Chhattisgarh Swami Vivekanand Technical University, Bhilai

Diploma in Mining Engineering **Semester-IV**

A) Course Code : 2000457(037)

B) Course Title : Entrepreneurship Development and Management

C) Pre- requisite Course Code and Title :

D) Rationale :

Our fast growing economy provides ample opportunities for diploma engineers to succeed in entrepreneurship. Diploma engineers can be their own masters and job provider to others by starting their service industry/assembly/marketing/consultancy/manufacturing enterprises. As entrepreneurship requires distinct set of skills which may not be developed while undergoing technical subjects. Hence a separate course has been introduced for developing such skills set amongst diploma students. This course aims at developing competencies in the diploma engineer for becoming an intrapreneur or a successful entrepreneur. After successfully completing this course students who develop qualities of successful entrepreneur can set up their own manufacturing industry/service industry/business/startup or be self employed and those who prefer job can become intrapreneur and share profits with their company.

E) Course Outcomes

CO-1 Demonstrate traits of a successful intrapreneur/entrepreneur

CO-2 Analyze the level of achievement motivation by preparing one's own portfolio.

CO-3 Innovate products and services using creativity techniques.

CO-4 Manage critical resources from support institutions.

CO-5 Prepare sustainable small business plans.

F) Scheme of Studies:

S.No.	Board of Study	Course Code	Course Title	Scheme of Studies (Hours/Week)			
				L	P	T	Total Credits(C) L+T+(P/2)
1.	Mechanical Engineering	2000457 (037)	Entrepreneurship Development and Management	2	-	1	3

Legend: L: Classroom Instruction (Includes different instructional strategies i.e. Lecture and other), P: Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies) T- Tutorial includes Sessional Work(SW) (includes assignment, seminar, mini project etc.) and Self Learning (SL), C: Credits

Note: SW and SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

G) Scheme of Examination:

S.No.	Board of Study	Course Code	Course Title	Scheme of Examination					
				Theory			Practical		Total Marks
				ESE	CT	TA	ESE	TA	
1	Mechanical Engineering	2000457 (037)	Entrepreneurship Development and Management	70	20	30	-	-	120

Note: i. Separate passing is must for TA component of Progressive Assessment, both for theory and practical.
ii. Separate passing is must for End Semester Exam (Theory) and End Semester Exam(Practical).

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 (L), Laboratory Instruction (P), 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 Demonstrate traits of a successful intrapreneur/entrepreneur

(Approx. Hrs: L+P+T=10)

Session Outcomes (SOs)	Laboratory Instruction (P)	Class room Instruction (L)	Self Learning (SL)
SO1.1 Select intrapreneurship or entrepreneurship as a career based on the qualities possessed by an individual. SO1.2 Identify various avenues of entrepreneurship for diploma engineers. SO1.3 Demonstrate qualities of successful intrapreneur/entrepreneur. SO1.4 Explain various steps in establishment of enterprise. SO1.5 Select an area of business opportunity as per your interest.		**Unit 1.0 Characteristics of entrepreneurs** 1.1 Concept of entrepreneur and intrapreneur. 1.2 Benefits of becoming an intrapreneur/ entrepreneur. 1.3 Scope of entrepreneurship in local and global market. 1.4 Planning for establishment of an enterprise. 1.5 Traits of successful intrapreneur/ entrepreneur and passion, initiative, independent decision making, team work, assertiveness, persuasion, persistence, information seeking, commitment to work contract etc. SW analysis. Team work simulation. 1.6 Trait of successful entrepreneur: calculated risk taking. Risk taking simulation exercise. 1.7 Business opportunity Guidance.	• History of entrepreneurship. • Definition of entrepreneurship • Social entrepreneurship

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Identify existing needs of the institute/college and convert them into business opportunity.

ii. Enumerate characteristics of assigned first generation successful entrepreneurs, intrapreneurs, managers by preparing a presentation.

iii. Analyze the reasons for success and failure of the assigned entrepreneurs by preparing ppt on the basis of news, articles, reviews, video etc.

b. Mini project:

i. Interviewing few local entrepreneurs and prepare a collage on "Traits of successful entrepreneurs".

ii. Identify traits to be developed in you for becoming a successful entrepreneur based on your strength and weakness analysis and submit an action plan to develop the same.

iii. Organize "best from waste" competition.

c. Other Activities:

i. Identify your hobbies and interests and convert them into business idea.

ii. Organize seminar on history of entrepreneurship, Definition and selected case studies of social entrepreneurship.

CO-2 Analyze the level of achievement motivation by preparing one's own portfolio.

(Approx. Hrs: L+P+T=10)

Session Outcomes (SOs)	Laboratory Instruction (P)	Class room Instruction (L)	Self Learning (SL)
SO2.1 Explain the concept of achievement motivation. SO2.2 Assess level of need for Achievement in the individual through different tools. SO2.3 Prepare an action plan for enhancing need for achievement		**Unit 2.0 Motivation Management** 2.1 Motives, motivation and motivational cycle. 2.2 Concept of Need for Achievement. 2.3 Need for Achievement assessment through various tools. • Ring toss game • Boat making exercise • Building block exercise • TAT stories • Who am I? 2.4 Interpretation and action plan for self development.	• Kakinada experiment Techno-preneurship.

SW-2 Suggested Sessional Work (SW):

a. Assignments:

i. Prepare a portfolio based on achievement motivation exercise and tasks.

b. Mini project:

i. Prepare a report on need for achievement exercises. ii. Develop achievement motivation field exercises.

c. Other Activities:

i. Prepare a plan for development of achievement motivation and execute it. ii. Develop case studies on Techno-preneurship.

iii. Prepare a report on Kakinada experiment.

CO-3 Innovate products using creativity techniques.

(Approx.Hrs-L+P+T=10)

Session Outcomes (SOs)	Laboratory Instruction (P)	Class room Instruction (L)	Self Learning (SL)
SO3.1 Elucidate the use creativity techniques for entrepreneurs. SO3.2 Improve a chosen product using brainstorming technique. SO3.3 Differentiate between creativity and innovation. SO3.4 Apply concept of product life cycle for conceiving a project. SO3.5 Design a product using new product development process.		**Unit 3.0 Management of Creativity.** 3.1 Creativity: Divergent thinking, creativity techniques. 3.2 Innovation, types and applications 3.3 Product life cycle, New product development process. Product development and innovation through creativity and innovation.	• Check list of questions. • Six thinking hats. • Case study of innovative first generation entrepreneur. • Schemes and incentives for innovation. • Innovative solutions for social problems.

SW-3 Suggested Sessional Work(SW):

a. Assignments:

i. Use the assigned creativity technique for improvement of product characteristic. ii.
ii. Use the assigned creativity technique for improvement of service process characteristic.

b. Mini project:

i. Apply innovative practices in different process of an enterprise.

c. Other Activities:

i. Prepare a prototype of a creative solution to industrial/ social problem.
ii. Organise seminar on Schemes and incentives for innovation, Innovative solutions for social problems and Kakinada experiment.

CO-4 Manage critical resources from support institutions.

Approx. Hrs: L+T+P = 10)

Session Outcomes (SOs)	Laboratory Instruction (P)	Class room Instruction (L)	Self Learning (SL)
SO4.1 Select appropriate form of business organization for enterprise SO4.2 Identify entrepreneurs hip support institutions for technical/ marketing and finance. SO4.3 Explain salient features of entrepreneurs hip promotion schemes of centre and state. SO4.4 Prepare a marketing mix plan for identified industry. SO4.5 Develop a materials management plan. SO4.6 Develop a human resource plan.		**Unit 4.0 Critical Resources** 4.1 Forms of business organization: Proprietorship, Partnership, Cooperative, Private, Public Ltd Company, Section 8 company, LLP 4.2 Institutional Support for entrepreneurship: MSMESI, CED, DTIC, CITCON, CSIDC, LUN, NSIC, KVIC, NABARD, Banks, SIDBI 4.3 Entrepreneurship promotion schemes of centre and state. 4.4 Marketing Mix, Market survey for project identification 4.5 Inventory control, vendor development, material movement, store management. 4.6 Manpower plan, hiring process, compensation, performance appraisal.	• Establishment procedure of Proprietorship, LLP, Cooperative, Section 8 company, LLP Factory Act, Labour Laws, GST,

SW-4 Suggested Sessional Work(SW):

a. Assignments:

i. Examine suitability of different forms of business organization for the given project and prepare a presentation for the same.
ii. Conduct a market survey and prepare a report along with marketing mix plan for the given project.
iii. Prepare materials management strategy for a business or manufacturing unit and submit as areport.
iv. Prepare a man power plan chart and job specifications for identified positions.

b. Mini project:

i. Explore facilities extended by support institutions to entrepreneurs for marketing of the given situation.
ii. Investigate facilities extended by support institutions to entrepreneurs for technical support of the given situation.
iii. Identify facilities extended by support institutions to entrepreneurs for financial support of the given situation

c. Other Activities:

i. Visit the assigned agencies engaged in institutional support for entrepreneurship and make a report.
ii. For your selected project decide a unique name of the enterprise, logo, signboard, letterhead and pamphlet.
iii. Organise a seminar on establishment procedure of proprietorship, LLP, cooperative, section 8 company, factory act, labour laws and GST

CO-5 Prepare sustainable small business plans.

