Curriculum

Three Year (Six Semesters) Diploma Course In

MINING ENGINEERING

==========

3rd Semester to 6th Semester

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Prepared by:

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Curriculum Development Cell

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INSTITUTE OF RESEARCH DEVELOPMENT & TRAINING U. P., KANPUR-208002

UPDATED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P. LUCKNOW IN C.D.C MEETING HELD ON 16.07.2026

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PREFACE

An important issue generally debated amongst the planners and educators' world is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programs. The curricula for diploma programs have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma program.

The real success of the diploma program depends upon its effective implementation. However, the best curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

F.R. KHAN
Director
I.R.D.T. Kanpur

ACKNOWLEDGEMENTS

We gratefully acknowledge the guidance and contribution received from the following persons:

i) Sh. Narendra Kumar Bhushan, IAS Additional Chief Secretary, Technical Education Govt. of U.P. for his exemplary vision & approach.

ii) Sh. F. R. Khan Director I.R.D.T. Kanpur for continually motivating, guiding and taking keen interest in the review of curriculum.

iii) All the participants from industries, Polytechnics and other technical institutions for their professional inputs during curriculum workshops.

iv) CDC Officer and other concerning staff of IRDT for their support and assistance in the conduct of curriculum workshops.

v) In the last but not least would like to thanks management of the industries who spare not only their precious time but also allowed the visit of their industries to the team making the curriculum

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LIST OF SUBJECT EXPERTS

The following experts participated in various workshop for Developing the Curricula Structure and Contents of **MINING ENGINEERING** at I.R.D.T. Kanpur.

1. Shri Priyadarshi Tiwari First Class Mine Manager CIMMCO Mining Amheta Katni.
2. Ms. Stuti Srivastava HOD G.P. Mirzapur.
3. Shri Rajeev Ranjan Verma Sr. Manager NMDC Panna.
4. Shri Dr. Ram Sajivan Lecturer MMIT Anogi Kannauj.
5. Smt. Ruchi Singh Lecturer G.P. Kanpur.
6. Smt. Priti Verma Lecturer G. P Fatehpur.
7. Shri Gautam Kumar Lecturer G.P. Ghatampur.
8. Shri Pranjul Mishra Lecturer G. P. Deeh Sadar Unnao.

1. SALIENT FEATURES

1) Name of the Program	➢ Diploma in Mining Engineering
2) Duration of the Program	➢ Three years (Six Semesters)
3) Entry Qualification	➢ Matriculation or equivalent NEP-2020/NSQF Level 4 as Prescribed by State Board of Technical Education, U.P.
4) Pattern of the Programme	➢ Semester Pattern
5) NSQF Level	➢ Level – 5
6) Ratio between theory and Practice	➢ 40% (Theory)/60% (Practical)

1) <u>Industrial Training/Internship:</u>

Four and six weeks of industrial training is made mandatory after the II and IV semesters during summer vacation. Total marks allotted to industrial training will be respectively 50 & 100.

In the last (6^{th} Semester) we have made the one semester Industrial training/Internship as optional along with usual classroom training.

2) <u>Audit & Pathways Subjects</u>:

As per AICTE and NEP-2020 directives, Essence of Indian Knowledge, & Tradition, Indian Constitution and Entrepreneurship & Startup subjects on Environmental Studies have beenincorporated in the curriculum.

3) <u>Student Centered Activities</u>:

A provision of 3-6 hrs per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise of co– curricular activities such as expert lectures, self-study, games, hobby classes like

photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.

4) <u>Project work:</u>

Micro/Mini/Major project work has been included in the curriculum to enable the student to get familiarized with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

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2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN MINING ENGINEERING

The following are the major employment opportunities for diploma holders in Mining Engineering:

- In mining industries primarily in Private sector and to some extent in Public sector.
- In service sector like Mining and Geology Department, Mines and Mineral development agencies, Military Engg. Services, Mines Research and Development etc.
- In marketing sector for sales and after- sales services.
- As an Entrepreneur
- Coal industries
- Cement industries

Though the diploma holders in Mining Engineering find placement in all functional areas like R&D, planning, shop floor production, quality control, inventory management but majority of them find employment in shop floor management

3. LEARNING OUTCOMES OF THE PROGRAM

1. Program Outcomes (POs)

The Program Outcomes (POs) describe the knowledge, skills, and attitudes that students are expected to develop by the time they graduate from the Diploma in Electronics and Communication Engineering program. These outcomes reflect what graduates will be capable of doing because of the learning and training received throughout the course. They represent the professional abilities and attributes that define a diploma holder in engineering.

As per **National Board of Accreditation (NBA)**, the seven Program Outcomes for an engineering diploma graduate are as follows -

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PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science and engineering fundamentals.

PO2: Problem's Analysis and solution
Identify, analyse and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing

Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

PO5: Socio/ Economic /Environmental impact assessment/remedy.

Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

At the end of the diploma program, the students will be able to:

1.	Prepare and interpret drawings of mining machinery and sites.
2.	Use mining software to prepare drawings of mining machinery and sites.
3.	Understand mine maps and create them.
4.	Basic of survey and its practical implementation in mines.
5.	Understand geological features and in mapping.
6.	Estimate rock mass classification.
7.	Understand strata deformation and control.
8.	Understand and perform experiments on rock specimens.
9.	Understand the method of mining in coal and metals.
10.	Understand the equipment selection according to method of working.
11.	Understand blasting mechanics and drill pattern.
12.	Estimate the fragments and its modification in blasting.
13.	Perform environmental impact assessment.
14.	Perform sampling to estimate environmental pollution.
15.	Understand the Mine legislation.
16.	Understand the Mine Management.
17.	Understand the coal mine and metal mine regulation.
18.	Understand various technology and associated machines in mining

STUDY AND EVALUATION SCHEME FOR THE CURRICULAM OF MINING ENGINEERING

THIRD SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	BASICS OF MINING ENGINEERING	Program Core (Theory)	2	0	0	2	40	0	40	60	3	0	-	60	100
3.2	MINING TECHNOLOGY-I	Program Core (Theory)	3	0	0	3	40	0	40	60	3	0	-	60	100
3.3	MINING GEOLOGY	Program Core (Practicum)	2	0	2	3	0	40	40	60	3	0	-	60	100
3.4	BASICS OF MECHANICAL ENGINEERING	Program Core (Practicum)	1	0	4	3	0	60	60	0	-	40	3	40	100
3.5	MINING MACHINERIES	Program Core (Theory)	3	0	0	3	40	0	40	60	3	0	-	60	100
3.6	MINING MACHINERIES (LAB)	Program Core (Practical)	0	0	4	2	0	60	60	0	0	40	3	40	100
3.7	**(Q)** OPEN ELECTIVE-1 **OR**	OPEN ELECTIVE (THEORY)	02	-	-	2	50	-	50	-	-	-	-	-	N/A
	*ADVANCE SKILL DEVELOPMENT	OPEN ELECTIVE (Certification Course)					-	-	-	-	-	-	-	-	N/A
3.8	SUMMER INTERNSHIP** (4 Weeks after 2nd semester)		-	-	-	2	-	50	50	-	-	-	-	-	50
#Student Centered Activities			-	-	13	-	-	50	50	-	-	-	-	-	50
Total			**13**		**23**	**20**	**120**	**260**	**380**	**240**	**-**	**80**	**-**	**320**	**700**

NOTE:-**(Q)** It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.

* Advance skill development mention at **3.7** in the table provide the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agency of repute of duration not less than 20 Hrs (Offline/Online).

** SUMMER INTERNSHIP (4-6 WEEKS) duration to be organized after second semester exam. Evaluation will be in third semester.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

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FOURTH SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	MINING TECHNOLOGY-II	Program Core (Theory)	3	0	0	3	40	0	40	60	3	0	0	60	100
4.2	MINES SURVEYING -I	Program Core (Theory)	3	0	0	3	40	0	40	60	3	0	0	60	100
4.3	MINES SURVEYING –I (LAB)	Program Core (Practical)	0	0	6	3	0	60	60	0	0	40	3	40	100
4.4	UNDERGROUND COAL MINING	Program Core (Theory)	3	0	0	3	40	0	40	60	3	0	0	60	100
4.5	MINE ENVIRONMENTAL ENGINEERING	Program Core (Practicum)	1	0	4	3	0	60	60	0	0	40	3	40	100
4.6	MINES MANAGEMENT, SAFETY AND LEGISLATION	Program Core (Theory)	3	0	0	3	40	0	40	60	3	0	0	60	100
4.7	**(Q)** OPEN ELECTIVE-2 **OR**	OPEN ELECTIVE (THEORY)	02	-	-	2	50	-	50	-	-	-	-	-	N/A
	*ADVANCE SKILL DEVELOPMENT	OPEN ELECTIVE (Certification Course)					-	-	-	-	-	-	-	-	N/A
4.8	ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	AUDIT COURSE	02	-	-	-	50	-	50	-	-	-	-	-	N/A
	#Student Centered Activities		-	-	09	-	-	50	50	-	-	-	-	-	50
Total			**17**	**-**	**19**	**20**	**160**	**170**	**330**	**240**	**-**	**80**	**-**	**320**	**650**

NOTE:- (**Q**) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.

* Advance skill development mention at **4.7** in the table provide the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agency of repute of duration not less than 20 Hrs (Offline/Online).

** SUMMER INTERNSHIP (4-6 WEEKS) duration to be organized after fourth semester exam. Evaluation will be in fifth semester.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

FIFTH SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	METALLIFEROUS MINING	PROGRAM CORE (PRACTICUM)	3	0	2	4	-	40	40	60	3	0	0	60	100
5.2	PROGRAME ELECTIVE-1	PROGRAM CORE (THEORY)	3	-	-	3	40	0	40	60	3	0	0	60	100
5.3	MINES SURVEYING -II	PROGRAM CORE (PRACTICUM)	2	0	6	5	0	40	40	60	3	0	0	60	100
5.4	SURFACE MINE, PLANNING AND DESIGN	PROGRAM CORE (PRACTICUM)	2	0	4	4	0	40	40	60	3	0	0	60	100
5.5	SKILL DEVELOPMENT	SURVEY CAMP***	-	-	-	2		60	60	0	0	40	3	40	100
5.6	INDIAN CONSTITUTION	AUDIT COURSE	02	-	-	-	50	-	50	-	-	-	-	-	50
5.7	SUMMER INTERNSHIP (4 Weeks after 4th semester)		-	-	-	2	-	60*	60*	-	-	40*	3	40*	100*
	#Student Centered Activities	-	-	-	02			50	50	-	-	-	-		50
Total			**12**		**14**	**20**	90	**290**	**380**	**240**	**12**	**80**	6	320	**700**

NOTE- * skill development mention at **5.5** in the table provide the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agency of repute of duration not less than 20 Hrs (Offline/Online). Assessment of this course will be done define by the Polytechnic (In case conducted at institute level) or the course conducting agency.

*** Survey camp two weeks duration to be organized during Vth Semester by the institute with collaboration of any mining industry.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

6th SEMESTER (NORMAL PATHWAY)

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	ENTREPRENEURSHIP AND START-UP	HUMANITIES AND SOCIAL SCIENCE	02	-	-	2	40	-	40	60	3	-	-	60	100
6.2	ELECTIVE (PATHWAY)	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
6.3	ELECTIVE (SPECIALISATION)	PROGRAM CORE (PRACTICUM)	02	-	03	3	-	60	60	-	-	40		40	100
6.4	IN-HOUSE PROJECT	PROJECT	4	-	16	12	-	240	240	-	-	160	-	160	400
	#Student cantered Activities		-	-	06	-	-	50	50	-	-	-	-	-	50
	Total		**11**		**25**	**20**	**80**	**350**	**430**	**120**	**-**	**200**	**-**	**320**	**750**

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

OR

(INDUSTRIAL PATHWAY)

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	ENTREPRENEURSHIP AND START-UP (Online Mode)	HUMANITIES AND SOCIAL SCIENCE	-	-	-	2	-	-	-	100	3	-	-	100	100
6.2	INDUSTRIAL HANDS-ON PRACTICE	INDUSTRIAL	-	-	-	12	150*			200**					350
6.3	INDUSTRIAL PROJECT	INDUSTRIAL	-	-	-	4	50*			50**					100
6.4	SEMINAR	IN-HOUSE	-	-	-	2	-	-	100	-	-	-	-	-	100
Total			-	-	-	**20**	-	-	**300**	-	-	-	-	**350**	**650**

NOTE: - 1) The industrial training tenure should not be less than 4 months

2) "ENTREPRENEURSHIP AND START-UP" course is mandatory in industrial training option. It will be taught in contact mode by his/her polytechnic institute. After completion the online course, student must appear for a separate exam conducted by Board of Technical Education, Lucknow.

