shaft Sinking
    - Describe vertical shaft and inclined shaft; determine shape and size of shaft, location of shaft. Describe sinking through normal ground. State shaft plumbing.
    - Describe sinking through difficult ground, cementation, freezing, mechanized shaft sinking, sinking upward, widening and deepening of shafts.

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Chapter 1,2,3,4.

BOOKS RECOMMENDED :

Sl. No.	Title of the Book	Name of Authors
1	Coal Mining	S. Mathur
2	EMT VOL I,III	D.J. Deshmukh
3	Modern Coal Mining	S.K. Das
4	Advanced Coal Mining	RT Deshmukh & B.Borovjev
5	UMS	
6	Coal Mine Ground Control	S S Peng
7	SME Mining Engg. Handbook	
8	Strata Control	Jermic

Th. 2 . MINE SURVEY – II

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	60	Examination	3 hrs
Theory Periods:	4P/week	Internal Assessment	20
Maximum Marks:	100	End Semester Examination	80

Topic- wise distribution of periods

CHAPTER	TOPIC	PERIODS
1	Tacheometry	10
2	Triangulation & Trilateration	12
3	Co-relation of Surface & Underground Survey	10
4	Setting out curves	10
5	Stope Surveying	10
6	G.P.S & Total Station	8
	Total	60

RATIONALE

Before starting the actual mining operation, it is essential for mining engineer to first survey the piece of land where mining operation is contemplated. This is not possible without the knowledge of mine surveying.

OBJECTIVES

On completion of the subject, students will be able to :

- Comprehend principle of tachometry & its application in measurement of distance.
- Explain principle of triangulation & trilateration.
- Explain principles of correlations by different methods.
  Define various terms in connection with cove setting, laying out of curves by different methods.
- Explain different methods of stope surveying, transfer of stope faces to mine Plan.
- Explain the basic principle of global positioning systems & total station.

COURSE CONTENTS

1. Tacheometry
   - Define stadia & its principle.
   - Explain diaphragm, reticules, tacheometer, instruments constants.
   - Find out height & distance from stadia intercepts, tangential systems, movable hair method.
2. Triangulation and Trilateration.
   - State purpose & principle involved in triangulation & trilateration method.
   - Classify various methods of triangulation survey primary, secondary & tertiary colliery triangulation.
   - Develop concept about reconnaissance survey. Describe methods of measuring angle, types of theodolite used in triangulation survey.
   - Describe the methods of base line measurement using E.D.M.
   - Define tape correction.
   - State construction of triangulation station of permanent nature.
3. Correlation of surface and underground survey
   - State direct correlation by traversing & optical methods.
   - Describe orientation by wires in two shafts.
   - Explain correlation by mines in vertical shafts.
   - State co-planning/ alignment, weissbach triangle weis-quadrilateral methods, precise magnetic correlation.

4. Setting out curves
   - State elements of curves.
   - Define designation of curves, simple, compound & reverse curves.
   - Explain setting out of surface & underground curves by chords & offsets, chords and angle, tangent and offset, plate layers method.
   - Describe various setting out by chain & one theodolite, two theodolites.
   - Define super elevation, transition and vertical curves.
5. Stope Surveying
   - Explain tape triangulation, instrumental survey.
   - Determine stope face.
   - State preparation of stope planes, plotting the stope station, plotting of stope face to the mine plan.
   - Find out area of extraction by Planimeter and calculation of triangle thereof.

6. G.P.S. & Total Station
   - Explain the basic principles of global positioning system & total station.
   - Introduction to DGPS.

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Chapter 1,2,3

RECOMMENDED BOOKS

Sl. No.	Title of the Book	Name of Authors
1	Surveying Vol I	E.Mason
2	Surveying and Levelling	T.P. Kanetkar
3	Geodetic Surveying Vol I	David Clerk
4	Mineral Economics	Sinha & Sharma

Th. 3. MINE VENTILATION

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	60	Examination	3 hrs
Theory Periods:	4P/week	Internal Assessment	20
Maximum Marks:	100	End Semester Examination	80

Topic wise distribution of Periods

CHAPTER	TOPIC	PERIODS
1	Natural Ventilation	8
2	Air Crossing & Distribution	10
3	Mechanical Ventilation	9
4	Booster Fan & Its Effect	10
5	Auxiliary Ventilation	7
6	Ventilation Survey	10
7	Leakage of air in Mines	6
	Total	60