(Approx. Hrs: L+P+T= 08)

Session Outcomes (SOs)	Laboratory Instruction (P)	Class room Instruction (L)	Self Learning (SL)
SO5.1 Prepare business plan/techno economic feasibility report. SO5.2 Calculate and comment on breakeven point for given project. SO5.3 Explain financing of startups.		**Unit 5.0 Sustainable business plan** 5.1 Format of business plan/techno-economic feasibility report. 5.2 Demand and annual production target based on market survey. 5.3 Outline production/service process. 5.4 Land, building and Machinery requirement. 5.5 Power, utilities and raw material requirement. 5.6 Fixed capital, Working capital, Subsidy and Cost of Project. 5.7 Means of finance, calculation of interest. 5.8 Profitability analysis, Break-evenpoint.	• Techno-economic feasibility report of MSME. • Startup process. • Angel Investors. • Venture capitalist. • Incubators.

SW-5 Suggested Sessional Work(SW):

a. Assignments:

i. Describe the procedure of registration and availing of facilities from the assigned support institution.
ii. Prepare a process plan for the selected project.

b. Mini project:

i. Prepare a marketing plan for the assigned project.
ii. Prepare a financial plan for the assigned project.
iii. Prepare a technical feasibility plan for the assigned project.
iv. Prepare a techno-economical feasibility report of the assigned project.

c. Other Activities:

i. Analyse a case study on startups focusing on financing from angel investor and venture capitalist.
ii. Organise seminar on Starup process, Angel investors, Venture Capitalist and Incubators

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

I) Suggested Specification Table (For ESA of Classroom Instruction):

Unit Number	Unit Titles	Marks Distribution			Total Marks
		R	U	A	
I	Characteristics of entrepreneurs	2	4	8	14
II	Motivation Management	2	2	6	10
III	Management of Creativity and Innovation	2	4	8	14
IV	Resource Management	2	4	10	16
V	Sustainable Business Plan	2	4	10	16
Total		**10**	**18**	**42**	**70**

Legend: R: Remember, U: Understand, A: Apply and above

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

K) Suggested Instructional/Implementation Strategies:

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

L) Suggested Learning Resources:

(a) Books :

S. No.	Titles	Author	Publisher	Edition & Year
1.	Entrepreneurial Development	Desai Vasant	Himalaya Publishing House	Mumbai/2017 ISBN 978 93 5097 383 7
2	Starting your own business, step by step Blue print for the First – time Entrepreneur	Harper Stephen C.	Mc Craw-Hill	2003 ISBN13: 9780071410120
3.	The Business Planning GUIDE	H.Bangs David	Upstart Publishing Company in Chicago	978-0793154098
4	Entrepreneurship Development in India	Gupta Dr.C.B. Shriniwasa NP	Sultan Chand & Sons	9788180548185
5	Entrepreneurship Development	Khanka Dr.S.S.	S.Chand New Delhi	ISBN 81 219 1801 4

S. No.	Titles	Author	Publisher	Edition & Year
6	Entrepreneurship Development and small Business Enterprises	Charantimath M.	Pearson Edu.Soc. INDIA	2013/ISBN 13 978 8131 762264
7.	Entrepreneurship Development	Sharma Sangita	PHI, DELHI	ISBN 978 81 203 5270 4

(b) Open source software and websiteaddress:

1. Free e books:https://www.free-ebooks.net/book-list/entrepreneurship
2. Startups:https://inc42.com/startups/?utm_source=top-menu&utm_medium=website&utm_campaign=menu
3. Indian Tech Startup funding report: https://pages.inc42.com/annual-indian-tech-startup-funding-report-2017/?utm_source=top-menu&utm_medium=website&utm_campaign=menu
4. Project profile: https://my.msme.gov.in/MyMsmeMob/MsmeProjectProfile/Home.htm
5. Project profile:http://www.dcmsme.gov.in/publications/pmryprof/pjseries.html
6. Project profilehttp://www.dcmsme.gov.in/reports/ProjectProfile.htm

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

N) 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-1Demonstrate traits of a successful intrapreneur/entrepreneur.	-	3	-	-	2	2	2	2	2	2	-	-
CO-2 Analyse the level of achievement motivation by preparing one's own portfolio.	-	3	-	-	2	2	2	2	2	2	-	-
CO-3 Innovate products using creativity techniques.	-	3	-	-	2	2	2	2	2	2	-	-
CO-4 Manage critical resources from support institutions.	-	3	-	-	2	2	2	2	2	2	-	-
CO-5 Prepare sustainable small business plans.	-	3	-	-	2	2	2	2	2	2	-	-

Legend: 1 – Low, 2 – Medium, 3 – High

O) Course Curriculum Map:

POs & PSOs No.	COs No. & Title	SOs No.	Laboratory Instruction (P)	Classroom Instruction (L)	Self Learning (SL)
PO-2,5,6,7,8, 9,10	CO-1 Demonstrate traits of a successful intrapreneur/entrepreneur.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5		Unit 1.0 Characteristics of entrepreneurs 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7	As mentioned in relevant page numbers
PO-2,5,6,7,8, 9,10	CO-2 Analyse the level of achievement motivation by preparing one's own portfolio.	SO2.1 SO2.2 SO2.3		Unit 2.0 Motivation Management 2.1, 2.2, 2.3, 2.4	
PO-2,5,6,7,8, 9,10	CO-3 Innovate products using creativity techniques.	SO.3.1 SO3.2 SO3.3 SO3.4 SO3.5		Unit 3.0 Management of Creativity and Innovation 3.1, 3.2, 3.3	
PO-2,5,6,7,8, 9,10	CO-4 Manage critical resources from support institutions.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5 SO4.6		Unit 4.0 Resource Management 4.1, 4.2, 4.3, 4.4,4.5,4.6	
PO-2,5,6,7,8, 9,10	CO-5 Prepare sustainable small business plans.	SO5.1 SO5.2 SO5.3		Unit 5.0 Sustainable Business Plan 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 Tutorial (T) 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 : 2039471(039)

B) **Course Title** : **Mine Surveying-I**

C) Pre- requisite Course Code and Title :

D) Rationale :

After understanding the Importance, procedure and carrying out land surveying project individually in the curriculum of third semester. A student has acquired a level of knowledge of which he will now be made equated with the under ground 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 -

1. Levelling
2. Theodolite
3. Contouring
4. Dip strike & Borehole Problems
5. Tacheometric survey.

E) Course Outcomes :

CO-1 Use various levelling instruments to perform levelling work.

CO-2 Measure horizontal and vertical angles using the odolite.

CO-3 Draw a mine plan using principles of contouring.

CO-4 Apply techniques / methods of advance surveying in mining field.

CO-5 Conduct tacheometric survey using tacheometer.