3) In industrial training option student must attend a seminar at his/her polytechnic institute after training to ern 2 credit.

4) Monthly progress report attested by industrial authority must be submitted during industrial training.

5) The industrial unit must evaluate student using the format provided by polytechnic, in both credits and marks.

6)"Entrepreneurship and Start-up" course is also mandatory in Industrial internship/training mode. It will be conducted online mode by his/her polytechnic institute. After completing the online course, students must appear for exam conducted by the Board of Technical Education, Lucknow.

7)***Evaluation by faculty mentor:-**

The institute will depute one faculty member for mentoring at least 20-30 students undertaking apprenticeship training. Such mentors will monitor, guide and provide counselling to the students as and when required. Faculty mentor of the institute(s) may make a surprise visit to the internship/apprenticeship site to check the student's presence physically. (The Proforma of the evaluation is attached as the Annexure -1)

8)** **Evaluation by industry:-** The industry shall assess the candidates based on the following parameters attendance, discipline and punctuality, familiarity of tools and material, engineering skills, application of knowledge and problem-solving skills, comprehension and observation, professional ethics, safety and environmental consciousness, communication skills, supervisory skills and general conduct during the period (The Proforma of the evaluation is attached as the Annexure -2)

9)**# Evaluation through seminar presentation/Viva-Voce at the institute :-** The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

OPEN ELECTIVE-1

SR.NO.	(Q) THEORY COURSES NAME
1.	PRODUCT DESIGN AND DEVELOPMENT
2.	FUNDAMENTALS OF INNOVATION AND DESIGN THINKING
**********	
SR.NO.	***CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)
2.	COURSES CONDUCTED BY INFOSYS PRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

OPEN ELECTIVE -2

SR.NO.	(Q) THEORY COURSES NAME
1.	RENEWABLE ENERGY TECHNOLOGY
2.	INDUSTRIAL ROBOTICS
**********	
SR.NO.	***CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)
2.	COURSES CONDUCTED BY INFOSYS PRINGBOARD
3.	COURSES CONDUCTED BY TCS ION
4.	COURSES CONDUCTED BY OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL ORGANIZATION OR PLATFORMS OF REPUTE
5.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
6.	COURSES CONDUCTED BY C-DAC
7.	COURSES CONDUCTED BY NEILIT

PROGRAME ELECTIVE-1

Sr.No.	SUBJECT NAME
1.	COMPOSITE MATERIALS
2.	ROCK MECHANICS & GROUND CONTROL
3.	MINERAL PROCESSING

ELECTIVE (PATHWAY)

Sr.No.	SUBJECT NAME
1.	INSPECTION & QUALITY CONTROL
2.	ADVANCED ENGINEERING MATHEMATICS
3.	FINANCE FUNDAMENTALS

ELECTIVE (SPECIALISATION)

Sr.No.	SUBJECT NAME
1.	DIMENSIONAL STONE TECHNOLOGY
2.	PROCESS AUTOMATION

5. GUIDELINES FOR ASSESMENTS OF STUDENT CENTERED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 15 Marks for general behaviour and discipline

(by HODs in consultation with all the teachers of the department)

ii. 10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a) 75 - 80% 6 Marks
b) 80 - 85% 8 Marks
c) Above 85% 10 Marks

iii. * Even Semester:
25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSSactivities as per following: (by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) State/National Level participation
b) Participation in two of above activities
c) Inter-Polytechnic level participation
d)

****Odd Semester:**
25 Marks maximum

a) Language Lab Practices
b) Group Discussion and Personality Development
c) Industrial Visits/Industrial Talks
d) Power Point Presentations and Resume Making
e) Development of Aptitude and Reasoning Skills
f) Participation in the technical Exhibitions, Symposiums, Seminars, Workshops at the Institute /District/State/National Level.

3.1	BASICS OF MINING ENGINEERING (Theory)	L T P
		2 0 0

1. COURSE OJECTIVES

Mining engineering will be responsible to prepare mining plan of the area in varying geological conditions and carrying out mining to achieve optimal output. The student of mining engineering will be responsible for carrying out mining, in structurally complex area, paleontological horizon, varied hydro geological conditions etc. Ultimately from geological formation which are economically rich with varied characters.

2. COURSE OUTCOME(CO):

After completing the course student will be able to:

CO1 • Demonstrate fundamental knowledge of mining and mining geology.
CO2 • Identify and classify different types of minerals and rocks.
CO3 • Apply geological knowledge in the exploration and evaluation of mineral deposits.
CO4 • Understand and analyze the functioning of different types of mining industries.
CO5 • Describe and assess the distribution and significance of mineral resources in India.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	-	-	2	*	*
CO2	3	2	-	-	-	-	1	*	*
CO3	3	3	2	2	1	-	2	*	*
CO4	3	2	2	-	1	1	2	*	*
CO5	3	1	-	-	3	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT 1- INTRODUCTION: (06 Periods)
Introduction of Mining, Introduction of underground coal mining, open cast coal mining Open cast mining, Small quarry, Underground metal ferrous mining Placer mining.

UNIT 2- INTRODUTION TO MINING INDUSTRY (06 Periods)

Mineral resources of India with focus on Uttar Pradesh. Mining of important minerals of Uttar Pradesh and India, various terms used in Mining. Mode of entry by inclines, adits and shafts.

UNIT 3- INTRODUCTION TO MINING SYSTEM: (07 Periods)

Mining system adopted in underground coal mining, metalliferous mining, open cast mining (manual, semi-mechanised, mechanised). Nomenclature and technical terminology used in all types of mining operation.

UNIT 4- (05 Periods)

Role and responsibilities of different agencies in mining engineering. Such as Ministry of Mines, Department of Mines in state government, Ministry of environment and forest, DGMS, CMRI, Indian bureau of Mines & Geological survey of India.

UNIT 5- (04 Periods)

Description of important Mineral resources their uses and occurrence in India.

5. INSTRUCTIONAL STRATEGY

As for as possible teachers while teaching is supposed to give practical examples of various geological conditions &" expose the students from time to time to the actual mine site where above mentioned aspects are visible and mining techniques are adopted with modifications based on geological parameters.

6. TEXT BOOKS/REFERENCES BOOKS

1. Rutley's Elements of Minerology By H.H. Read
2. Elements of Mining-I By D. J. Deshmukh
3. Elements of mining - AROGYAMSWAMY

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted(%)
1	6	21
2	6	21
3	7	25
4	5	18
5	4	15
Total	28	100

3.2	MINING TECHNOLOGY-I (Theory)	L T P
		3 0 0

1. COURSE OJECTIVES

The course aims to equip diploma holders in mining engineering with the knowledge and skills required to carry out mining operations after identifying mineral-rich areas through exploration. It introduces basic mining terminology, methods of mineral exploration, and drilling and blasting techniques. Emphasis is placed on practical understanding through real-life examples of mining operations such as boring, drilling, and blasting to enhance industry-oriented learning.

2. COURSE OUTCOME(CO):

After successful completion of the course, the student will be able to:

CO1: Understand and use standard nomenclature and technical terminology commonly employed in mining engineering.

CO2: Identify and select appropriate mining systems based on site conditions and the type of mineral deposit.

CO3: Explain the principles and methods of prospecting, including pits, shafts, trends, and patterns, and identify drilling equipment, tools, drilling patterns, and their selection criteria.

CO4: Describe the classification, properties, storage, handling, and safety aspects of explosives used in mining operations.

CO5: Calculate explosive quantity, powder factor, and detonator factor; differentiate between various blasting methods; and explain sustainable mining practices for sand, bajri, boulders, and morrum in accordance with Sustainable Sand Mining Guidelines-2016.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	-	-	1	*	*
CO2	3	2	2	1	-	-	1	*	*
CO3	3	3	2	3	-	-	1	*	*
CO4	3	2	-	2	2	-	1	*	*
CO5	3	3	2	2	3	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENT

UNIT 1- DRILLING (08 Periods)

Terminology for drilling equipment and tools for under ground mining. Drilling patterns and their selection. Wedge, Burn, Fan, Pyramid cut, etc. for drivage and stone drift. Drilling pattern for coal working. Dust control and safety measures during Drilling operation

UNIT 2- PROSPECTING (10 Periods)

Principle and method of prospecting - pit, shaft, trench and boreholes. Principle of boring, selection of sites for boreholes, surface layout for boring, methods of boring - percussive and rotary system. Details of equipment, properties of drilling mud. Borehole logging, maintenance of records. Deviation of borehole, survey of boreholes, difficulties in boring, fishing tools and their uses.

UNIT 3- EXPLOSIVE AND BLASTING (10 Periods)

Classification and properties of explosives. Storage, Transportation and handling of explosives, Various initiating devices - fuse, cord, detonators, exploders, basic tool and equipment, safe practices in use of explosive, priming charging, stemming. Calculation of explosive quantity, powder factor, detonator factor. Magazine layout, Construction and safety features. Dangers due to static electricity in blasting circuits and their testing. Precautions before connection, firing, series and parallel connection. Misfire, socket, their causes and handling. Precautions after blasting. Introduction to SMS, SME, PMS and Heavy ANFO system, Electronic detonators & ordinary safety fuse.

UNIT 4- DEEP HOLE BLASTING: (08 Periods)

Calculation of charges, multi row blasting, twin bench blasting, muffle blasting, V-cut square cut and staggered patterns, over casting/side casting by blasting, deep hole blasting in u/g mines, Control Blasting techniques. Common causes of accident from explosive.

UNIT 5- RIVER BED MINING (Sustainable method of sand mining): (06 Periods)

Mining of sand, bajri, boulders and morrum (coarse sand) exclusively Found in river bed as per sustainable sand mining guidelines-2016 & 2020 of MOEF & CC Government of India.

5. INSTRUCTIONAL STRATEGY

Expose the students to real life problems. Plan assignments so as to promote problem solving abilities and develop continued learnings kills.

6. TEXT BOOKS/REFERENCE BOOKS

1. Elements of mining I & II - D.J. Deshmukh
2. Drilling Technology - Chugh
3. Elements of mining - AROGYAMSWAMY
4. Sustainable Sand Mining Guidelines-2016 - MOEF & CC Govt. Of India
5. Mining and Working Vol 1 & 2 -S. Ghatak (Lovely Prakashan ,Dhanbad)
6. Under Ground Mines - D.J Deshmukh

Website for Reference:
http://swayam.gov.in
http://nptel.ac.in

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	10	20
3	10	20

4	**08**	**20**
5	**06**	**20**
Total	**42**	**100**

3.3	**MINING GEOLOGY (Practicum)**	**L T P**
		2 0 2

1. COURSE OBJECTIVES

The course aims to prepare diploma holders in Mining Engineering for mine development activities and supervision of sampling, assay planning, geological mapping, and estimation of ore reserves to achieve optimal mineral extraction. It provides fundamental knowledge of economic geology, including fossil fuels, metallic and non-metallic mineral resources, their characteristics, and geological mapping techniques. The course also emphasizes experiential learning through technical mine visits, enabling students to observe and understand practical methods of ore reserve estimation and geological mapping under varied field conditions.