RATIONALE

The provision of proper ventilation is very essential for any underground mining operation. As a mining Engineer, one should have the thorough knowledge of types of ventilation, methods of air crossing, types of fans etc

OBJECTIVES

On completion of the course, students will be able to :

- Describe different instruments measuring temperature, pressure and humidity and have idea on natural ventilation and laws of mine air friction.
- Describe different types of ventilation and methods of air crossings and distribution.
- Illustrate different types of fans, fan characteristics, Mine characteristics and selection of fans.
- Identify different locations of booster fan and solve simple problems relating to this.
- Explain different systems of auxiliary ventilation and its advantages and disadvantages.
- Explain different ways of pressure survey, quantity survey & quality survey.
- Explain causes & preventives measure of leakage of air in mines.

COURSE CONTENTS

1. Natural Ventilation
   - Definition of natural ventilation and factors affecting natural ventilation.
   - Describe the different types of Thermometer.
   - Describe the different types of Barometer.
   - Describe kata thermometer.
   - Describe water gauge.
   - Calculate ventilation pressure by using piton static tube.

- Explain effects of heat & humidity.
- Explain natural ventilation motive column, geothermic gradient.
- Enumerate laws of mine air friction and solve problems on above.
- Statutory provision as per CMR 2017,MMR 1961.

2. Air Crossing and distribution
   - Describe ventilation stopping, air crossing, ventilation door, brattice partition.
   - Describe different types of ventilation.
   - Accessional & declensional ventilation.
   - Homotropal & Antitropal ventilation.
   - Boundary ventilation.
   - Central & combined ventilation.
   - Explain splitting of air current & solve numerical problems on splitting.
   - Describe air locks at pit top.

3. Mechanical Ventilation
   - Explain construction & principle of operation of centrifugal flow fans.
   - State fan laws & calculate fan efficiency and capacity.
   - Explain installation of mine fan with reversal arrangement.
   - Describe fan drift, fan drive, evasee and diffusers.

Explain fan characteristics and mine characteristics.
   - Describe methods of output of mine fans.

4. Booster fan and its Effects
   - Describe installation, location and purpose of booster fan.
   - Solve problems relating to booster fan.

5. Auxiliary Ventilation
   - Describe systems of auxiliary ventilation.
   - Describe advantages & disadvantages of auxiliary ventilation.

6. Ventilation Survey
   - Describe methods of pressure survey using barometer, gauge and pitot tube with manometer.
   - Describe the method of measurement of cross-sectional area.
   - Describe the method of velocity measurements by using anemometer, voltmeter, and pitot- static tube and smoke & cloud method.
   - Determine percentage of oxygen, methane, carbon monoxide SO_2 & H_2S.

7. Leakage of air in Mines
   - Describe causes and preventive measures of leakage of air in mines.

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Chapter 1,2,3

RECOMMENDED BOOKS

Sl. No.	Title of the Books	Name of Authors
1	Mine Ventilation	G B Mishra
2	EMT II	D J Deshmukh
3	Coal Mine Practices	E. Mason
4	Mine Ventilation	L C KAKU
5	UMS Volume -I	
6	SME HANDBOOK VOL-I & III	

Th. 4. ELECTRICAL EQUIPMENT IN MINES

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	60	Examination	3 hrs
Theory Periods:	4P/week	Internal Assessment	20
Maximum Marks:	100	End Semester Examination	80

Topic- wise distribution of periods

CHAPTER	TOPIC	PERIODS
1	Electrical cables for Mining use	5
2	Protective systems including Fuses & Circuit Breakers	14
3	Fundamentals of Transformer	10
4	Industrial drives-Mining Type	4
5	Electric Braking Used in Mines	8
6	Flame proof and intrinsically safe apparatus	5
7	Underground signaling arrangement	4
8	Sensors & their applications	5
9	Describe Battery locomotive and Electric LHD	5
	Total	60

RATIONALE

For a Mining Engineer, it is essential to have the fundamental concepts of electrical engineering and its applications in mining operation.

OBJECTIVES

On completion of the course, students will be able to :

- Describe various types of electrical cables used in Mines.
- State & explain the purposes of uses.
- Describe and explain circuit breakers and draw circuit diagram of gate-end box and drill panel.
- Describe different types of protective system.
- Select electric drives for mining use.
- Describe & explain different types of electric braking.
- Describe proof apparatus and intrinsically safe apparatus.
- Explain underground signaling arrangement.