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		
2039471(039)	3	1	2	70	20	30	40	60	220	5

Legend: L= CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others)

P=LI : Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

T=SW: Sessional Work (includes assignment, seminar, mini project etc.), SL: Self Learning, Tutorial (T)

C=Credits

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

G) Course-Curriculum Detailing:

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

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

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

CO-1 Use various levelling instruments to perform levelling work.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Apply basic principles of levelling in field. SO1.2 Use auto level for levelling in given conditions. SO1.3 Use different methods of levelling under given conditions. SO1.4 Solve numerical problems based on levelling. SO1.5 Carryout corrections for errors in levelling. SO1.6 Identify and rectify source of errors in levelling instruments through calibration.	LE1.1 Find out the reduced level of different points with a given datum. LE1.2 Conduct leveling work with Auto level at given areas. LE1.3 Calculate R.L. of given point by H.I. method. LE1.4 Calculate R.L. of given point by rise and fall method. LE1.5 Measure and calculate sensitivity of bubble tube of a given level instrument. LE1.6 Calibrate levelling instruments in laboratory and removal of errors therein.	**Unit 1.0 Levelling** 1.1 Introduction 1.2 Basic terminology related with levelling i.e. 1.2.1 Level surfaces, 1.2.2 Horizontal & vertical surfaces, 1.2.3 Datum and Bench Marks 1.2.4 Reduced Level, Rise, Fall, 1.2.5 Line of collimation, Axis of Telescope, Axis of bubble tube, 1.2.6 Station, Back sight, Fore sight, intermediate sight, Change point, 1.2.7 Height of instruments, Focusing lens parallax, etc. 1.3 Types of Level- Dumpy Level, Tilting Level, Auto Level, Digital Level 1.4 Components of Auto Level with neat sketch 1.5 Types of Levelling Staffs Self-reading staff & Target staff 1.6 Temporary and permanent adjustment of Level Instruments. 1.7 Classification of Levelling –	• Prepare notes on permanent adjustment of a dumpy level. • Case study of levelling work of near by mining or civil construction project • Study of calibration of dumpy level and auto level.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
		1.7.1 Simple Levelling, 1.7.2 Differential Levelling, 1.7.3 Fly Levelling, 1.7.4 Profile Levelling, 1.7.5 Reciprocal Levelling and Precise Levelling 1.8 Examples & methods of finding out the R. L. in Level Book by H.I. Method and Rise & Fall Method with necessary checking procedure. 1.9 Correction for Curvature and refraction and related example. 1.10 Errors in Leveling levelling instruments and their removal through calibration of instruments. 1.11 Determination of sensitivity of bubble tube.	

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Write notes on Temporary and Permanent adjustment of level Instruments.

ii. Solve given numerical problem related to levelling.

b. Mini Project:

i. Establish a bench mark in your institute campus.

CO-2 Measure horizontal and vertical angles using the odolite.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Apply various technical terms of theodolite in field work. SO2.2 Sketch and describe a	LE2.1 Calculate least count of a given theodolite. LE2.2 Measure horizontal angles by repetition and reiteration	**Unit 2.0 Theodolite** 2.1 Introduction to theodolite 2.2 Definitions and various technical terms related to	• Collect information regarding latest traversing instruments.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
transit Vernier theodolite. SO2.3 Perform temporary adjustment of a theodolite at given survey station. SO2.4 Check and perform permanent adjustment of a given theodolite SO2.5 Measure horizontal and vertical angle by theodolite under the given conditions. SO2.6 Identify and remove sources of error in theodolite through calibration .	method. LE2.3 Measure vertical angles to calculate height of tower/headgear. LE2.4 To carry out traversing work assuming your own conditions using theodolite. LE2.5 Calibrate the theodolite in laboratory.	theodolite. 2.3 Uses of theodolite 2.4 Sketch and describe the Transit Vernier theodolite 2.5 Graduation system of a vernier theodolite 10 sec, 20 sec least count 2.6 Reading of main and vernier scale on horizontal and vertical plate 2.7 Temporary adjustment of a theodolite 2.8 Permanent adjustment of theodolite (Fundamental axis of theodolite and their relationship) 2.9 Methods of measuring horizontal angles and vertical angles –Ordinary , repetition and reiteration method 2.10 Use theodolite for measuring a magnetic bearing, prolong a line, ranging a line 2.10 Measuring direct and deflection angles 2.11 Errors in theodolite work and calibration of theodolite in laboratory.	• Case study of different traversing work of nearby mining or civil project. • Study of calibration of theodolites in laboratory.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

i. Sketch and describe the parts of vernier theodolite.
ii. Write temporary and permanent adjustment of theodolite.

b. Mini Project

i. Prepare a traverse survey report of your institution's campus using theodolite.

CO-3 Draw a mine plan using principles of contouring

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Identify purpose of contour. SO3.2 Apply the factors affecting contour intervals under the given situation . SO3.3 Describe characteristic of contours. SO3.4 Explain method of contouring at given condition.	LE3.1 Draw a Contour a given area by direct method. LE3.2 Draw a Contour of a given area by indirect method. LE3.3 Draw a plan by use of contour line at given location.	**Unit 3.0 Contouring** 3.1 Introduction and purpose of contouring. 3.2 Horizontal equivalent 3.3 Contour interval 3.4 Factors affecting contour interval 3.5 Characteristics of contours. 3.6 Method of contouring- 3.6.1 Direct, 3.6.2 Indirect method 3.7 Interpolation of contours methods- i) Estimation method ii) Arithmetical method iii) Graphical method 3.8 Plotting of contour maps. 3.9 Uses of contour on mine plans	• Study the contour maps of mines visited in nearby areas • Study the applicability of contour in given mining conditions.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

i. Write characteristics of contour lines.
ii. Explain direct/indirect method of contouring.

b. Mini Project:

i. Prepare a map of hilly/river area showing contour lines at given interval.

CO-4 Apply techniques / methods of advance surveying in mining field.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Identify the purpose of bore hole survey. SO4.2 Derive relation between true, apparent dip	LE4.1 Draw a layout of borehole survey design under given conditions. LE4.2 Sketch and describe dip and strike of seam in	**Unit 4.0 Dip, Strike and Bore Hole Problems** 4.1 Definitions 4.2 Purposes of bore hole surveying. 4.3 Relation between true dip, apparent dip and	• Study the dip, strike and borehole survey plan of nearby mine.

and angle between them. SO4.3 Calculate bore hole problems of given data. SO4.4 Apply principles of GPS and GIS in surveying.	given conditions.	angle between them. 4.4 Numerical problem on dip, strike and bore hole surveying. 4.5 Remote sensing- 4.5.1 Introduction, 4.5.2 Application of advances in remote sensing in various mining activities like GPS,GIS etc.	• Study and elaborate the application of GPS and GIS in monitoring of various mining activities.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

i. Calculate the amount and direction of true dip from the given data.

b. Mini Project

i. Prepare a 3D model to show true dip, apparent dip and strike based on bore hole survey data.

CO-5 Conduct Tacheometric survey using tacheometer.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Apply the principle of tacheometry. SO5.2 Describe theory of anallytic lens. SO5.3 Carryout Tacheometric survey of a given area	LE5.1 To determine the constants of a given Tacheometer. LE5.2 Calculate multiplying constant of a given tacheometer. LE 5.3 Measure distance and elevation of a station by tacheometric survey	**Unit 5.0 Tacheometry** 5.1 Introductions 5.2 Stadia Diaphragm and its Principle. 5.3 Theory of anallytic lens 5.4 Determination of multiplying and additive constant and distance and elevation formulae. 5.5 Tacheometric survey .	• Study tacheometric survey of any field project. • Study the calibration of tacheometer present in laboratory.

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 Sessional Work (SW) :

a. Assignments:

i. Explain the Theory of Anallytic lens

ii. Write the uses of Tacheometric survey in open cast mines.

b. Mini Project

i. prepare a report of tacheometric survey report of institution's bulding.

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

H) Suggested Specification Table (For ESA of Classroom Instruction):

Unit Number	Unit Titles	Hours	Total Marks
I	Levelling	14	20
II	Theodolite	14	18
III	Contouring	14	15
IV	Dip, Strike and Borehole Problems	12	10
V	Tacheometry	10	07
Total		**64**	**70**

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

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
1.	Find out the reduced level of different points with a given datum.	15	15	30
2.	Conduct leveling work with Auto level at given areas.	15	15	30
3.	Calculate R.L. of given point by H.I. method.	15	15	30
4.	Calculate R.L. of given point by rise and fall method.	15	15	30
5.	Measure and calculate sensitivity of bubble tube of a given level instrument.	15	15	30
6.	Calibrate levelling instruments in laboratory and removal of errors therein	15	15	30
7.	Calculate least count of a given theodolite	15	15	30
8.	Measure horizontal angles by repetition and reiteration method.	15	15	30
9.	Measure vertical angles to calculate height of tower/headgear.	15	15	30
10.	To carry out traversing work assuming your own conditions using theodolite.	15	15	30
11.	Calibrate the theodolite in laboratory.	15	15	30
12.	To draw a Contour a given area by direct method.	15	15	30
13.	To draw a Contour a given area by indirect method.	15	15	30
14.	Draw a plan by use of contour line at given location.	15	15	30
15.	Draw a layout of borehole survey design under given conditions.	15	15	30
16.	Sketch and describe dip and strike of seam in given conditions.	15	15	30
17.	To determine the constants of a given Tacheometer.	15	15	30
18.	Calculate multiplying constant of a given tacheometer.	15	15	30
19.	Measure distance and elevation of a station by tacheometric survey	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 Study Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Surveying vol-I and II	B.C. Punimia	Laxmi publication	Latest Edition
2	Mine surveying and leveling vol-1, 2, 3	S. ghatak	Coal field publishers.	7th Edition 2002