2. COURSE OUTCOMES (CO):

After successful completion of the course, the student will be able to:
CO1: Identify and classify important minerals and economically significant rocks.
CO2: Analyze the formation, classification, and distribution of mineral deposits in India.
CO3: Explain the origin, composition, and occurrence of fossil fuels in India.
CO4: Describe the definition, scope, and principles of stratigraphy and its relevance to mining.
CO5: Interpret the geological formations of India and apply appropriate methods for environmental pollution control, including understanding basic river ecology.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	-	-	1	*	*
CO2	3	2	-	1	1	-	1	*	*
CO3	3	2	-	-	2	-	1	*	*
CO4	3	1	-	2	-	-	1	*	*

CO5	3	3	2	2	3	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT 1- **INTRODUCTION:** (06 Periods)

GEOLOGY- Introduction to geology and science of earth, weathering of rocks- Chemical and physical weathering,

MINERALOGY- Definition, crystal line and amorphous aggregates i.e. minerals. Physical properties of minerals, Moh's scale description of the rock forming minerals.

STRUCTURE GEOLOGY- Dip, strike, outcrops and in crops, structural planes and topography, Igneous structure, Folds and Faults: Definition and their classification.

PETROLOGY- Description and classification of Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks.

Ex. No.	Name of Experiment	Hours
1	Study and identification of important rocks in hand specimen	**2**

UNIT 2- FORMATION OF MINERAL DEPOSITS: (06 Periods)

Definition of ore and gangue minerals, tenor and grade of ores. Classification of mineral deposits. Introduction of various processes of formation of economic mineral deposits. Crystallography: Definition, Application and scope, crystal system description, geologic occurrences, geographical distribution in India and uses of the important rock forming minerals / groups. Fossil Fuels: Origin and constituents of coal and petroleum. Structural Features of coal seams and reservoir traps . Their occurrence in India.

Ex. No.	Name of Experiment	Hours
1	Study and identification of important minerals in hand specimen	**2**

UNIT 3- ENGINEERING GEOLOGY & ENVIRONMENTAL GEOLOGY (04 Periods)

Different types of rocks, Physio-mechanical properties of rocks, Structural geology, stereo projections, rock mass Classification. Introduction and its role in mitigation and control of environmental pollution and rivers ecology.

Ex. No.	Name of Experiment	Hours
1	Identification of Stereo projection of joints.	4
2	Microscopic study of 10 important rock forming minerals	4

UNIT 4- ECONOMIC FUEL GEOLOGY (06 Periods)

Ore genesis and geo-thermal, biometric study of formation and classification of mineral deposits in India: Iron, Copper, lead, Zinc , manganese, bauxite, chromite, gold and silver minerals.

Ex. No.	Name of Experiment	Hours
1	The study of different economic minerals in hand specimen.	2
2	Microscopic study of syenite, dolerite, basalt, granite, gabbro, mica schist, gneiss, dolomitic lime stone	4

UNIT 5- STRATIGRAPHY: (06 Periods)

Definition and scope, Geological time scale. Fossils: Definition and importance of Fossils to geologist and mining engineers. Conditions, Modes of preservation and uses Stratigraphic scale . Major geologic formation of India : Dharwar, Cuddapah, Vindhyan, Gondwana and Tertiary systems. Their economic importance.

Ex. No.	Name of Experiment	Hours
1	Plotting of bore log, calculation of ore reserve and sampling	4
2	Geological section of simple maps representing simple structures and completion of outcrops on Topographical maps.	2
3	Preparation of assay plans	4

5. INSTRUCTIONAL STRATEGY

Expose the students to real life problems. Plan assignments so as to promote problem solving abilities and develop continuedlearning skills.

6. TEXT BOOKS/REFERENCE BOOKS

1. Text book of Geology of India and Burma BY M.S. Krishnan
2. Ore deposite of India. By Gokhlae & Ray.
3. India's Mineral Resouces By Krishnaswamy
4. Text book of mine economic By Sinha & Sharma
5. Winning Coal & Iron in india By R.T. Deshmukh & D.J. Deshmukh
6. Industrial Minrals By Sinha

Website for Reference:

http://swayam.gov.in

http://nptel.ac.in

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	22
2	6	22
3	4	12
4	6	22
5	6	22
Total	28	100

3.4	BASICS OF MECHANICAL ENGINEERING (Practicum)	L T P
		1 0 4

1. COURSE OBJECTIVES

The course aims to provide students of Mining Engineering with fundamental knowledge of mechanical engineering principles, including thermodynamics, fluid mechanics, internal combustion engines, power transmission devices, and mechanical systems relevant to mining applications. It focuses on understanding mechanical systems used in excavation, transportation, and mineral processing, enabling students to effectively apply mechanical concepts in the planning, operation, maintenance, and safe use of mining machinery and infrastructure.

2. COURSE OUTCOMES (CO):

After successful completion of the course, the student will be able to:

CO1: Understand and apply basic principles of mechanical engineering in mining systems and equipment.
CO2: Explain thermodynamic processes and apply them to engines, compressors, and energy systems used in mining operations.
CO3: Identify and describe the components and functioning of power transmission systems and mechanical machinery used in mines.
CO4: Demonstrate awareness of mechanical maintenance practices, operational reliability, and safety protocols relevant to mining operations.
CO5: Explain the construction, working principles, and applications of air compressors used in underground and surface mines.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	2	-	-	1	*	*
CO2	3	2	-	2	1	-	1	*	*
CO3	3	1	2	3	-	-	1	*	*
CO4	3	2	-	3	2	1	1	*	*
CO5	3	2	-	3	1	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENT:

UNIT 1- Concepts of Thermal Engineering and Power Transmission Devices

(07 Periods)

Basic definition of heat, work. Thermodynamic process. Laws of Thermodynamics. Names of different parts of I.C. engine & their functions. Principles of operation of 2 & 4 stroke engines. valve timing diagram of two and four stroke engines. Purpose of cooling & Lubrications. Power Transmission Devices, Power transmission by belts, compound belt drive, speed, torque and maximum power transmitted by belts.

Ex. No.	Name of Experiment	Hours
1	Study the principle of working of 4-stroke and 2 stroke diesel engines.	4
2	Load test (Performance test) on Four Stroke Diesel Engine or Four Stroke Petrol Engine.	4
3	Morse test on multi-cylinder petrol engine.	4
4	Heat balance test on Four Stroke Diesel or Petrol Engine.	5
5	Brake test on diesel engine and calculation of horse power.	5
6	Draw the valve timing diagram of single cylinder four stroke petrol engines.	4
7	Draw the valve timing diagram of single cylinder four stroke diesel engines.	4
8	To determine coefficient of friction of a flat belt and V belt by varying masses and angles of contact for different cases.	5
9	To investigate the relation between belt tensions, angle of wrap and coefficient of friction for flat and V belt.	5

UNIT 2- AIR COMPRESSORS (07 Periods)

Description and working of reciprocations and rotary compressor, single and multistage compressor, conditions of maximum efficiency, efficiency of compressor, volumetric efficiency, effect of cylinder clearance and altitude on efficiency of compressors, Advantage of using compressed air in mines, portable compressor air motor.

Ex. No.	Name of Experiment	Hours
1	Study of rotary air compressor in respect of the following construction features, operation, starting and stopping, safety devices.	4
2	Study of reciprocation air compressor in respect of the following construction features, operation, starting and stopping, safety devices.	4
3	To find the loss of air pressure in pipes and hoses of various diameters.	4
4	Volumetric efficiency of Air Compressor.	4

5. INSTRUCTIONAL STRATEGY

The instructional strategy for teaching strength of materials in polytechnic colleges emphasizes practical application and industry relevance. Through a curriculum aligned with the state technical education board, the syllabus is broken down into manageable units, prioritizing topics pertinent to Indian engineering contexts. Visual aids, bilingual explanations, and hands-on demonstrations are utilized to accommodate linguistic diversity and enhance understanding. Incorporating industry examples and field visit to

construction sites and manufacturing facilities fosters experiential learning. Assessment methods include practical assessment, written exams, and peer learning initiatives, complemented by career guidance to inform students about opportunities in mechanical engineering. Continuous feedback mechanisms ensure the refinement and effectiveness of the instructional approach.

3.5	MINING MACHINERY (Theory)	L T P
		3 0 0

1. COURSE OBJECTIVES

The course aims to prepare diploma holders in Mining Engineering to supervise the operation of mining machinery at mine sites and assist in the selection and procurement of suitable machines during the initial stages of mining projects. It focuses on understanding the justification, suitability, and efficiency of mining machinery based on the nature of mineralization, depth of occurrence, type of mining, and local geological conditions. The course provides fundamental knowledge and practical skills related to various mining machines, supported by laboratory demonstrations of working models and field exposure to machinery in actual mining operations.

2. COURSE OUTCOMES(CO):

After successful completion of the course, the student will be able to:

CO1: Explain the construction, working, and applications of face machinery and describe different modes of transportation used in mining.

CO2: Identify various opencast mining machines, explain their working and safety aspects, and understand communication systems used in mining industries.

CO3: Understand the construction and working principles of wire ropes and identify the components and operation of winding systems.

CO4: Explain the principles, methods, and applications of tunnels, raises, and shafts in mining operations.

CO5: Describe the types, working principles, characteristics, and applications of mine pumps used for mine dewatering.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	3	-	-	1	*	*
CO2	3	2	-	3	2	-	1	*	*
CO3	3	2	1	3	-	-	1	*	*
CO4	3	2	2	2	1	-	1	*	*
CO5	3	2	-	3	2	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT 1- OPEN CAST MACHINERY: (08 Periods)

Blast hole drills , rippers and scrapers , shovels , drag lines, dumpers, road graders and dozers - their construction and operation , bucket wheel excavators, spreaders- construction and operation

UNIT 2- Face Machinery: (06 Periods)

Principles of drilling , Cutting and ploughing, Drills , loaders , continuous miners , Features of modern shearers.

UNIT 3- Transport and Mine Communication (08 Periods)

(i) Rail haulage Types of rope haulage, Track, mine tubes and mine cars , safety appliances on haulage roads , locomotive haulage.

(ii) Conveyors: Construction and operation of belt , chain and cable belt conveyors. Aerial ropeways-types , construction, application and operation.

(iii) Signalling, telephone and wireless communication

UNIT 4- Underground Mining Machinery (14 periods)

(i) **WIRE ROPES :**

Types, construction and use, care and maintenance , rope splicing .

(ii) **WINDING :**

Types of winding system- drum winding and friction winding. shaft fittings- signals, guides, clutch plate, keps, tilting platform, cage receivers, drives. Fitting of Winding engines – brakes, depth indicator, automatic contrivance, friction sheave, suspension gear, cages and skips , multilevel and deep winding.

(iii) **FULL FACE BORERS FOR TUNNELS, RAISES AND SHAFTS :**

operation, construction features, their suitability, operation and maintenance of boring machines.

UNIT 5- MINE PUMPS AND FANS: (06 Periods)

Types of construction and characteristics of mine pumps and fans, Sluggish and Parallel application, Installation of mine pumps and fans

5. TEXT BOOKS/REFERENCE BOOKS

1. Elements of Mining Vol-III By D. J. Deshmukh
2. Mine Fires, Explosion, Recovery and Inundations By M. A. Ramlu.
3. Water Problems in Mines By Rakesh & M. C. Lele
4. Combating coal fires By Dr. B. Singh
5. Mining of Coal By S. Ghatak
6. Open cast mining By C.P.Singh.
7. Surface mining By G.B.Mishra.
8. Elements of Mining-II By D. J Deshmukh
9. Mining and Working By S. Ghatak
10. Mine Disasters in India VOL. I & II By National Council of Safety in Mines

6. INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching learning.
2. Students should be taken to various industrial **UNIT**s for clear conception of topics.
3. Efforts should be made to relate the process of teaching with direct experiences in the industry

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**08**	**20**
2	**06**	**15**
3	**08**	**20**
4	**14**	**30**
5	**06**	**15**
Total	**42**	**100**

3.6	MINING MACHINERIES (Practical)	L T P 0 0 4

1. COURSE OBJECTIVES

The course aims to provide diploma students of Mining Engineering with basic knowledge and practical skills related to various types of mining machinery. It prepares students to supervise the operation and routine functioning of machinery at mine sites. The course emphasizes hands-on exposure to face machinery, pumps, haulage systems, conveyors, and locomotives through laboratory demonstrations and field-based practical examples. Practical teaching using working models and observations of machinery in actual mining operations enables students to understand real mining conditions and equipment usage.