COURSE CONTENTS

1. Electrical cables for Mining use
   - Classify cables for mining use.
   - Constructional features of high tension and low-tension cables armored & trailing cables.
     - State size of cables & their use.

        - State procedures of cable laying at surface, underground roadway & in shafts.
    - Describe cable joint box mining type.

2. Protective Systems
    - Fuses.
        - Fuse Materials
        - Rewireable Fuse, HRC Fuse.
        - Uses of Fuse.
    - Circuit Breakers.
        - Describe & Explain Air Circuit Breaker.
        - Describe & Explain Minimum Oil Circuit Breaker (MOCB).
        - Describe & Explain Bulk Oil Circuit Breaker (BOCB).
        - Describe & Explain Air Blast Circuit Breaker.
        - Describe SF6 Circuit Breaker.
    - Explain essential qualities of a good protective system.
    - State & describe types of relays (plunger, induction & direction over current, over loads, no volt and latching relay, frequency relay and Earth leakage relay)
    - Describe protection of transformer by differential relay.
    - Describe general principle of working-basis remote control circuit & various protective devices of Gate-End Box.
    - Describe functions & operation of drill panel.
    - Earthing system in mines.
    - Voltage limit.

3. Fundamentals of Transformer (without numerical problems)

4. Industrial drives- Mining type
    - Explain starting & running characteristics of D.C. & A.C. Motors.
    - State selection of motors for mining use.
5. Electric braking used in Mines
    - Describe & explain regenerative braking.
    - Describe & explain magnetic braking.
6. Flame proof & intrinsically safe apparatus
    - Define flame proof apparatus & intrinsically safe apparatus.
    - Describe & explain the safety features of flame proof & intrinsically safe apparatus.

7. Underground signaling arrangement
    - Describe signals & shaft signal.
    - Describe communication system in U/G mines.
    - Point to point communication.
    - Intercom system/Telephone
    - Cordless system.
8. Sensors & their applications.
9. Battery locomotive, Automation with Thyroster control, Elecrical LHD, Electric mine phone.

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Chapter 1,2,3.4.

RECOMMENDED BOOKS

Sl. No.	Title of the Books	Name of Authors
1	Electrical Equipment in Mines	H.Cotton
2	Electrical Power System	V K Mehta
3	Power Electronics	P S Punmia

Pr.1 . MINE SURVEY – II LAB

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	90	Examination	3 hrs
Practical Periods:	6P/week	Sessional Exam	50
Maximum Marks:	100	End Semester Examination	50

Topic wise Distribution of Periods

CHAPTER	TOPIC	PERIODS
1	Study of Tacheometer	15
2	Study of GPS	15
3	Study of DGPS	15
4	Study of Total Station	15
5	Uses of Autocad in survey	15
6	Software based Mine planning	15
	Total	90

A. **RATIONALE**:

In the field of mining, it will help in all measurements,calculations & mapping at all stages from prospecting to exploitation and utilizing mineral deposits by both surface & underground working.

B. OBJECTIVE:
On completion of lab students will able to :

- Develop a clear idea about Tacheometer and Tacheometry.
- Know various components of GPS and DGPS & their uses.
- Use Total station in calculations of various components in mining field.
- Learn uses of Autocad and software in Mine planning.

C. Course Contents

- Fix triangulation and measurement of peripheral and hub angles. Base line measurement applying all corrections and plotting by co-ordinates.
- Determine the north.
- Set out curves by Total Station and Theodolites.
- Correlate underground and surface survey during survey camp.
- Measurement of Horizontal & Vertical angles, measurement of distance by Total Station.
- Mining lease boundary survey using Total Station .
- Base line fixation using Total Station.
- Coordinate point shifting and reference point shifting by Total Station .

- Fixation of control point by 02 traversing (both Horizontal and Vertical control points) with Total Station and auto level.
- Topographic survey & existing features.
- Area calculation using software.
- Volume calculation using software
- GPS Survey.
- Preparation of plan and section using AUTOCAD.
- DGPS Survey.
- Reserve calculation of Ore.