(b) Open source software and website address :

1. https://www.youtube.com/watch?v=MhbU0qyYt48.
2. https://www.youtube.com/watch?v=A-kf1oX_xJ0.
3. https://www.youtube.com/watch?v=Hp1atEWAmho.
4. https://www.youtube.com/watch?v=ZSuOeUGZE-4

(c) Others: Not Applicable

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Dumply level	Bubble sensitivity up to 36 seconds, minimum magnification power 24X, erect image type.	1,2,3,5,6
2	Auto level	Magnification power minimum 32X, minimum focusing range 50cm.	2
3	Vernier theodolite	Size minimum 15 cm, least count 10/20 seconds, telescope internal focusing and erect image type with stadia diaphragm.	7,8,9,10,11
4	Tacheometer	Minimum 16 cm size, least count 10/20 seconds, telescope internal focusing and erect image type with stadia diaphragm.	17,18,19

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 Use various levelling instruments to perform levelling work.	3	2	3	3	1	2	2	3	3	3	1	3
CO-2 Measure horizontal and vertical angles using theodolite.	3	2	3	3	1	2	2	3	3	3	2	3
CO-3 Draw a mine plan using principles of contouring.	3	3	3	2	2	2	2	3	2	3	-	3
CO-4 Apply techniques / methods of advance surveying in mining field**.**	2	2	3	3	2	2	2	3	3	3	-	3
CO-5 Conduct Tacheometric survey using tacheometer.	3	2	3	3	1	2	2	3	3	3	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7, 8,9,10 PSO – 1,2	CO-1 Use various levelling instruments to perform levelling work.	SO1.1 SO1.2 SO1.3 SO1.4 SO1.5 SO1.6	LE1.1 LE1.2 LE1.3 LE1.4 LE1.5 LE1.6	Unit 1.0 LEVELLING 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10	As mentioned in relevant page numbers
PO-1,2,3,4,5,6,7, 8,9,10 PSO -1,2	CO-2 Measure horizontal and vertical angles using theodolite.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5 SO2.6	LE2.1 LE2.2 LE2.3 LE2.4 LE2.5	Unit 2.0 THEODOLITE 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10,2.11	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 2	CO-3 Draw a mine plan using principles of contouring.	SO3.1 SO3.2 SO3.3 SO3.4	LE3.1 LE3.2 LE3.3	Unit 3.0 CONTOURING 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 2	CO-4 Apply techniques / methods of advance surveying in mining field.	SO4.1 SO4.2 SO4.3 SO4.4	LE4.1 LE4.2	Unit 4.0 DIP, STRIKE AND BORE HOLE PROBLEMS. 4.1,4.2,4.3,4.4,4.5	
PO-1,2,3,4,5,6,7, 8,9,10 PSO -1,2	CO-5 Conduct Tacheometric survey using tacheometer.	SO5.1 SO5.2 SO5.3	LE5.1 LE5.2 LE5.3	Unit 5.0 TACHEOMETRY 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 : 2039472(039)

B) Course Title : Winning and Working Metal

C) Pre- requisite Course Code and Title :

D) Rationale :

Though the present trend of Mining is for open cast mining to meet the hung national target but the importance of underground mining can not be ignored, the deep deposits of coal or metalliferous minerals can not be worked, but by underground mining. it is also a fact that accident ratio are more in under-ground mining than in open cast mining, yet where the OB ratio is beyond working limit, under ground mining become necessity.

As such the student should be well acquainted with the under ground mining both for coal and metal in this subject. other aspect of underground mining (coal) are dealt which are not covered previously . Similarly U/G mining (metalliferous) are also included to make a diploma pass out in mining perfect.

E) Course Outcomes :

CO-1 Appreciate the present condition of Indian metal mining industry.

CO-2 Perform various development work in underground metal mines.

CO-3 Use appropriate stoping method under different strata conditions.

CO-4 Use suitable data related to famous metal mining areas of India.

CO-5 Carryout sampling for given rock formation efficiently.

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		
2039472(039)	2	1	0	70	20	30	0	0	120	3

Legend: L= CI: Classroom Instruction (Includes different instructional strategies i.e. Lecture (L) and others)

P=LI : Laboratory Instruction (Includes Practical performances in laboratory workshop, field or other locations using different instructional strategies)

T=SW: Sessional Work (includes assignment, seminar, mini project etc.),SL: Self Learning, Tutorial (T)

C=Credits,

Note: SW & SL has to be planned and performed under the continuous guidance and feedback of teacher to ensure outcome of Learning.

G) 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 Appreciate the present condition of Indian metal mining industry.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Define the terms used in Metal mining. SO1.2 Elaborate the limitations of underground metal mining SO1.3 Describe present status of metal mining industry in India.		**Unit 1.0 General Introduction** 1.1 Present status of Indian metal mining industry. 1.2 Scope and limitation of underground metal mining with reference to feasibility, safe working conditions, economic value of mineral. 1.3 Important metal mining terminology.	• Identify and locate various underground metal mines in India and write their brief historical development about these mines. • Elaborate the development of underground metal mining industry and analyze the prospects about their future development.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Prepare a map and locate the different metal mines and write brief historical background about development of these mines.

ii. Enlist various metal mining terminology and define them.

b. Mini Project:

i. Prepare a model of Cyclone dust sampler.

c. Other Activities (Specify):

ii. Visit a nearby mine where dust sampler being used and prepare a report comprises of its major specifications / features, working and applications.

CO-2 Perform various development work in underground metal mines.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Identify factors affecting level interval SO2.2 Describe ore bins and orepass system. SO2.3 Identify the applicability of Cross cut and drift under the	LE2.1 Sketch and describe cross cuts, drifts and other modes of access used for underground metal mines. LE2.2 Sketch and describe alimak raise climber used for raising in	**Unit 2.0 Development in U/G Metal Mines** 2.1 factors affecting level intervals and back/block length, formation of stations, ore bins, main ore pass system, grizzly. 2.2 Modes of access 2.2.1 Cross-cuts and drift.	• Elaborate various raising methods used in metal mining industry in India and other parts of the world. • Study and describe in

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
given condition. SO2.4 Apply various raising methods in underground metal mines. SO2.5 Select suitable machinery used in various raising methods.	underground metal mines. LE2.3 Sketch and describe longhole boring method used for raising in underground metal mines. LE2.4 Sketch and describe vertical crater retreat method for raising in underground metal mines.	2.2.2 Raises and winzes – their shape, size and position, Modern methods of raising - (a) Alimak raise climber and Jora-lift raising, (b) Longhole method (c) Vertical crater retreat method of raising; (d) Raise boring with reaming.	brief about various safety features used in raising methods in underground metal mines of India and abroad. • Develop a picture story about major raising methods used at present scenario.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

i. Write factor affecting level interval.
ii. Compare alimak raise climber and jora raise method.
iii. Differentiate Raise and Winze.

b. Mini Project:

i. Prepare a model of Alimak Raise Climber/ Jora Raise.

c. Other Activities (Specify):

i. Visit a nearby U/G metal mine where Alimak Raise Climber/ Jora Raise/VCR/Long Hole method is adopted.

CO-3 Use appropriate stoping method under different strata conditions.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Identify factors affecting choice of stoping method. SO3.2 Describe various stoping methods used in underground metal mines. SO3.3 Identify the	LE3.1 Prepare a stull support platform for overhand stopping method to support at least 4 miners. LE3.2 Sketch and describe suitable numbers of post, caps and girts from given sets of timbers. LE3.3 Arrange square set timbers at least	**Unit 3.0 Stoping Method** 3.1 Factors governing the choice of stoping methods. 3.2 classification of stoping methods- 3.2.1 Overhand, Underhand and breast stoping method. 3. 2.2 Stopes naturally supported- (a) Sublevel	• Prepare a picture gallery with description about the following stoping methods:- 1. Sublevel stoping. 2. Room and pillar stoping. 3. Stopes

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
factors responsible for choice of different stoping methods. SO3.4 Select suitable machinery used in different stoping methods in the given situation. SO3.5 Apply various safety features used in different underground metal mining methods.	4x4x4 Cubical blocks. LE3.4 Design and draw suitable plan for square set timbering. LE3.5 Design a face of shrinkage method of stopping and calculate percentage of production per block. LE3.6 Calculate the percentage of extraction for given size of room and pillars.	stoping. (b) Room and pillar stoping. 3.2.3 Stopes artificially supported- a. Shrinkage stoping- b. Cut-and-fill stoping. c. Square-set stoping. 3.2.4 Caved stopes- a. Block caving; b. Sublevel caving. c. Top slicing	artificially supported- a. Shrinkage stoping- b. Cut-and-fill stoping. c. Square-set stoping. 4. Caved stopes- a. Block caving; b. Sublevel caving. c. Top slicing

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

i. Compare Underhand and Overhand stoping.
ii. Compare sublevel stoping and sublevel caving.
iii. Design square set timbering method for a given strata condition.

b. Mini Project:

i. Prepare a model of Room and Pillar stoping method.

c. Other Activities (Specify):

i. Visit a nearby underground metal mines and prepare a report on it.