2. COURSE OUTCOMES(CO):

After successful completion of the course, the student will be able to:

CO1: Select and use appropriate mining machinery for specific mining operations and site conditions to improve operational efficiency.

CO2: Apply basic maintenance practices and safety measures to ensure safe operation of mining machinery.

CO3: Utilize mining machinery effectively to minimize downtime and enhance productivity in mining operations.

CO4: Understand the role of modern mining machinery and practices in reducing energy consumption and minimizing environmental impact.

CO5: Demonstrate awareness of recent developments and technological advancements in mining machinery used in the mining industry.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2

					Environment				
CO1	3	2	2	3	-	-	1	*	*
CO2	2	2	-	3	2	-	1	*	*
CO3	2	3	1	3	-	1	1	*	*
CO4	2	2	-	2	3	-	1	*	*
CO5	2	1	-	2	1	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENT

LIST OF EXPERIMENTS

Ex. No.	Name of Experiment	Hours
1.	Study of fittings of winding engines- drums, brakes, and depth indicators.	6
2.	Measurement of rate of penetration by jack hammer.	6
2.	Study and sketch of compressed air mono pump	4
3.	Study of different types of haulage systems – tensioning arrangement in endless haulage and different types of haulage clips	8
4.	Study and sketch of continuous Miner and Long-wall shearer.	4
5.	Tension arrangements unloading of buckets of an aerial rope- way.	4
6.	Study of different types of conveyors like belt conveyors, shake & vibrating conveyors, chain-conveyors	8
7.	Capping and recapping of wire ropes.	6
8.	Study different types of safety hooks and Suspension of ropes and cables in the shaft	6
9.	Pit top layouts and Pit bottom layouts	4

5. INSTRUCTIONAL STRATEGY

1. Organize practical sessions where students can operate and understand different types of mining machinery, including drills, loaders, and conveyor systems, to gain first-hand experience.
2. Invite experts in mining machinery and mechanization to discuss modern equipment, technological advancements, providing industry insights.

3. Use case studies to explore successful examples of mechanization in mining, emphasizing the benefits, challenges, and impact on productivity and safety.

3.7(a)	PRODUCT DESIGN & DEVELOPMENT (Theory)	L T P
		2 0 0

1. COURSE OBJECTIVES

This course is designed to provide the basic concepts of Product Design and Development (PDD), understanding of various phases of PDD, hands on CAD on various tools used for PDD, Manufacturing Considerations, Detail Design and Engineering, 3D CAD design tool with its different features and applications, concept creation and 3D modelling, part design, generative shape design, assembly design, etc., prototyping of concept models using Additive Manufacturing. This course helps students to convert Ideas into real products.

2. COURSE OUTCOMES(CO):

The subject should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.
Students will be able to

CO1 • Comply with Industry health and safety guidelines
CO2 • Familiarize with the product design process to design a new product
CO3 • Use CAD software to design a component with solid part model, sheet metal part model and assembly models
CO4 • Develop concept models, Detail Design, Engineering Drawing, GD&T
CO5 • Create 3D printing part using slicing software and 3D CAD modelling

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	-	-	2	3	-	1	*	*
CO2	2	2	3	2	-	-	1	*	*
CO3	2	1	2	3	-	-	1	*	*
CO4	2	2	3	3	-	1	1	*	*
CO5	2	1	2	3	1	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

4. CONTENT

UNIT 1- INDUSTRIAL SAFETY PRACTICES (04 Periods)

(i) Types and use of fire extinguishers.
(ii) Safe handling and maintenance of tools and equipment.
(iii) Importance of using proper tools.
(iv) Occupational safety and health (OSH) practices.

UNIT 2- INTRODUCTION TO PRODUCT DESIGN DEVELOPMENT (06 Periods)

(i) Introduction and need for product design.
(ii) Stages of the PDD process and standard industry practices.
(iii) Key elements: market research, customer needs, feasibility, concept design, ergonomics, regulatory aspects, and cost.
(iv) Detailed design: material selection, Design for Assembly (DFA), Design for Manufacturing (DFM) and Design failure mode and effect analysis (DFMEA)
(v) Verification, validation, quality control, packaging.
(vi) Program management and product support.

UNIT 3- ENGINEERING DRAWING & 3D DESIGN TOOLS (06 Periods)

(i) Basics of engineering drawings, projections, and views.
(ii) Concept creation, 2D/3D design, and use of design tools.
(iii) Introduction to 3D CAD software and its applications.
(iv) Overview of modules: part, surface, assembly, drawing.
(v) Interface, customization, specification tree, and layout.

UNIT 4- CONCEPT CREATION & 3D MODELLING (06 Periods)

(i) Sketcher tools and dimensional constraints.
(ii) Part design (Pad, Pocket, Hole, etc.).
(iii) Surface design (Extrude, Sweep, etc.).
(iv) Assembly design, constraints, exploded views, BOM.
(v) Engineering drawings and GD&T.
(vi) Case studies on modelling different materials.

UNIT 5- ADDITIVE MANUFACTURING (06 Periods)

(i) Basics of prototyping and 3D printing.
(ii) Material types and selection based on properties and applications.
(iii) 3D printing process and industrial uses.
(iv) Introduction to slicing software and its functions

5. INSTRUCTIONAL STRATEGY

To effectively deliver the above content, begin with interactive lectures and multimedia presentations to introduce core concepts, supported by real-world case studies. Incorporate demonstrations and guided tutorials, especially for CAD tools, engineering drawing, and additive manufacturing. Encourage

collaborative group work and design projects to foster creativity and problem-solving in product development. Practical sessions should follow each theory component, allowing learners to immediately apply their knowledge through lab-based exercises and simulations. Finally, integrate industry guest talks or virtual factory visits to expose students to current practices and trends, making the learning process more engaging and career-relevant.

6. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	4	12
2	6	22
3	6	22
4	6	22
5	6	22
Total	28	100

3.7 (b)	FUNDAMENTALS OF INNOVATION AND DESIGN THINKING (Theory)	L T P
		2 0 0

1. COURSE OBJECTIVES

This course is designed to give a strong understanding of basic concepts of Innovation & Design thinking, to develop many creative ideas through structured brainstorming sessions. The ideas are validated through 3D printing& confirmatory tests. Design thinking is an iterative process that use to understand users & usage patterns, their assumptions, redefine problems and create innovative solutions. It is most useful to tackle problems that are ill-defined or unknown.

2. COURSE OUTCOMES(CO):

The subject should be taught in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Students will be able to

CO1 • Comply with Industry health and safety guidelines

CO2 • Create value by using problems solving approach and by applying innovation techniques

CO3 • Create innovative products, processes, services, business models etc.

CO4 • Familiarise with 3D CAD modelling software, common Engineering standards, symbols

CO5 • Start their own business | start up | entrepreneurship

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	2	-	-	1	3	-	1	*	*
CO2	2	3	3	1	-	-	1	*	*
CO3	2	2	3	2	1	1	1	*	*
CO4	2	1	3	3	-	-	1	*	*
CO5	1	1	2	-	-	3	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional

4. CONTENT

UNIT 1- **INDUSTRIAL SAFETY PRACTICES** (04 Periods)

(i) Types and use of fire extinguishers.
(ii) Safe handling and maintenance of tools and equipment.
(iii) Importance of using proper tools.
(iv) Occupational safety and health (OSH) practices.

UNIT 2- **INTRODUCTION TO INNOVATION & DESIGN THINKING** (06 Periods)

(i) Definition, types, and necessity of innovation.

(ii) Linear vs non-linear innovation; open vs closed models.
(iii) Design thinking: principles, mindset, and value.
(iv) Risk-reward analysis in innovation.
(v) From innovation to start-up: key steps.
(vi) Scoping and foundational principles of design thinking.

UNIT 3- DESIGN THINKING TOOLS & IDEA GENERATION (06 Periods)

(i) Brainstorming techniques and tools.
(ii) Phases of design thinking: Explore, Empathize, Experiment, Engage, Evolve.
(iii) Tools: SCOPES, STEEP, POEMS, SCAMPER.
(iv) Deep user needs analysis (SPICE).
(v) Idea selection, concept development, prototyping.
(vi) Storytelling, co-creation, strategic alignment.
(vii) Case studies.

UNIT 4- INTRODUCTION TO 3D MODELING & ADDITIVE MANUFACTURING
(06 Periods)

(i) CAD tools, 3D modeling, product drawing & BOM.
(ii) Prototyping basics and its industrial role.
(iii) Additive vs traditional manufacturing.
(iv) Types of 3D printers, components, working, software (slicing).
(v) Laser cutting basics, process, applications, pros & cons.
(vi) Case studies and latest advancements.

UNIT 5- START-UP & PROJECTION PLAN (06 Periods)

(i) Basics of management, leadership, HR, communication, and production.
(ii) Entrepreneurial concepts and forms of business.
(iii) Start-up essentials: planning, research, vision, model, operations.
(iv) Business modeling, market positioning, financial analysis.
(v) Start-up success factors and common failure points.
(vi) Case studies and project work.

5. INSTRUCTIONAL STRATEGY

The teacher should lay stress on Demonstrations & Role Play, Video-Based Learning,

Case Study Analysis: Discuss successful innovations to highlight theory in practice. He should assign real-world problems for learners to solve using design thinking, organize Software Tutorials and Business Plan Workshops.

6. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	4	12
2	6	22
3	6	22
4	6	22
5	6	22
Total	28	100

4.1	MINING TECHNOLOGY –II (Theory)	L T P
		3 0 0

1. COURSE OBJECTIVES:

The course aims to equip diploma holders in Mining Engineering with the knowledge and skills required for scientific development of mines in both hard and soft rock conditions, ensuring optimal production and safety of personnel engaged in mining operations. It provides fundamental and updated knowledge of shaft sinking, tunnelling, and inclined developments, along with an introduction to elementary mineral processing techniques. The course emphasizes practical understanding through typical field examples and technical visits, enabling students to relate theoretical concepts with modern mining practices in actual mining environments.

2. COURSE OUTCOMES:

After successful completion of the course, the student will be able to:

CO1: Select suitable site, size, and shape of shafts; understand standard terminology related to shaft sinking; and explain methods of shaft sinking, tunnelling, and inclined mine development.

CO2: Identify and select appropriate special methods of shaft sinking suitable for difficult ground conditions.

CO3: Describe the types, constructional features, and applications of tunnel boring machines used in mining and civil excavations.

CO4: Explain the scope, objectives, and limitations of elementary mineral processing operations.

CO5: Apply the principles of resource optimization and explain the theory and practical aspects of crushing and grinding in mineral processing.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	2	3	1	-	1	*	*
CO2	3	3	2	2	1	-	1	*	*
CO3	3	2	-	3	-	-	1	*	*
CO4	3	2	-	2	2	-	1	*	*
CO5	3	3	2	2	2	1	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT 1- SHAFT SINKING (08 Periods)

Site selection size and shape of shafts, sinking shaft- preparatory arrangements, drilling and blasting, mucking, hoisting, ventilation, pumping, lighting and dewatering , temporary and permanent lining, complete cycle operation, Mechanized shaft sinking.

UNIT 2- SPECIAL METHODS OF SINKING IN DIFFICULT AND WATER BEARING GROUND (10 Periods)

piling, drop shaft caisson, cementation, freezing etc. Shaft sinking by shaft borers, widening and deepening of shafts.

UNIT 3- TUNNELLING (10 Periods)

Main haulage drifts and tunnels: Purpose, shape , size and location ;excavation-ground breaking , muck disposal, ventilation and supporting .High speed drifting / tunnelling : application of mechanical methods, road headers and tunnel boring machines.

UNIT 4- ELEMENTARY MINERAL PROCESSING (08 Periods)

Scope, object and limitation of mineral processing. Theory and practice of crushing and grinding. Briefidea of jaw crusher, cone crusher, ball mill. Heavy media separation and jigging methods of coal washing.