Pr.2 .MINE VENTILATION LAB

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	90	Examination	3 hrs
Practical Periods:	6P/week	Sessional Examination	50
Maximum Marks:	100	End Semester Examination	50

Topic wise distribution of Periods

CHAPTER	TOPIC	PERIODS
1	Calculation of relative humidity by stationary hygrometer	8
2	Study of relative humidity by storrow's hygrometer	7
3	Calculation of cooling power of mine air using Kata thermometer.	8
4	Study of air crossing, ventilation doors at pit-top	8
5	Study & use of Vane Anemometer,Digital Anemometer, Velometer	9
6	Determination of duct characteristic.	9
7	Study of constructional features of axial flow and centrifugal fans.	9
8	Determination of fan characteristic curve.	8
9	Study and sketching of regulator, airlocks	8
10	Study and use of digital anemometer.	8
11	Measurement of quantity of air flow by digital anemometer.	8
	Total	90

A. RATIONALE

The provision of proper ventilation is very essential for any underground mining operation. As a mining Engineer, one should have the thorough knowledge about types of mechanical ventilators,different measuring instruments & air leakage protecting devices used in mines.

B. OBJECTIVES

On completion of the lab, students will be able to :

- Know uses of stationary & storrow's hygrometer in calculation of relative humidity.
- Calculate cooling power of air with help of kata thermometer.
- Illustrate different types of fans, fan characteristics and selection of fans.
- Explain the uses of Regulators and Air locks in different parts of mine.
- Calculate velocity of air with the help of vane anemometer.
- Explain different ways of pressure survey, quantity survey & quality survey.

C. Course Contents

- Determine the relative humidity by stationary hygrometer.
- Determine the relative humidity by storrow's hygrometer.
- Determine the cooling power of mine air using Kata thermometer.
- Study and sketching of air crossing, ventilation doors at pit-top & different types of explosive proof fire stopping.
- Study & use of Vane Anemometer,Digital Anemometer, Velometer, Pitot static-tube measurement of quantity of air flow. Study of digital pressure meter.
- Determination of duct characteristic.
- Study of constructional features of axial flow and centrifugal fans.
- Determination of fan characteristic curve.
- Study and sketching of regulator, airlocks.
- Study and use of digital anemometer.
- Measurement of quantity of air flow by digital anemometer.

Pr .3 . ELECTRICAL EQUIPMENT IN MINE LAB

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	90	Examination	3 hrs
Practical Periods:	6P/week	Sessional Examination	50
Maximum Marks:	100	End Semester Examination	50

Topic wise Distribution of Periods

CHAPTER	TOPIC	PERIODS
1	Preparation of Electrical switch board to control two light points, one plug point	15
2	Study of circuit breakers	15
3	Study of Gate End Box	15
4	Study of Relays	15
5	Identify the different part of given cable	15
6	Use of Megger check and the continuity of windings	15
	Total	90

A. RATIONALE

For a Mining Engineer, it is essential to have the fundamental concepts of electrical engineering and its applications in mining operation.

B. OBJECTIVES

On completion of the lab, students will be able to :

- Prepare an electrical switch board to control 2 light points & 1 plug points.
- Describe and explain circuit breakers and draw circuit diagram of gate-end box and drill panel.
- Describe different types of protective system and Relays.
- Distinguish different types of cables used for mining purpose
- Explain the uses of Megger check and continuity of windings.

C. **Course Contents**

- Prepare an Electrical switch board to control two light points, one plug point, one fan point and put a required fuse.
- Study of circuit breakers (Air Circuit Breaker & Oil Circuit Breaker).
- Study of Gate End Box.
- Study of Relays (Buchholz Relay , Over Current Relay).
- Identify the different part of given cable and find fault on the cable.
- By the use of Megger check the continuity of windings, body to winding, body to earth of an 3-Phase induction Motor.

Pr. 4. Technical Seminar

Name of the Course : Diploma in Mining Engineering			
Course code:		Semester	4th
Total Periods:	30	Examination	-
Practical Periods:	2P/week	Sessional Examination	50
Maximum Marks:	50		

Each student has to select a recent topic of latest technology in the area of Mining Engineering and present a seminar in front of all students of the class. He/She has to prepare a PowerPoint presentation of the selected topic of minimum 10 slides are the total presentation will be approximately 10 minutes duration .There will be interactive session between the presenter and rest of the students including the faculty members of the dept at the end of presentation .A student has to present at least 2 nos. of seminar during a semester and to submit the report for evaluation.