CO-4 Use suitable data related to famous metal mining areas of India.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Identify the problems associated with deep mines. SO4.2 Describe Bherveli mines with reference to working,		**Unit 4.0 Case Studies on Indian Metal Mines** 4.1 Kolar gold mines- problems of deep mining. 4.2 Manganese ore mine- (Balaghat). 4.3 Mosabani copper	• Elaborate briefly some of the most profitable and deepest underground metal mines of world.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
transportation and safety features under prevailing condition therein. SO4.3 Explain Mosabani copper mines with reference to working, transportation and safety features under prevailing condition therein. SO4.4 Describe Khetri copper mine with reference to working, transportation and safety features under prevailing condition therein. SO4.5 Jaduguda uranium mines working, transportation and safety features under prevailing condition therein.		mines. 4.4 Khetri copper mines. 4.5 Jaduguda uranium Mines.	• Study about the future prospects of application of underground metal mining in India.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

i. Write an essay on Khetri copper mines.

ii. Write problems associated with deep mining and suggest suitable solution of them.

b. Mini Project

i. Prepare a model of underground metal mining method used in khetri ,Balaghat, Jaduguda mines.

c. Other Activities (Specify):

i. Visit Jaduguda mines and prepare a report on it.

ii. prepare a report of the nearby underground metal mine visit.

CO-5 Carryout sampling for given rock formation efficiently.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 apply the principles of sampling under the given	LE5.1 Collect a sample of 5 kg. and reduce it by conning and	**Unit 5.0 Sampling and Salting** 5.1 definition and related terms	• Elaborate about the sampling method used

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
condition. SO5.2 Describe the purpose of sampling. SO5.3 Use various sampling methods for mining activities in the given situation. SO5.4 Describe procedure of reduction of samples size. SO5.5 Identify the purpose of salting its use in sampling methods.	quartering up to 200 gm sample size. LE5.2 Measure samples of 200 gm. Each , pack them and tag in a proper way. LE5.3 carryout chip sampling and find its result. LE 5.4 carryout channel sampling and find its result.	5.2 Purpose of sampling and various uses of sampling 5.3 Classification of sampling methods- 5.3.1 Stope sampling 5.3.2 Channel sampling 5.3.3 Chip sampling 5.3.4 Bulk sampling 5.3.5 Drill Sampling 5.4 reduction of sample size-coning and quartering. 5.5 Salting 5.5.1 Classification of salting methods. 5.6 Safety against salting.	in nearby mine visited during industrial visit. • Study the sampling method used in various metal mines in India and abroad.

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

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

i. Write purpose of sampling.
ii. Compare chip and channel sampling.
iii. Explain safety against salting.

b. Mini Project:

i. collect samples from nearby mines and perform sampling of the collected samples.

c. Other Activities (Specify):

i. To collect sample from nearby mines by different methods.

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

H) Suggested Specification Table (For ESA of Classroom Instruction):

Unit Number	Unit Titles		Total Marks
I	General	06	08
II	Development	10	17
III	Stoping Method	18	27
IV	Case study of some Important Metal Mines	06	08
V	Sampling and Salting	08	10
Total		**48**	**70**

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

J) Suggested Instructional/Implementation Strategies:

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

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Elements of Mining Technology	D.J. Deshmukh	Denett and Co. Nagpur	2016
2	A study of metalliferous mining method	Y.P. chacharkar	Lovely Prakashan, Dhanbad	2014

(b) Open source software and website address :

1. https://www.youtube.com/watch?v=Ruo0YrLGAwA
2. https://www.hindustancopper.com/Page/KCCPlant
3. http://moil.nic.in/

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Square set stoping model	With timber support and minimum dimension of 25 by 15 cm	8
2	Stoping models	With relevant support system, loading arrangements and mechanization.	3,4,5,6,7,8,9,10
3	Raising models	With relevant support and mechanization.	2

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 Appreciate the present condition of Indian metal mining industry.	3	3	1	2	2	2	1	2	2	3	1	-
CO-2 Perform various development work in underground metal mines.	3	3	2	2	2	3	2	2	2	3	-	2
CO-3 Use appropriate stoping method under different strata conditions.	3	3	3	2	2	3	2	2	2	3	2	3
CO-4 Use suitable data related to famous metal mining areas of India.	2	3	2	3	2	3	2	2	2	2	2	-
CO-5 Carryout sampling for given rock formation efficiently.	3	3	2	2	2	3	3	2	2	3	1	2

Legend: 1 – Low, 2 – Medium, 3 – High

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 1	CO-1 Appreciate the present condition of Indian metal mining industry.	SO1.1 SO1.2 SO1.3		Unit 1.0 General Introduction- 1.1,1.2,1.3	As mentioned in relevant page numbers
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 2	CO-2 Perform various development work in underground metal mines.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LE2.1 LE2.2 LE2.3 LE2.4	Unit 2.0 Development in U/G Metal Mines- 2.1,2.2	
PO-1,2,3,4,5,6,7, 8,9,10 PSO – 1, 2	CO-3 Use appropriate stoping method under different strata conditions.	SO3.1 SO3.2 SO3.3 SO3.4	LE3.1 LE3.2 LE3.3 LE3.4 LE3.5 LE3.6	Unit 3.0 Stoping Method- 3.1,3.2	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 1	CO-4 Use suitable data related to famous metal mining areas of India.	SO4.1 SO4.2 SO4.3 SO4.4 SO4.5		Unit 4.0 Case studies on Indian Metal Mines- 4.1,4.2,4.3,4.4,4.5	
PO-1,2,3,4,5,6,7, 8,9,10 PSO – 1, 2	CO-5 Carryout sampling for given rock formation efficiently.	SO5.1 SO5.2 SO5.3 SO5.4 SO5.5	LE5.1 LE5.2 LE5.3 LE5.4	Unit 5.0 Sampling and Salting- 5.1,5.2,5.3,5.4,5.5,5.6	

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 : 2039473(039)
B) Course Title : Mine Environment & Pollution Control
C) Pre- requisite Course Code and Title :
D) Rationale :

It is essential to study the technology applied in mining field. Under ground coal mining practice involves careful planning with due regards to safety of men, material and mine, optimum production with consideration to conservation of mineral. Underground mining methods are considered more hazardous due to its procedure of winning under extremely difficult conditions inviting chances of infringement of safety.

E) Course Outcomes :

CO-1 Measure and minimize the dust concentration present in the mine environment.

CO-2 Operate various air pollution control devices.

CO-3 Apply the concepts of environmental engineering for prevention and control of water pollution.

CO-4 Apply the techniques of environmental engineering to reduce the noise produced in mine workings.

CO-5 Implement the laws and regulations relevant to the environment conservation in mine workings.

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		
2039473(039)	2	1	2	70	20	30	40	60	220	4

G) 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 Measure and minimize the dust concentration present in the mine environment.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Identify physiological effect of Mine Dust in the given situation. SO1.2 Explain working principles and constructional features of given dust sampling equipment. SO1.3 Identify and take measures for prevention of occupational diseases due to dust.	LE1.1 Measure the dust concentration of given sample of air using konimeter. LE1.2 Measure dust concentration using electro static precipitator. LE1.3 Sketch and describe various types of dust sampling instruments.	**Unit 1.0 Mine Dust** 1.1 Classification of mine dust. 1.2 Physiological effects, measurement of dust concentration, size of dust particles. 1.3 Sampling of air borne dust, prevention and suppression of dust, Threshold Limit Value (TLV) 1.4 Dust sampling method and its equipment. 1.5 Occupational diseases due to dust.	• Use available literature, manuals, standards and websites to explore applicable Acts/ Laws for mine dust concentration. • Study the dust measuring method adopted for finding dust concentration in nearby mine and by weather monitoring department of your area

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Write Physiological effects of Mine dust.
ii. Write occupational diseases and its effect on human body.

b. Mini Project:

i. Prepare a model of Cyclone dust sampler.

c. Other Activities (Specify):

i. Visit a nearby mine where dust sampler being used and prepare a report comprises of its major specifications / features, working and applications.