Introductory froth floatation principle, floatation of sulphides , oxides and coal Simplified sheets for coal ,copper ,lead ,zinc , gold, iron, manganese ores and lime stone.

UNIT 5- COAL QUALITY & BENEFICIATION METHODS (06 Periods)

Methods of coal washing ,Coal quality improvement while mining and its advantages . Dry & Wet Coal beneficiation

5. INSTRUCTIONAL STRATEGY

Students should been courage to participate in role play and other student-centered activities in class room sand actively participate in listening exercises

6. TEXT BOOKS/REFERENCE BOOKS

1. Elements of mining I & II BY D.J. Deshmukh
2. Mineral Dressing By Gaudin
3. Mining and Working Vol 1 & 2 BY S. Ghatak (Lovely Prakashan,Dhanbad)
4. Surface mining BY T N SINGH

WebsiteforReference:

http://swayam.gov.in

http://nptel.ac.in

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
1	08	20
2	10	20
3	10	20
4	08	20
5	06	20
Total	42	100

4.2	MINES SURVEYING –I (Theory)	L T P 3 0 0

1. COURSE OBJECTIVES

The course aims to prepare diploma holders in Mining Engineering to carry out surveying of mine areas in both opencast and underground mines for efficient planning and proper development of mining operations. It provides elementary knowledge of surveying techniques such as chain surveying, compass surveying, leveling, and theodolite surveying with specific reference to mining and mine surveying. The course emphasizes practical learning through demonstrations of surveying instruments, field procedures, and preparation of mine survey plans.

2. COURSE OUT COMES(CO)

After successful completion of the course, the student will be able to:

CO1: Explain the principles, types, and applications of surveying, including plane and geodetic surveying, for engineering and mining works.

CO2: Analyze and adjust surveying errors by applying the theory of errors, laws of weights, and error adjustment techniques in traverse and triangulation surveys.

CO3: Perform chain surveying operations using appropriate instruments, apply necessary corrections, and prepare accurate field records and survey plans.

CO4: Conduct compass and dial surveying by measuring bearings, correcting local attraction, performing traversing, and plotting survey data.

CO5: Carry out leveling operations and contouring using suitable instruments, reduce levels accurately, interpret contour maps, and estimate areas and earthwork.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2

					Environment				
CO1	3	1	-	-	-	-	1	*	*
CO2	3	3	-	1	-	-	1	*	*
CO3	2	2	-	3	-	-	1	*	*
CO4	2	2	-	3	-	-	1	*	*
CO5	3	2	1	3	1	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT 1- INTRODUCTION: (06 Periods)

Definition of plane surveying and geodetic surveying. Use of surveying in engineering. Principles of surveying. Methods of locating a point.

UNIT 2- THEORY OF ERRORS: (06 Periods)

Classification & causes of errors, most probable true & residual errors, average & standard errors, most probable values of single observation & arithmetic means, laws of weight.
Adjustment of traverse. Adjustment of errors in triangulation.

UNIT 3- CHAIN SURVEYING: (10 Periods)

Brief description and uses of: -

i) Scales (different type of scale)

i) Chains - meter chain, engineer's chain, gunter's chain, revenue chain.

ii) Tapes - linen, metallic, fibre glass, steel, invar, steel band.

iii) Ranging rods, offset rods.

v) Line ranger, cross staff, optical square.

vi) ARROWS:

Folding, unfolding, testing and adjusting the chain. Ranging chain lines - Direct indirect. Method of chaining on plane ground conventional signs in surveying. Reading and recording results in field book. Chaining on sloping ground - direct method and indirect method, common errors and precautions to be taken in the field to minimise them. To calculate correct dimension with a defective chain/tape - correction for change in temperature, sag, etc. Chain surveys of small areas - triangulation, traversing. Preparation of a reference sketch, Fixing and marking - stations, base line, chain lines, check lines, tie lines, chain angles, Changing and detail filling by taking off- sets Booking results in field book and plotting common obstacles in chain surveying. Chaining through obstacles.

UNIT 4- COMPASS SURVEYING AND DIALS: (10 Periods)

Names and function of different parts of a prismatic compass and surveyor's compass, their construction and uses.

Definition of meridian, magnetic meridian, true meridian, magnetic declination, dip, bearing - fore bearing, back bearing whole circle bearing, quadrantile bearing or reduced bearing - conversion of whole circle bearing to quadrantile bearing and vice versa. Reading the bearing of lines with the help of prismatic compass and computing included angles. Distribution of instrumental error.

Definition of local attraction. Causes of local attraction and its effect on observed bearing. Correction of error due to local attraction.

Traversing with chain and compass, open traverse, closed traverse. Booking readings in field book computation and plotting. Adjustment of errors in a closed traverse.

Construction and use of the miners dial, Vernier and micro optic dials, traversing, booking and plotting.

UNIT 5- LEVELING AND CONTOURS: (10 Periods)

Definition of level, leveling instruments, level line, names and function of different parts of dumpy level & tilting level.

Temporary adjustment of a dumpy level & tilting level, difference between dumpy level & tilting level.

Definition of the term-axis of telescope, line of collimation axis of bubble tube, vertical axis of the instrument. Height of the instrument and height of the line of collimation, focusing, parallax, its removal, bench marks, back sight, intermediate sight, change point.

Simple & differential leveling with dumpy & tilting levels, reduction of level by various methods, arithmetic checks, errors in leveling & precautions to be taken.

Plane table surveying: Methods and instruments

Contouring: Definition, characteristics of contours, method of contouring by level, the Theodolite, tachometer, use of contour map. Inter polation of contours. Estimation of Area and walls.

5. INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching learning.
2. Students should be taken to various industrial units for clear conception of topics.
3. Efforts should be made to relate the process of teaching with direct experiences in the industry

6. TEXT BOOKS/REFERENCE BOOKS

1. Surveying By B. C. Punmia
2. Surveying By K. R. Arora
3. Mine's and Surveying By S. Ghatak

Websites for Reference:

http://swayam.gov.in
http://nptel.ac.in

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	18
2	06	18
3	10	22
4	10	22
5	10	20

	Total	**42**	**100**

4.3	**MINES SURVEYING –I (Practical)**	**L T P** **0 0 6**

1. COURSE OBJECTIVE

Mine surveying deals with the fundamental principles and practices of measuring and mapping surface and underground mine workings. The course enables students to understand geological formations, spatial data collection techniques, and the use of surveying instruments in mining environments. It covers the principles of triangulation, levelling, traversing, and topographic mapping relevant to mining operations. Practical applications include accurate layout of excavations, monitoring ground stability, preparation of mine plans, and compliance with safety regulations. Proficiency in mine surveying is essential for efficient resource extraction and effective hazard mitigation in mining operations.

2. COURSE OUTCOMES (CO)

After successful completion of the course, the students will be able to:

CO1: Identify and explain the principles, instruments, and methods used in chain, compass, and levelling surveys.

CO2: Perform basic surveying operations such as chaining, ranging, compass traversing, and levelling with proper field procedures.

CO3: Record, reduce, and plot surveying data accurately using field books, graphical methods, and standard plotting techniques.

CO4: Apply levelling techniques to determine differences in elevation, prepare longitudinal and cross sections, and carry out contour surveys.

CO5: Test, adjust, and use surveying instruments such as dumpy level, tilting level, mining dial, and theodolite for accurate mine surveys.

CO6: Conduct surface and underground surveys for small mining areas and prepare survey plans relevant to mine planning and safety.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PS O2
CO1	3	-	-	-	-	-	-	*	*
CO2	3	3	-	2	-	-	-	*	*
CO3	3	2	-	3	-	-	-	*	*
CO4	3	3	3	-	-	-	-	*	*
CO5	3	1	-	-	-	-	-	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

3. CONTENTS

UNIT 1-Chains:

i. Study of various types of chain, types and other accessories e.g. engineers chain, metric chain, steel tape, metallic tape, cross staff, optical square, line ranger.
ii. Use of Chains :-

a. Folding and unfolding chains.
b. Testing and adjusting the lengths of chains.
c. Ranging and chaining on level and sloping ground.
d. Setting right angles.
e. Setting parallel lines
f. Taking offsets.

iii. Recording observation in field book and plotting.

UNIT 2- Compass:

i. Study of the different parts of prismatic compass.
ii. Measurements of bearings by prismatic compass.
iii. Traverse by prismatic compass and graphical adjustment of closing error.

UNIT 3- Study of different parts and temporary adjustment of

i. Dumpy level.
ii. Tilting level.

UNIT 4- Study of leveling staves and Theodolite.

UNIT 5- Use of dumpy level and tilting level in:

i. Finding the difference in level between two points.
ii. Longitudinal sectioning and its plotting.
iii. Cross sectioning and its plotting.
iv. Reciprocal leveling

UNIT 6-Testing and adjustment of dumpy and tilting levels.

UNIT 7- Testing and adjustment of mining dial and survey of a small area with mining dial and plotting.

UNIT 8- Contouring and preparation of a contour survey plan of an uneven area.
Suggested List of Students Activity:

• Activity 1: Engage in a surface mapping and surveying exercise in a designated mining area. They will use surveying equipment to measure and map surface features, creating a detailed topographic map of the area.

• Activity 2: Perform an underground survey in an operational or simulated mine. They will navigate the mine workings, measure and map underground features, and ensure accurate recording of data for mine planning and safety.

4. INSTRUCTIONAL STRATEGY

1. Students should be taken to various industrial units for clear conception of topics.
2. Efforts should be made to relate the process of teaching with direct experiences in the industry.
3. Introduce real-world scenarios where students can see how mine surveying plays a crucial role in mining operations.
4. Invite professionals from the mining industry to give guest lectures. This provides students with insights from experienced practitioners and exposes them to various career paths in mining.
5. Implement problem-based learning, where students are presented with a mining-related problem to solve.

5. TEXT BOOKS/REFERENCE BOOKS

1. Surveying — By B. C. Punmia
2. Surveying — By K. R. Arora
3. Mine's and Surveying — By S. Ghatak

Websites for Reference:

Web-based/Online Resources:

CHAIN & COMPASS SURVEYING

- Direct Ranging : https://www.youtube.com/watch?v=x8FaSZCPbM8
- Indirect Ranging : https://www.youtube.com/watch?v=6oIyMP2iO5s
- Chain Triangulation : https://www.youtube.com/watch?v=wbd-Ib2xc0Y
- Measuring Horizontal Distance by the Direct Method
- Chaining on Sloping Grounds : https://www.youtube.com/watch?v=dwNHZbZ40AQ

- **Types of Cross Staff :** https://www.youtube.com/watch?v=w0OBpHLQv7w
- Difference b/w surveyor & prismatic compass : https://www.youtube.com/watch?v=5DsCSxKkGws
- Whole circle bearing & Quadrantal bearing : https://www.youtube.com/watch?v=iLQYLoc4ja4
- Conducting a closed traverse (Irregular polygon) in surveying : https://www.youtube.com/watch?v=pGS2YX30nI8
- Open traverse : https://www.youtube.com/watch?v=6NA3Y79Pf38

Local attraction and its correction : https://www.youtube.com/watch?v=2EYQDwcizcE

LEVELLING & CONTOURING

- Temporary adjustment in levelling : https://www.youtube.com/watch?v=NDK1t9RdMy0
- Levelling survey: https://www.youtube.com/watch?v=_SiSn_tcXZA
- Contour surveying : https://www.youtube.com/watch?v=iZrNkKBPocc

THEODOLITE SURVEYING & TRIGONOMETRICAL LEVELLING

- Measurement of horizontal angle repetition method : https://www.youtube.com/watch?v=lTJE-PJR0ds
- Measurement of horizontal angle reiteration method : https://www.youtube.com/watch?v=p2j9W1IuDT0
- Latitude and departure: https://www.youtube.com/watch?v=a38vHYfbgTs
- Trigonometrical levelling : https://www.youtube.com/watch?v=_y24shD5UlE

4.4	UNDERGROUND COAL MINING (Theory)	L T P 3 0 0

1. COURSE OBJECTIVES

The diploma holder in mining Engineering will be Responsible to select a suitable method in mining, in different types of deposit coal mines. Content covers detailed aspects about the method of mining, their criteria of section on Indian perspective. Teachers are expected to demonstrate various methods with the suitable models.

2. COURSE OUTCOMES (CO)

After undergoing the subject, the student will be able to:

CO1 • Know about mining condition in Indian coalfields.
CO2 • Apply correct and efficient method of Pillar mining. Understand the basic concept of Long wall mining. Process and their requirement and equipments used for long wall mining.
CO3 • Select underground coal mine planning.
CO4 • Able to differentiate between long mining wall and short wall mining. Draw the layout of working of short wall mining.

CO5 • To know the process of under winning method

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	-	-	1	*	*
CO2	3	3	2	3	1	-	1	*	*
CO3	3	2	3	2	1	1	1	*	*
CO4	2	2	2	2	-	-	1	*	*
CO5	3	2	1	2	-	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT 1 - Introduction: Mining condition in Indian coalfields, choice of mining methods. (12 Period)

Bord and Pillar mining:
Design of bord and pillar working, the panel system, panels and inter- panel barriers, size of pillar and galaries. Method of driving galleries; preparatory arrangement for depillaring. Pillar extraction and safety, Room & pillar method of working.

Long Wall Mining:
Long wall system of working, advancing and retreating methods, design of long wall working - long wall layout, face length, panel length, size of great roads, development of Long wall panels, equipment of a long wall face, strata behaviour and support requirements.

UNIT 2- Underground coal mine planning: (06 Period)

Elements of underground coal mining planning - size and production capacity of mines, in-seam mining versus horizon mining.

UNIT 3- Mining of Thin and Steeply Inclined Seams: (10 Period)

Inclined and Horizontal classification, problems of mining thick seams, modern multi- slice methods- inclined slicing, horizontal slicing and cross slicing in ascending and descending sequence
Under winning methods - Sub level caving, integral caving, blasting gallery method and hydraulic mining. Concept of thin seams, problems in mining thin seams, equipment and methods for thin seam extraction, special mining method.

UNIT 4- Short wall and high wall mining method: (06 Period)

layout of working, equipment and system of extraction and high wall mining Method, description of method, production and productivity estimation.

UNIT 5- Ground Control and support design: (08 Period)

Design of pillars, stress analysis of simple mine openings, different types of roof supports, power of supports, self-advancing goaf edged supports, shotcrete support, goaf different types of roof bolts, local and regional supports, back filling in mines.

5. TEXT BOOKS / REFERENCE BOOKS:

1. Elements of mining I & II By D.J. Deshmukh

2. Advance coal mining By B. Singh

3. Principles and Practices of Modern Coal Mining By R. D. Singh

Websites for Reference:

http://swayam.gov.in
http://nptel.ac.in

6. INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental

Stud like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

7. SUGGESTED DISTRIBUTION OF MARKS

UNIT NO.	Time Allotted (Periods)	Marks Allotted (%)
1	12	28
2	06	15
3	10	25
4	06	15
5	08	17
Total	42	100

4.5	MINE ENVIRONMENT ENGINEERING(Practicum)	L T P 1 0 4

1. COURSE OBJECTIVES

The diploma holders in mining Engineering will be responsible for the development of mine maintaining proper environmental conditions in open cast and underground mining.
The course content of the subject provide him basic knowledge and skills about mine environmental engineering i.e. heat and humidity in mines, mine gases ventilation and lighting. The teachers while teaching are supporte to give practical examples of environmental conditions of various working in India and typical world examples and visits of mine sites.

2. COURSE OUTCOMES(CO)

After undergoing this course, the students will be able to:

CO1 • Understand the concept of heat and humidity in mines
CO2 • Knowledge about the mine atmosphere, gases in mine and their physical and chemical properties.
CO3 • Identify the use of anemometer and velimeter and to make readings to calculate air flow.
CO4 • Understand the principal and types of mine fans with layouts for regulation of air current.
CO5 • Dust and its harmful effect on the human body.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	-	2	-	1	*	*
CO2	3	2	-	-	3	-	1	*	*
CO3	2	2	-	3	1	-	1	*	*
CO4	3	2	2	3	2	-	1	*	*
CO5	2	1	-	-	3	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS.

UNIT 1- Mine Gases and Atmosphere: (4 Periods)

Mine atmosphere, requirements of breathing air mine gases, detection of gases by flame, safety lamps, Methane Layering and drainage of methane from virgin coal seam.

Ex. No.	Name of Experiment	Hours
1	Testing of methane with flame safety lamps	4
2	To study different types of flame safety lamps.	4
3	To study Mc Luckie's methanometer and gas detector	4

UNIT 2- General Conditions in Mines: (2 Periods)

Geothermal-gradient, humidity its determination and effect, kata thermometer, effects of heat and moisture in mine absolute and relative humidity, dew point, determination of humidity, hygrometer.

Ex. No.	Name of Experiment	Hours
1	Study and sketch of whirling hygrometer and determination of relative humidity	4
2	Study and use of kata thermometer	4

UNIT 3- Ventilation System in Mines: (2 Periods)

Natural and artificial ventilation, distribution and coursing of air currents, law of air flow, equivalent orifices; measurement of air flow by anemometers. Air leakage and its prevention, mine fans main, auxiliary and booster type.

Ex. No.	Name of Experiment	Hours
1	Study of anemometer and velometer and to make readings to calculate air flow	4
2	Study of principal types of mine fans with layouts for regulation of air current	4

UNIT 4- Lighting and Dust Formation: (4 Periods)

Lighting standards and illumination survey, Dust Formation, dangers, dust sampling apparatus, preventive and suppression measures for dust.

Ex. No.	Name of Experiment	Hours
1	Study of a cap lamp	4
2	Study and sketch of fire-fighting equipment for class-A,B,C, D and E	4
3	Study, sketch and describe the gravimetric dust extractor	4
4	Measurement of dust by portable hand held dust extractor	4

UNIT 5- Combustion System of coal: (2 Periods)

Factors affecting spontaneous combustion of coal, incubation period, sources of mine fire and their mitigation.
Objective and classification of risqué apparatus, rescue stations, rescue organization- construction and function.

Ex. No.	Name of Experiment	Hours
1	To conduct an illumination survey with lux meter.	4
2	Study of self-contained breathing apparatus, smoke helmet, gas mask and self-rescuer	8

5. INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching learning.
2. Students should be taken to various industrial units for clear conception of topics.
3. Efforts should be made to relate the process of teaching with direct experiences in the industry.

6. TEXT BOOKS/REFERENCE BOOKS

1. Mine Environmental Engg. By G. B. Mishra
2. Elements of Mining Vol. II By D. J. Deshmukh

Websites for Reference:

http://swayam.gov.in
http://nptel.ac.in

4.6	MINES MANAGEMENT, SAFETY AND LEGISLATION (Theory)	L T P
		3 0 0

1. COURSE OBJECTIVES

The knowledge of this subject is required for mining engineering technicians, but it becomes more important for those technicians who wish to choose mining industry as their career. This course is designed to develop understanding of various functions of mining management. The subject contains detailed knowledge of various mines act, rules and regulation relating ventilation, welfare, opening, methods of work, explosives, mineral concession etc.

2. COURSE OUTCOMES(CO):

CO1 • To identify the role of manager in staffing, manpower planning and recruitment of the employees

CO2 • Identify the role of inventory in materials management

CO3 • Understand the different mining laws of India.

CO4 • Understand the health and safety laws applied in the mining area. Understand the provision of Indian explosive act and rules

CO5 • Understand the health hazards associated with mining industries. Develop the safe working environment in the mine.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PS O2
CO1	2	1	-	-	-	3	1	*	*
CO2	2	1	-	-	-	3	1	*	*
CO3	3	1	-	-	2	-	1	*	*
CO4	3	2	-	-	3	-	1	*	*
CO5	2	2	1	-	3	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT 1- INTRODUCTION TO MANAGEMENT PROCESS: (05 Periods)

Planning, organising, directing, motivating, controlling, co-ordinating and communicating. Role of manager. Staffing : Jobs analysis, manpower planning and recruitment. Performance appraisal. Manpower development and planning.

UNIT 2- MATERIALS MANAGEMENT: (04 Periods)

Introduction , purchase and stores management : inventory analysis and control, value analysis.

UNIT 3- MINERAL CONSERVATION AND DEVELOPMENT LAWS (14 Periods)

Salient Provisions of the mines and minerals(Regulation & Development) Act 1957; Mineral Concession Rules, and Mineral Conservation and Development Rules, 1988. Salient Provision of Indian Explosive Act and Rules

UNIT 4- HEALTH & SAFETY LAWS (14 Periods)

The Mines Act 1952, The Mines Rules 1955; The Coal Mines Regulations, The Metalliferous Mines Regulations, Mines Rescue Rules, 1985; Additional Provisions of Indian Electricity Rules, 1956, applicable to mines.

UNIT 5- SAFETY IN MINES (05 Periods)

Occupational hazards of mining; Accidents and their classification; Causes and Prevention of accidents, Mining disaster, Measures for improving safety in mines

5. TEXT BOOKS/REFERENCE BOOKS

1. Legislation in Indian Mines Rakesh & Prasad
2. Coal Mines Regulation 1957 Geeta Book Store, Dhanbad
3. Mining Manual Pub. Dimonion Law Depot, Dhanbad
4. Metalliferrous Mines regulation-1961 Geeta Book Store,Dhanbad
5. Explosive Act 1984 Pub. Eastern Book Comp. Lucknow
6. Indian electricity rules-1965 Geeta Book Store Dhanbad
7. U. P. Miner Mineral (Concession) Rule 1963
8. Mines and Mineral Development And Regulation Act- 1957
9. Mines Act- 1952
10. Mine's management legislation By S. Ghatak and General Safety Mine's Rule 1955
11. Vocational Training Rules
12. Mines Rescue Rules 1985

6. INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching learning.
2. Students should be taken to various industrial **UNIT**s for clear conception of topics.
3. Efforts should be made to relate the process of teaching with direct experience in the industry.

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**05**	**20**
2	**04**	**10**
3	**14**	**25**
4	**14**	**25**

5	**05**	**20**
Total	**42**	**100**

4.7 (a)	**RENEWABLE ENERGY TECHNOLOGY (Theory)**	**L T P**
		2 0 0

1. COURSE OBJECTIVES

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the renewable energy technology equipment.

2. COURSE OUTCOMES

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Maintain ocean thermal energy technologies
- Maintain the optimised working of solar PV and CS power plants.
- Maintain the optimised working of large wind power plants
- Maintain the optimised working of small wind turbines.
- Maintain the optimised working of biomass-based power plants.

3. CONTENT

UNIT – 1 Ocean Energy Technologies (04 Periods)

Ocean energy map of India and its implications; Specification, Construction and working of the following ocean energy technologies:

- Tidal power technologies
- Wave power technologies
- Marine current technologies
- Ocean Thermal Energy Conversion (OTEC) technologies

UNIT –2 Solar PV and Concentrated Solar Power Plants (06 Periods)

- Solar Map of India: Global solar power radiation, Solar PV
- Concentrated Solar Power (CSP) plants, construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors
- Solar Photovoltaic (PV) power plant: components layout, construction, working.
- Rooftop solar PV power system

UNIT –3 Large Wind Power Plants (06 Periods)

Wind Map of India: Wind power density in watts per square meter, Lift and drag principle; long path theory, Geared type wind power plants: components, layout and working, Direct drive type wind power plants: components, layout and working, Constant Speed Electric Generators: Squirrel Cage Induction Generators (SCIG), Wound Rotor Induction Generator (WRIG), Variable Speed Electric Generators: Doubly-fed induction generator (DFIG), wound rotor synchronous generator (WRSG), permanent magnet synchronous generator (PMSG).

UNIT–4 Small Wind Turbines (06 Periods)

- Horizontal axis small wind turbine: direct drive type, components and working.
- Horizontal axis small wind turbine: geared type, components and working.
- Vertical axis small wind turbine: direct drive and geared, components and working.
- Types of towers and installation of small wind turbines on roof tops and open fields.
- Electric generators used in small wind power plants.