CO-2 Operate various air pollution control devices.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Identify causes and consequences of air pollution. SO2.2 Apply basic techniques to prevent and control air pollution in the	LE2.1 Operate air pollution control devices for a given sample of air. LE2.2 Detect various gases resulting from blasting using suitable detectors.	**Unit-2.0 Air Pollution** 2.1 Air pollution - 2.1.1 Air pollution due to various gases and suspended particulate matter 2.1.2 Causes , consequences	• Watch video film/ animations/ photographs etc. related to air pollution. • Effects of air pollution and preventive

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
given situation. SO2.3 Use The Air(Prevention and control of pollution)Act for the abatement of air pollution due to mining activities .	LE2.3 Measure the amount of suspended particulate matter (SPM) in a given sample of air.	and preventive measures of air pollution 2.1.3 Ambient air quality standards in India. 2.2 Air pollution due to blasting of explosives, effects and control. 2.3 The Air (Prevention and control of Pollution)Act 1981.	measures used for its control in nearby mines. • Study the reports submitted with regard to air pollution by nearby mines.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

i. Write ambient air quality standards in India.
ii. Write the causes, consequences, preventive measures of air pollution.

b. Mini project:

i. Prepare a model of various dust sampling instruments.

c. Other Activities (Specify):

i. Prepare a banner/ animations/photograph etc. related to issue of air pollution.

CO-3 Apply the concepts of environmental engineering for prevention and control of water pollution.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Identify causes and preventive measure of water pollution. SO3.2 Apply techniques to minimize acid mine drainage SO3.3 Describe the procedure of BOD and COD calculation.	LE3.1 Determination of Biochemical Oxygen Demand (BOD) of Waste water samples. LE3.2 Determination of Chemical Oxygen Demand (COD) of Waste water samples. LE3.3 Carryout the treatment of acid mine drainage.	**Unit-3.0 Water Pollution** 3.1 Water pollution 3.1.1 Causes and preventive measures of water pollution 3.2 Acid-mine drainage 3.3 Water Treatment plants 3.4 Bio Chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS).	• Study properties of pure water. • Study the effects of mining activity of nearby mines in adjoining water bodies. • Study the report related to water pollution submitted by nearby mine.

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

i. Write the causes and preventive measures of acid mine drainage.
ii. Write a procedure of BOD and COD calculation of a given waste water sample.

b. Mini Project:

i. Prepare a model of water treatment plant.

c. Other Activities (Specify):

i. Visit a nearby water treatment plants and submit a report on it.

CO-4 Apply the techniques of environmental engineering to reduce the noise produced in mine workings.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Identify the sources and consequences of noise pollution SO4.2 Apply the safety measures used for the abatement of noise. SO4.3 Operate and use the various instruments used for measuring ground vibration.	LE4.1 Measure the noise level using sound level meter. LE4.2 Measure the ground vibration produced due to blasting.	**Unit-4.0 Noise Pollution** 4.1 Pollution due to noise and its consequences, 4.1.1 Noise produced by different machinery. 4.2 Control and safety measurement of noise levels. 4.3 Ground vibration: causes, precaution, prevention and reduction.	• Collect data related to noise pollution , its effects and preventive measures taken at various locations in mine and prepare a comparative report on it.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

i. Enlist different noise producing machinery along with their noise levels.
ii. Write the safety measures adopted for the abatement of noise.

b. Mini project:

i. Prepare a report on damage caused due to ground vibration and suggest preventive measures to control the same in nearby mine.

CO-5 Implement the laws and regulations relevant to the environment conservation in mine workings.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Describe the organizational structure for state pollution control board. SO5.2 Describe the procedure for obtaining mining	LE5.1 Perform the procedure for measuring Air quality index using suitable equipment. LE5.2 Prepare a detailed flowchart of land reclamation	**Unit-5.0 Law and Rules Related to Environment** 5.1 Central and state pollution control board. 5.2 Air quality index E 5.3 Environment Protection Act and Rule 1986. (Provisions	• Study the land reclamation method and its application of nearby abandoned mines. • Study about the standards

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
leasehold. SO5.3 Enlist the provisions of environment protection act 1986.	process.	applicable related to Mining operation only) 5.4 Land reclamation Process. 5.5 Water Conservation Act of 2009. 5.6 Indian forest Act 1927.(provision related to mining)	of air quality index maintained in 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:

i. Make a poster for awareness regarding water conservation.
ii. Write the provisions of Indian forest Act 1927.
iii. Write application of GPS and GIS in mining field.

b. Mini Project

i. Prepare a report on mine closure.

c. Other Activities (Specify):

i. Prepare and present PPT on mine reclamation process.

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

H) Suggested Specification Table (For ESA of Classroom Instruction):

Unit Number	Unit Titles	Hours	Total Marks
I	Mine Dust	12	18
Ii	Air Pollution	13	17
Iii	Water Pollution	09	13
Iv	Noise Pollution	08	12
V	Law and Rules Related to Environment	06	10
Total		**48**	**70**

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

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
1	Measure the dust concentration of given sample of air using konimeter.	15	15	30
2	Measure dust concentration using electro static precipitator.	15	15	30
3	Sketch and describe various types of dust sampling instruments.	15	15	30
4	Operate air pollution control devices for a given sample of air	15	15	30
5	Detect various gases resulting from blasting using suitable detectors	15	15	30
6	Measure the amount of suspended particulate matter(SPM) in a given sample of air.	15	15	30
7	Determination of Biochemical Oxygen Demand (BOD) of Waste water samples.	15	15	30
8	Determination of Chemical Oxygen Demand (COD) of Waste water samples.	15	15	30
9	Demonstration of treatment of acid mine drainage.	15	15	30
10	Measure the noise level using sound level meter.	15	15	30
11	Measure the ground vibration produced due to blasting.	15	15	30
12	Perform the procedure for measuring Air quality index using suitable equipment.	15	15	30
13	Prepare a detailed flowchart of land reclamation process	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 Study Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Mine Environment and Ventilation	G.B. Mishra	Oxford University Press	Illustrated reprint, 1986
2	Water Conservation Act of 2009.	GOI	GOI	2009
3	Explosive and Blasting techniques	G.K. Pradhan	Mintech publication Bhubaneswar	2014
4	Indian forest Act 1927	GOI	GOI	
5	The Air (Prevention and control of Pollution)Act 1981.	GOI	GOI	

(b) Open source software and website address :

1. https://www.youtube.com/watch?v=_Da4h4V9IBU.
2. https://www.slideshare.net/shalusaraf/air-prevention-control-of-pollution-act-1981.
3. https://www.youtube.com/watch?v=s8YROQxtaro.
4. http://envfor.nic.in/legis/env/env1.html

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Konimeter	Dust sampler with dust measurement up to 2.5ppm	1
2	Electrostatic Precipitator	Electrostatic precipitator with dry and wet filter .	2
3	Multi gas detector	Capable of detection of gases like oxygen , carbondioxide , carbonmonooxide, hydrogen sulphide.	5
4	Sound level meter	Capable of measuring noise up to 4000 hertz.	10