UNIT–5 Biomass-based Power Plants (06 Periods)

- Properties of solid fuel for biomass power plants: bagasse, wood chips, rice husk, municipal waste.

- Properties of liquid and gaseous fuel for biomass power plants: Jatropha, bio-diesel gobargas.
- Layout of a Bio-chemical based (e.g. biogas) power plant.
- Layout of a Thermo-chemical based (e.g. Municipal waste) power plant.
- Layout of a Agro-chemical based (e.g. bio-diesel) power plant.

4. TEXT BOOKS/REFERNCE BOOKS

1. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
2. Neill, Simon P.; Hashemi, M. Reza: Fundamentals of Ocean Renewable Energy: GeneratingElectricity from the Sea, Academic Press, ISBN:978-0-12-810448-4
3. David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, Renewable Energy Systems, PearsonEducation New Delhi , ISBN: 9789332586826,
4. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning, New Delhi, ISBN:978-93-88028-49- 3; E-book 978-93-88028-50-9
5. Deambi, Suneel: From Sunlight to Electricity: a practical handbook on solar photovoltaic ap-plication; TERI, New Delhi ISBN:9788179935736
6. Gipe, Paul: Wind Energy Basics, Chelsea Green Publishing Co; ISBN: 978-1603580304
7. Wizelius, Tore, Earnest, Joshua - Wind Power Plants and Project Development, PHI Learning,New Delhi, ISBN:978-8120351660
8. Kothari, D.P. et aL: Renewable Energy Sources and Emerging Technologies, PHI Learning,New Delhi, ISBN: -978-81-203-4470-9
9. Bhadra, S.N., Kastha, D., Banerjee, S, Wind Electrical Systems installation; Oxford University Press, New Delhi, ISBN: 9780195670936.

5. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	4	12
2	6	22
3	6	22
4	6	22
5	6	22
Total	28	100

4.7 (b)	INDUSTRIAL ROBOTICS (Theory)	L T P 2 0 0

1. COURSE OBJECTIVES

This course aims to equip students with foundational and advanced knowledge of industrial robotics, including robot anatomy, programming, kinematics, and control systems. Students will learn to design, simulate, and operate robotic systems used in manufacturing. Emphasis is placed on automation integration, safety protocols, and real-world applications, preparing learners for careers in robotics engineering, industrial automation, and smart manufacturing environments.

2. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that **Students will be able to**

CO1• Comprehend and adhere to industry health and safety guidelines while working with robotic systems to mitigate hazards.

CO2• Differentiate between coordinate systems and define the custom or user-defined coordinate frames for robotic operations.

CO3• Develop basic robot programs incorporating various motion types and relevant parameters.

CO4• Integrate robot with automation components i.e., PLC HMI, conveyor, and other manufacturing peripherals

CO5• Generate innovative ideas and apply creative problem-solving approaches to develop robotic automation solutions.

1. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO no.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PS O2
CO1	2	1	-	-	1	-	-	*	*
CO2	2	2	2	-	-	-	1	*	*
CO3	3	2	3	1	-	-	1	*	*
CO4	3	2	3	-	1	1	1	*	*
CO5	2	3	3	2	1	1	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

3. CONTENT

UNIT 1- INTRODUCTION TO INDUSTRIAL SAFETY PRACTICES AND INTRODUCTION TO INDUSTRIAL ROBOTICS (08 Periods)

Fire Extinguishers & its Types, safely handling Tools & Equipment, Use of proper Tools & Equipment & its maintenance, OSH & practices to be observed as a precaution.

Introduction of Robots and their Importance in Manufacturing and Production, Applications of robots in manufacturing and assembly for which they can be efficiently utilized, Role of robots and automation systems in boosting the safety at dangerous manufacturing tasks, Structure and functions of robot System (Basic Package) and additional Equipment, Major Applications of Robots-Pick and Place, Arc Welding, Ultrasonic welding, Part Transfer, Packing, Palletizing. Type of End of arm tools and differences between them: Handling tools - Pneumatic Gripper, Vacuum Gripper, Hydraulic Gripper, Hydraulic Gripper, and Servo-Electric Gripper. Welding guns – Arc Welding guns, Spot welding guns. Robotic cell and its various components. Cycle time and its importance. Operator job in robotic cell. Safety procedure for Programmer and an Operator.

UNIT 2- JOGGING OF ROBOT (04 Periods)

Turn ON /OFF Steps of Robot, Checking Robotic cell Health, Introduction to Teach pendent and key functions, Industrial robot Coordinate system, Different coordinate systems in Robots, Defining X, Y, Z co-ordinate system, Jogging Robot using Teach pendant in different Modes of coordinate systems: Joint co-ordinate system, rectangular co-ordinate system, and User or object co-ordinate system, Tool co-ordinate system, TCP (Tool centre point definition) i.e., TCP File. , Creating user defined work objects i.e., user coordinate frame File.(Box, circle, triangle work object definition)

UNIT 3- PROGRAMMING OF A OF ROBOT USING TEACH PENDANT (06 Periods)

Robot Program Structure, Different Motion Types used in Programming (PTP, Linear, Circular, Spline): Move J (PTP) , Move L (Linear) , Move C (Circular) , Move S (Spline) ; Different Motion Parameters used in Program Point Recording, Basic Program creation using Motion types and parameters, Path

optimization for smooth robot movement and cycle time, Safety instructions to be followed while loading and unloading of parts.

UNIT 4- ROBOT INTEGRATION WITH PLC, HMI AND OTHER EQUIPMENT

(06 Periods)

PLC and robot communication and HMI, Conveyor system and its communication with PLC, Methods to create fencing and safety equipment's, Steps to work with two different types of Robots at same project, Tool mounting on Robot Flange, Different connections of grippers (Electric, Pneumatic etc.).

UNIT 5- ROBOT PROGRAMMING WITH ADVANCE LEVEL INSTRUCTIONS

(04 Periods)

Loop control instructions, Arithmetic and Logical instructions, Shift instructions, Interfacing End of arm tools to Robot using robot I/O, establishing communication between Robot I/O and PLC modules, Function Keys in Pendant for Arc welding and Material Handling robot, MIG welding Instructions in Robot, MIG welding Program and how to optimize it, Material Handling Program and how to optimize it.

* Case studies and Mini Project should be carried out throughout the semester.

4. TEXT BOOKS/REFERNCE BOOKS

1. **Modern Robotics: Mechanics, Planning, and Control**
   Authors: Kevin M. Lynch, Frank C. Park
   Publisher: Cambridge University Press
2. **Robot Modelling and Control**
   Authors: Mark W. Spong, Francesco Bullo
   Publisher: Wiley
3. **Springer Handbook of Robotics**
   Editors: Bruno Siciliano, Oussama Khatib
   Publisher: Springer
4. **Robotics for Engineers**
   Author: Yoram Koren
   Publisher: McGraw-Hill
5. **Robotic Engineering: An Integrated Approach**
   Author: Richard D. Klafter, Thomas A. Chmielewski, Michael Negin
   Publisher: Prentice Hall

5. INSTRUCTIONAL STRATEGY

Combine theoretical instruction with hands-on training using robotic arms and simulation software. Use lectures, demonstrations, and lab sessions to teach robot programming, kinematics, and control. Incorporate project-based learning, real-world case studies, and industry visits. Assess through practical tasks, quizzes, and group projects to reinforce industrial robotics applications.

6.SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	**8**	**30**

2	**4**	**15**
3	**6**	**20**
4	**6**	**20**
5	**4**	**15**
Total	**28**	**100**

4.8	**ESSENCE OF INDIAN KNOWLEDGE AND TRADITION**	**L T P**
		2 0 0

COURSE OBJECTIVE:

Understand the fundamental aspects of the Indian Knowledge System, its integration with modern science, principles of Yoga and holistic healthcare, and practical applications in contemporary contexts.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

CO1: Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upavedas, Vedangas, and Upangas.

CO2: Relevance of science and spirituality, and contributions of ancient Indian science and technology.

CO3: Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.

CO4: Practical applications and case studies of the Indian Knowledge System's relevance today.

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Engineering Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	1	1	2	1	3	*	*
CO2	3	2	2	1	3	1	3	*	*
CO3	3	2	2	1	3	1	3	*	*
CO4	3	2	3	2	3	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS

Unit 1: Introduction to Indian Knowledge System **(07 Periods)**

Overview of Indian Knowledge System

- Importance and relevance
- Introduction to the Vedas
- Upavedas
- Vedangas
- Upangas

Unit 2: Modern Science and Indian Knowledge System **(07 Periods)**

- Relevance of Science and Spirituality,
- Science and Technology in Ancient India,

Unit 3: Yoga and Holistic Healthcare **(07 Periods)**

- Basic principles of Yoga
- Benefits of holistic healthcare practices
- Integration with modern healthcare

Unit 4: Case Studies / Assignment **(07 Periods)**

- Practical Applications / Case studies demonstrating the relevance of Indian Knowledge System in modern times

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	07	40
2.	07	30
3.	07	15
4.	07	15
Total	28	100

5.1	METALLIFEROUS MINING (Practicum)	L T P
		3 0 2

1. COURSE OBJECTIVE

The course aims to equip diploma holders in Mining Engineering with the knowledge and skills required to select suitable approaches for accessing mineral deposits, developing mine areas, choosing techno-economic methods of extraction, and carrying out actual mining operations.
It provides detailed understanding of mine development techniques, selection of methods of working—both opencast and underground—and various modern and conventional mining methods.
The course emphasizes experiential learning through site visits and field observations, enabling students to correlate theoretical concepts with real-life mining practices adopted in Indian mines.

2. COURSE OUTCOMES

After successful completion of the course, the student will be able to:

CO1: Explain the construction, working principle, and applications of the Alimak raise climber in underground mine development.

CO2: Understand and describe the basic concepts, advantages, and limitations of the shrinkage stoping method.

CO3: Demonstrate knowledge of the square set stoping method, including its application in weak ground conditions.

CO4: Explain and apply the principles of sublevel stoping methods used for large ore bodies.

CO5: Prepare neat sketches and explain the working principles of block caving, sublevel caving, and top slicing methods. Understand and illustrate modern ring-hole drilling and blasting systems as practiced in Indian mines such as Zawar Mines and Khetri Copper Mine.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	3	-	-	1	*	*
CO2	3	2	-	2	-	-	1	*	*
CO3	3	2	1	2	-	-	1	*	*
CO4	3	3	2	2	1	-	1	*	*
CO5	3	3	2	3	1	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT -1 INTRODUCTION TO METALLIFEROUS MINING (06 Periods)

Definition and importance of metalliferous mining,Difference between coal and metalliferous mining,Overview of metallic minerals: Iron, Copper, Bauxite, Lead, Zinc, Manganese, Gold, etc.Types of deposits (lode, vein, bedded, massive, disseminated, etc.)

UNIT -2 OPENING UP OF ORE DEPOSITS (12 Periods)

Choice of mode of entry-adit , shaft, declined and combined mode. their applicability , number and disposition : Choice of level interval and block / block length ; shape , size , position , excavation and equipping of shaft station , grizzly , ore / waste bin , main orepass system , underground crushing

and loading stations, underground chambers, sump and other subsidiary excavation ; arrangement for dumping into main orepass.

UNIT -3 MINE DEVELOPMENT IN METALLIFEROUS MINE (10 Periods)

Driving of raises by conventional methods Alimakeraise climber, its cycle of operation, drop raising using large dia drills, raise borers, winzes, pit bottoms station methods of stops preparation.

UNIT -4 STOPING METHOD (6 Periods)

Factors influencing the selection of stoping methods, various methods of stoping under-hand, overhand, breast stoping, shrinkage stoping cut and fill method. Block caving, sublevel caving, vertical crater mining, square set stoping, sublevel stoping.