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	Measure and minimize the dust concentration present in the mine environment.	3	2	3	3	3	3	3	2	2	3	1	2
CO-2	Operate various air pollution control devices.	3	2	3	3	3	3	3	2	2	3	2	-
CO-3	Apply the concepts of environmental engineering for prevention and control of water pollution.	3	2	3	3	3	3	3	2	2	3	-	3
CO-4	Apply the techniques of environmental engineering to reduce the noise produced in mine workings.	3	2	3	3	3	3	3	2	2	3	2	2
CO-5	Implement the laws and regulations relevant to the environment conservation in mine workings.	2	2	1	1	3	3	3	2	3	3	2	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-1,2,3,4,5,6,7, 8,9,10 PSO – 1,2	CO-1 Measure and minimize the dust concentration present in the mine environment.	SO1.1 SO1.2 SO1.3	LE1.1 LE1.2 LE1.3	Unit 1.0 Mine Dust 1.1,1.2,1.3,1.4,1.5	As mentioned in relevant page numbers
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 1	CO-2 Operate various air pollution control devices.	SO2.1 SO2.2 SO2.3	LE2.1 LE2.2 LE2.3	Unit 2.0 Air Pollution. 2.1,2.2,2.3	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 2	CO-3 Apply the concepts of environmental engineering for prevention and control of water pollution.	SO3.1 SO3.2 SO3.3	LE3.1 LE3.2 LE3.3	Unit 3.0 Water Pollution 3.1,3.2,3.3,3.4	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 1,2	CO-4 Apply the techniques of environmental engineering to reduce the noise produced in mine workings.	SO4.1 SO4.2 SO4.3	LE4.1 LE4.2	Unit 4.0 Noise Pollution 4.1,4.2,4.3	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 1,2	CO-5 Implement the laws and regulations relevant to the environment conservation in mine workings.	SO5.1 SO5.2 SO5.3	LE5.1 LE5.2	Unit 5.0 0 Law and Rules Related to Environment 5.1,5.2,5.3,5.4,5.5,5.6	

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 : 2039474(039)
B) **Course Title** : **Winning and Working (Coal)**
C) Pre- requisite Course Code and Title :
D) Rationale :

Though the present trend of mining is for open cast mining, the importance of underground mining cannot be ignored. The deep deposits of coal can only be worked by underground mining. It is also a fact that accident ratio are more in under-ground mining than in open cast mining, yet where the Over Burden ratio is beyond working limit, underground mining becomes the necessity. This course is designed to make students comprehend different mining methods used for underground mining of coal, safety measures and management of other related operations such as.

E) Course Outcomes :

CO-1 Select suitable method of mining as per requirement.

CO-2 Apply Bord & Pillar method efficiently and safely.

CO-3 Apply Longwall mining method in given situation.

CO-4 Use thick seam mining method in given situation effectively and safely.

CO-5 Undertake special mining methods under given conditions.

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		
2039474(039)	2	1	2	70	20	30	40	60	220	4

G) Course-Curriculum Detailing:

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

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

CO-1 Select suitable method of mining as per requirement.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO1.1 Describe mode of occurrence and use of fossils. SO1.2 Describe the coal formation process. SO1.3 Identify factors affecting the coalification. SO1.4 Identify coal seam abnormalities. SO1.5 Select suitable coal mining method for a given situation. SO1.6 Prepare a note on present scenario of coal mining industry in India. SO1.7 Enlist the petroleum deposit in India	LE1.1 Identify coking coal from given sample of coal. LE1.2 Identify non-coking coal from given sample of coal. LE1.3 Identify coal seam abnormalities in mine plan LE1.4 Prepare a brief account of present situation of coal mining industry in India	**Unit-1.0 Introduction** 1.1 Fossils – Definition, 1.1.1 Fosssilisation and use of fossils. 1.2 Origin of Coal, 1.2.1 Coalification 1.2.2 Theories of Coal formation – In situ theory, Drift theory, 1.2.3 Classification of Coal Peat, Lignite, Bituminous and Anthracite, 1.2.4 Coking and non Coking coal. 1.2.5 Chemical properties of coal with reference to production of coal gas , water gas and producer gas. 1.2.6 Coal seam abnormalities. 1.3 Factors affecting the choice of Coal Mining Methods. 1.4 choice of coal mining methods. 1.5 Occurrence of coal in India with special reference to C.G. 1.6 introduction to Indian coal mining industry 1.7 Petroleum , 1.7.1 Origin of petroleum, 1.7.2 Petroleum deposits of India.	• Collect data related to suitable method of mining applied under situation present in near by mine through industrial visit. • Classify the grade of coal on basis of grades of major coal bearing areas of India. • Elaborate the alternative sources of energy emerging to replace coal and petroleum in future.

SW-1 Suggested Sessional Work (SW):

a. Assignments:

i. Explain the theories of coal formation.
ii. Select coal mining method under given situation.
iii. Describe coal seam abnormalities.

b. Mini Project:

i. Prepare a detailed report of mining methods used in mine visited during industrial visit.

CO-2 Apply Bord & Pillar method efficiently and safely.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO2.1 Select the appropriate size and shape of pillars at given depth. SO2.2 Apply the cycle of operation involved in depillaring . SO2.3 Describe and use different pillar extraction techniques. SO2.4 Identify the conditions for application of mechanized bord and pillar mining method. SO2.5 prepare systematic support framework for the given conditions in bord and pillar method.	LE2.1 Plan and draw a layout of Bord and Pillar development and working without panel system. LE2.2 Plan and draw a layout of Bord and Pillar development and working with panel system. LE2.3 Plan and draw mechanized bord and pillar mining. LE2.4 Compute percentage of extraction in bord and pillar method for given size of gallery and pillar.	**Unit-2.0 Bord and Pillar method** 2.1 Important Terminology related to bord and pillar mining, 2.2 Classification of bord and pillar system 2.3 Size and Shape of Pillar, Galleries, Size of Panel, Size of barrier, Cycle of Operation. 2.4 Depillaring 2.4.1 Problems in Depillaring, 2.4.2 Preparatory Arrangements, 2.4.3 Depillaring by Stowing method 2.4.4 Depillaring by Caving Method, 2.4.5 Dangers Associated With Depillaring 2.5 Pillar Extraction Techniques 2.5.1 Factors influencing choice of pillar extraction techniques. 2.6 Mechanization 2.6.1 Factors affecting Mechanization 2.6.2 Mechanized bord and pillar mining. 2.6 Numerical on percentage of Extraction. 2.7 Systematic support system.	• Study bord and pillar method applied in nearby mine through industrial visit. • Study the standard operating procedures applied in the visited mine. • Study the variation in systematic support rule applied in the visited mine. • Study the mechanizatio n involved in the standard operating procedures in visited mine.

SW-2 Suggested Sessional Work (SW) :

a. Assignments:

i. Write the suitable conditions for bord and pillar method.

ii. Write the factors affecting the choice of mining methods.

b. Mini Project:

i. Compute the total load acting on a pillar for the given data.
ii. Prepare a model of bord and pillar mining showing ventilation control devices and transporting arrangements.

c. Other Activities (Specify):

i. Make a group of 10 members and visit any mine working with bord and pillar technique in your locality.

CO-3 Apply longwall mining method in given situation.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO3.1 Select a appropriate length of longwall face. SO3.2 Explain single unit and double unit of longwall faces. SO3.3 Explain longwall advancing and longwall retreating method of mining. SO3.4 Identify the merits and demerits of longwall mining under given conditions. SO3.5 Apply basic standard operating procedures of longwall mining.	LE3.1 Design a layout of Logwall Advancing system. LE3.2 Design a layout of Logwall Retreating system. LE 3.3 Plan and draw a layout of longwall Double unit face in given conditions. LE 3.4 draw a layout of mechanization applied in a longwall mine.	**Unit-3.0 Longwall Mining** 3.1 Important Terminology, 3.2 Types of Longwall Faces and Their Choice, 3.2.1 Single and Double Unit Longwall Faces 3.3 Development of Longwall Panels and Faces, 3.4 Longwall Advancing Method, 3.5 Longwall Retreating Method, 3.6 Length Of Longwall Faces, 3.6.1 Direction Of Face Advance, 3.7 Face Organization, 3.8 Longwall mining with coal plough. 3.9 Introduction to variants of long wall mining 3.10 Merits and Demerits of Longwall Mining ,	• Study about suitability and applicability of longwall method of mining. (preferably with a mine visit of a underground longwall mine) • Study the mechanization and powered support used in near by mine visited during industrial visit. • Analyze the future prospects for application of longwall mining in India

SW-3 Suggested Sessional Work (SW) :

a. Assignments:

i. Prepare a brief account of longwall advancing and retreating methods.
ii. Draw a layout of single unit longwall retreating mining method.

iii. List the Preparatory arrangements required for extraction of a Double unit longwall face.

b. Mini Project:

i. Prepare a model of longwall advancing method showing stowing, transportation system and face arrangements.

c. Other Activities (Specify):

i. Make a group of 10 members and visit any mine working with longwall mining technique in your locality

CO-4 Use thick seam mining method in given situation effectively and safely.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO4.1 Identify various problems associated with thick seam mining. SO4.2 Select appropriate method of thick seam mining under the given conditions. SO4.3 Describe the working of blasting gallery method. SO4.4 apply the methods of the working in contiguous seams.	LE4.1Prepare a layout of blasting gallery method assuming your own condition. LE4.2Prepare a layout of inclined slicing, horizontal, diagonal slicing, transverse slicing and sublevel caving method assuming your own suitable condition. LE4.3Sketch and describe situation for application of cable bolting method.	**Unit-4.0 Thick Seam Mining** 4.1 Problems in Mining of Thick Seams, 4.2 Choice Of Thick Seam Mining Methods, 4.3 Method Of Thick Seam Extraction 4.3.1 Inclined Slicing, 4.3.2 Horizontal Slicing, 4.3.3 Diagonal Slicing, 4.3.4 Transverse Slicing, 4.3.5 Sublevel Caving, 4.3.6 Blasting Gallery Method, 4.3.7 Cable-Bolting method 4.3.8 French method of working thick seam. 4.4 Contiguous seam.	• Study of different mining methods applied in a thick seam with suitable conditions in near by mine visited during industrial visit. • study of support system applied in thick seam of visited mine. • Study different case studies about application of underground gasification of coal and coal bed methane.

SW-4 Suggested Sessional Work (SW) :

a. Assignments:

i. Enlist and explain the factors affecting the choice of thick seam mining methods.
ii. Compare different types of slicing methods.
iii. Prepare a brief account about the present application and future prospects of underground gasification of coal and coal bed methane.

b. Mini Project :

i. Prepare a model showing blasting gallery method.

c. Other Activities (Specify):

i. Visit a nearby mine and prepare a report on it.

CO-5 Undertake special mining methods under given conditions.

Session Outcomes (SOs)	Laboratory Instruction (LI)	Class room Instruction (CI)	Self Learning (SL)
SO5.1 Explain the suitability and applicability of horizon mining. SO5.2 Enlist the causes of air blast and Bumps. SO5.3 Deal with the problems associated with deep seam mining.	LE5.1 Draw a layout of room and pillar method of mining assuming own data. LE5.2 Plan and draw a layout of horizon mining method. LE5.3 Draw a layout for underground gasification of coal.	**Unit-5.0 Special Mining Methods** 5.1 Room and Pillar method, 5.2 Horizon Mining method 5.3 Mining of Seams below water bodies. 5.4 Shortwall mining. 5.5 Problems associated with mining deep seams. 5.6 Underground coal gasification 5.7 introduction to coal bed methane (CBM) recovery 5.8 Air blast, Bumps, Rock burst Local fall, Main fall	• Case study of different variants of special mining methods and their applicability in Indian conditions. • Case study of recent application of underground gasification of coal and coal bed methane in the world.

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

SW-5 Suggested Sessional Work (SW) :

a. Assignments:

i. Write the advantages and disadvantages of room and pillar method of mining over bord and pillar method of mining.
ii. Sketch and describe horizon mining method.
iii. Summarize the reasons resulting in Air blast/Bumps/Local fall/Main fall.

b. Mini Project :

i. Prepare a model of air blast

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

H) Suggested Specification Table (For ESA of Classroom Instruction):

Unit Number	Unit Titles	Hours	Total Marks
I	Introduction	12	18
II	Bord and Pillar Method	12	18
III	Longwall Mining	10	12
IV	Thick Seam Mining	08	12
V	Special Mining Methods	06	10
Total		**48**	**70**

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

Laboratory Instruction Number	Short Laboratory Experiment Title	Assessment of Laboratory Work (Marks)		
		Performance		Viva-Voce
		PRA	PDA	
1	Identify coking coal from given sample of coal.	15	15	30
2	Identify non-coking coal from given sample of coal.	15	15	30
3	Identify coal seam abnormalities in mine plan	15	15	30
4	prepare a brief account of present situation of coal mining industry in India	15	15	30
5	Plan and draw a layout of Bord and Pillar development working by without panel system.	15	15	30
6	Plan and draw a layout of Bord and Pillar development working by panel system.	15	15	30
7	Plan and draw mechanized bord and pillar mining.	15	15	30
8	Compute percentage of extraction in bord and pillar method for given size of gallery and pillar.	15	15	30
9	Design a layout of Longwall Advancing system.	15	15	30
10	Design a layout of Longwall Retreating system.	15	15	30
11	Plan and draw a layout of longwall Double unit face in given conditions	15	15	30
12	draw a layout of mechanization applied in a longwall mine.	15	15	30
13	Prepare a layout of blasting gallery method assuming your own condition.	15	15	30
14	Prepare a layout of inclined slicing ,horizontal , diagonal slicing, transverse slicing and sublevel caving method assuming your own suitable condition.	15	15	30
15	Sketch and describe situation for application of cable bolting method .	15	15	30
16	Draw a layout of room and pillar method of mining assuming own data.	15	15	30
17	Plan and draw a layout of horizon mining method.	15	15	30
18	Draw a layout for underground gasification of coal.	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 Study Method
4. Group Discussion
5. Industrial visits
6. Industrial Training
7. Field Trips
8. Portfolio Based Learning
9. Role Play
10. Demonstration
11. ICT Based Teaching Learning (Video Demonstration, CBT, Blog, Face book, Mobile)
12. Brainstorming
13. Others

K) Suggested Learning Resources:

(a) Books :

S. No.	Title	Author	Publisher	Edition & Year
1	Elements of mining technology vol-1	D.J. Deshmukh	Denett. & Co.	2008
2	Principles and practices of modern coal mining	R.D. Singh	New Age International	latest
3	Coal mining in India	S.P. Mathur	Sahyog prakashan bilaspur	2008

(b) Open source software and website address :

1. https://coal.nic.in/
2. https://www.youtube.com/watch?v=WUwdqSlxXuw
3. https://www.youtube.com/watch?v=NsiGV7lmNXE
4. https://www.youtube.com/watch?v=9zyKqCl-sHU

(c) Others:

1. Demonstration Videos of bord and pillar and longwall mining method.

L) List of Major Laboratory Equipment and Tools:

S. No.	Name of Equipment	Broad Specifications	Relevant Experiment Number
1	Bord & Pillar model	Stationary model with support and pillar arrangements.	5,7
2	Longwall methods model	Stationary model with powered support and AFC arrangements.	6,8,9,10,11,12

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 Select suitable method of mining as per requirement.	3	3	2	2	2	3	2	2	2	3	2	3
CO-2 Apply bord and pillar method efficiently and safely.	3	3	2	3	2	3	2	3	2	3	-	3
CO-3 Apply longwall mining method in given situation.	3	3	2	3	2	3	2	3	2	3	-	3
CO-4 Use thick seam mining method in given situation effectively and safely.	3	3	3	2	2	3	3	2	2	3	1	3
CO-5 Undertake special mining methods under given conditions.	3	2	2	2	2	3	2	3	2	3	2	1

Legend: 1 – Low, 2 – Medium, 3 – High

N) Course Curriculum Map:

POs & PSOs No.	COs No. & Titles	SOs No.	Laboratory Instruction (LI)	Classroom Instruction (CI)	Self Learning (SL)
PO-1,2,3,4,5,6,7, 8,9,10 PSO – 1,2	CO-1 Select suitable method of mining as per requirement	SO1.1 - SO1.7	LE1.1 LE1.2 LE1.3 LE1.4	Unit 1.0 Introduction 1.1,1.2,1.3,1.4,1.5,1.6,1.7	As mentioned in relevant page numbers
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 2	CO-2 Apply bord and pillar method efficiently and safely.	SO2.1 SO2.2 SO2.3 SO2.4 SO2.5	LE2.1 LE2.2 LE2.3 LE2.4	Unit 2.0 Bord and Pillar Method 2.1,2.2,2.3,2.42.5,2.6,2.7	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 2	CO-3 Apply longwall mining method in given situation.	SO3.1 SO3.2 SO3.3 SO3.4	LE3.1 LE3.2 LL3.3 LE3.4	Unit 3.0 Longwall Mining 3.1,3.2,3.3,3.4,3.5,3.6,3.7,3.8,3.9,3.10	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 1,2	CO-4 Use thick seam mining method in given situation effectively and safely.	SO4.1 SO4.2 SO4.3 SO4.4	LE4.1 LE4.2 LE4.3	Unit 4.0 Thick Seam Mining 4.1,4.2,4.3,4.4	
PO-1,2,3,4,5,6,7, 8,9,10 PSO - 1,2	CO-5 Undertake special mining methods under given conditions.	SO5.1 SO5.2 SO5.3	LE5.1 LE5.2 LE5.3	Unit 5.0 Special Mining Methods 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 : 2039464(039)

B) Course Title : Minor 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.

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		
2039464(039)	0	0	2	0	0	0	40	60	100	1

G) 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.