UNIT -5 DEEP PRESSURE MINING (8 Periods)

Ex. No.	Name of Experiment	Hours
1.	Study and sketch of Alimake raise climber.	**4**
2.	Study and sketch of shrinkage method.	**4**
3.	Study and sketch of sqaure set stoping method.	**4**
4.	Study and sketch of cut and fill method.	**4**
5.	Study and sketch of sublevel stoping methods.	**4**
6.	Study and sketch of block caving, sublevel caving and top slicing methods.	**4**
7.	Study and sketch of modern ring hole drilling and blasting system as used at Zawar mines and Khetri copper mine.	**4**

5. INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organizations on visit. Approach extracted reading and handouts may be provided.

6. RECOMMENDED BOOKS

1. S.M.E. Handbook BY Hartman

2. Introduction to mining BY G.B. Mishra

3. Surface mining By D.J. Deshmukh
   By T. N. Singh

4. A Handbook on surface mining technology By Dr Sameer Kumar Das

Websites for Reference:

http://swayam.gov.in
http://nptel.ac.in

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	15
2	12	30
3	10	25
4	06	15
5	08	15
Total	42	100

5.2.1	COMPOSITE MATERIALS (Theory)	L T P
		3 0 0

1. COURSE OBJECTIVES

This course aims to provide students with a comprehensive understanding of composite materials, encompassing their various types, matrixes, and reinforcements. It will equip them with in-depth knowledge regarding polymer matrix composites and their production methods. Furthermore, the course will impart knowledge on the manufacturing processes and applications of different metal matrix composites and ceramic composites. Students will also become familiar with the latest advancements in polymer composite manufacturing. Ultimately, this course intends to enable students to acquire the necessary knowledge for selecting appropriate composites for industrial applications and understanding the behavior of composite structures under mechanical loading.

2. COURSE OUTCOMES(CO):

Upon the successful completion of this course, students will be able to:

CO1: Identify and classify the different types of composite materials, and explain the properties of their constituent matrix and reinforcement phases.

CO2: Demonstrate knowledge of manufacturing methodologies for polymer matrix composites (PMCs) and their suitability under different environmental and operational conditions.

CO3: Explain the manufacturing processes, concepts, and applications of metal matrix composites (MMCs) and ceramic composites.

CO4: Discuss recent advancements in composite manufacturing and their relevance to industrial applications.

CO5: Apply composite materials knowledge to practical applications, including understanding mechanical testing procedures and material selection.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	-	-	1	*	*
CO2	3	2	2	3	-	-	1	*	*
CO3	3	2	2	3	-	-	1	*	*
CO4	2	1	2	2	-	-	3	*	*
CO5	2	2	3	2	-	2	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT - 1 INTRODUCTION TO COMPOSITES (08 Periods)

Introduction to composites, **Matrix**- Types of Matrix-Polymer matrix composites (PMC), M Matrix Composites(MMC), Ceramics Matrix Composites and different application

Reinforcements- Basic requirements of selection of Reinforcements-Types of Reinforcements-Whiskers-Glass Fiber-Carbon fibers-Aramid fibers-Ceramic fibers-properties and applications.

UNIT-2 MANUFACTURING OF POLYMER MATRIX COMPOSITES

(08 Periods)

Types of PMC manufacturing methods- Hand Layup and Spray Techniques, Filament Winding, Pultrusion, Resin Transfer Molding (RTM) and Autoclave-Based Methods and application of PPC.

UNIT-3 MANUFACTURING OF METAL MATRIX COMPOSITES (MMC) AND CERAMICS MATRIX COMPOSITES (CMC)

(12 Periods)

MMC manufacturing methods- Solid State Processing - Diffusion Bonding, Power Blending and Consolidation, Liquid State Processing - Stir Casting, Squeeze Casting and applications of MMC.

CMC manufacturing Methods- Cold Pressing and Sintering, Hot Pressing, Reaction Bonding Processes, Infiltration, Electrophoretic Deposition and applications

UNIT-4 RECENT DEVELOPMENT IN COMPOSITE MANUFACTURING

(08 Periods)

Advanced composites-self healing composites, micro and nano-composites, biodegradable composites and carbon composites- process, applications and limitations

UNIT-5 MECHANICAL TESTING **(06 Periods)**

Mechanical testing of Composites-Tensile testing, fatigue testing, Toughness testing - testing procedure, equipment used and applications

5. Text Books

1. Aboudi, J., Arnold, and Bednarcyk. 2012. Micromechanics of Composite Materials: A Generalized Multiscale Analysis Approach. 1st ed.. Butterworth-Heinemann. Oxford, UK
2. Suresh, S., Martensen, A., and Needleman, A., "Fundamentals of Metal MatrixComposites", Butterworth, Heinemann, 2013.ISBN: 0080523714, 9780080523712.
3. Callister, W Jr, Rethwisch, D. 2012. Fundamentals of Materials Science and Engineering: An Integrated Approach. 4st ed.. John Wiley & Sons, Inc. Hoboken. NJ.
4. Strong, A. Brent, "Fundamentals of Composites Manufacturing : Materials, Methods and Applications", First Edition, Society of Manufacturing Engineers, 2008, ISBN 13: 9780872638549.
5. Ru-Min Wang,Shui-Rong Zheng,Ya-Ping Zheng,"Polymer Matrix Composites and Tchnology", First Edition, Woodhead publisher, 2011, ISBN:978-0-85709-221-2.
6. https://openscholarship.wustl.edu/cgi/viewcontent.cgi?article=1012&context=mems500

6. INSTRUCTIONAL STRATEGY

It is recommended that teachers implement task-based learning activities, wherein students engage in specific assignments or projects. The integration of technology tools and resources, including online platforms, interactive multimedia, and virtual communication tools, is advised to augment student engagement and offer supplementary practice opportunities. Furthermore, the incorporation of progressive evaluation techniques is encouraged to deepen the level of comprehension. Emphasis should be placed on illustrating the practical applications of composites to facilitate enhanced understanding

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	8	19
2	8	19
3	12	28

4	**8**	**19**
5	**6**	**15**
Total	**42**	**100**

5.2.2	**ROCK MECHANICS AND GROUND CONTROL (Theory)**	**L T P**
		3 0 0

1. COURSE OJECTIVES

Rock mechanics and ground control are essential disciplines within civil and mining engineering, focusing on the behaviour of rock masses and ensuring safe and efficient excavation and construction. These fields encompass the study of rock properties, stress distribution, and support systems to mitigate hazards such as collapses and ground instability. Understanding these principles is crucial for designing robust structures and maintaining operational safety in underground and surface environments.

2. COURSE OUTCOME(CO):

CO1: Understand the fundamental concepts and principles of rock mechanics.
CO2: Analyze stress and strain behavior in rock masses under different loading conditions.
CO3: Evaluate the physical and mechanical properties of rock materials and their influence on rock mass behavior.
CO4: Apply rock mechanics principles to design excavation, support systems, and assess stability in underground and surface projects.
CO5: Develop and recommend strategies for effective ground control in mining and civil engineering applications.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability	PO6 Project Management	PO7 Life Long Learning	PSO1	PS O2

	Knowledge				and Environment				
CO1	3	1	-	-	-	-	1	*	*
CO2	3	3	2	2	-	-	1	*	*
CO3	3	3	2	2	-	-	1	*	*
CO4	2	3	3	3	1	1	2	*	*
CO5	2	2	3	2	2	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENT

UNIT 1- INTRODUCTION TO ROCK MECHANICS (09 Periods)

Definition of some important terms used in rock mechanics, application of rock mechanics in mining, introduction to stress analysis, principal stresses and strains, differential equations of static equilibrium.

UNIT 2- PHYSICAL PROPERTIES OF ROCKS AND ROCK INDICES

(09 Periods)

Density, porosity, moisture content, permeability, swell index, slake durability index, thermal conductivity, hardness, durability, Protodyaknov index, impact strength index, point load index, rock mass classification.

UNIT 3- MECHANICAL PROPERTIES OF ROCKS (08 Periods)

Preparation of test specimens, laboratory determination of mechanical properties of rocks, compressive strength, tensile strength, shear strength, modulus of elasticity, Poisson's ratio, triaxial strength of rocks, Mohr's envelope, effect of various parameters on the strength of rocks, in-situ strength, effect of joints and fracture on mechanical properties of rocks.

UNIT 4- NON-DESTRUCTIVE TESTING METHODS AND TIME DEPENDENT PROPERTIES OF ROCKS (08 Periods)

Dynamic wave velocities, dynamic elastic constants, their determination in the laboratory, application in mining, time dependent properties of rocks, creep, mechanism of creep of rocks –different stages, rheological models.

UNIT 5- UNDERGROUND SUPPORTS (08 Periods)

Various methods of roof examination, pressure arch theory, ground forces and field stresses, mechanism, objectives and limitations of supports, conventional supports – column type, timber sets, arches, yielding type; rock and cable bolting, rock grouting, shotcreting, roof stitching, support of shaft bottoms, galleries, junctions and places of roof falls, design of supports, longwall powered supports. Design of systematic support rules for B & P Development, depillaring LW gate readings and extraction.

5. INSTRUCTIONAL STRATEGY

- Use computer based learning aids for effective teaching learning.
- Students should be taken to various industrial units for clear conception of topics.
- Efforts should be made to relate the process of teaching with direct experiences in the industry.

6. RECOMMENDED BOOKS

1. Rock mechanics and ground control by D. Biswas
2. Rock mechanics and strata control by B.S. Verma
3. Rock mechanics for practicing engineers by A.K. Verma, D.Dev & KUM Rao
4. Rock Mechanics and Design of Structure by L. Obert and W.I Duvall
5. Handbook on Mechanical Properties of Rocks, Vol. I, II, III and IV, by V.S. Vutukuri, and R.D. Lama
6. Ground Control by S.S. Peng

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	9	21
2	9	21
3	8	20
4	8	19
5	8	19
Total	42	100

5.2.3	MINERAL PROCESSING (Theory)	L T P 3 0 0

1. COURSE OJECTIVES

The course on Mineral Processing (Ore Dressing) aims to equip students with a comprehensive understanding of techniques used for the extraction and refinement of valuable minerals from ores. Students will learn various operations such as comminution, classification, concentration, and dewatering, with the goal of maximizing recovery of valuable minerals while minimizing waste. The course also covers key methods like flotation, magnetic separation, and gravity separation, along with environmental and safety considerations.

2. COURSE OUTCOMES

After completing this course, students will be able to:

CO1: Explain the scope, objectives, and methods of mineral processing, including ore sorting, harmful material removal, and ore transportation.

CO2: Analyze the principles of comminution, including crushing, grinding, reduction ratios, and types of crushers.

CO3: Apply laboratory and industrial sizing, classification, and sampling techniques, and understand metallurgical accounting.

CO4: Demonstrate knowledge of various concentration and separation techniques such as gravity, magnetic, froth flotation, and coal washing.

CO5: Explain special mineral processing methods, including chemical extraction, leaching, cyanidation, ion exchange, solvent extraction, and pilot plant practices for different ores.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	-	2	-	1	*	*
CO2	3	3	2	2	1	-	1	*	*
CO3	3	3	2	3	1	1	1	*	*
CO4	3	2	2	3	2	-	1	*	*
CO5	3	2	3	3	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT -1 INTRODUCTION MINERAL PROCESSING (6 periods)

Scope, objectives, minerals/ores for mineral processing, methods of treatment, choice of methods, sequence of operations, product, flow sheets, ore sorting – hand mechanical, electronic, removal of harmful materials, ore transportation

UNIT -2 COMMINUTION (8 periods)

Introduction to comminution, primary/secondary/tertiary crushing, purpose, duty, theory of crushing, crushing sequence, reduction ratio, types of crushers and comparison, general crushing flow sheet, wet/dry grinding, mechanism and various affecting parameters

UNIT-3 LABORATORY & INDUSTRIAL SIZING AND SAMPLING AND CONTROL (10 periods)

Purpose, factors governing particle behaviour, laboratory and industrial screen, trommels, vibrating screens, etc. wet and dry screening, classification, classifiers. Purpose, sampling -solid ore, pulp, head feed, grinding circuit samples, flotation products, etc., X-ray fluorescence, automatic sampling. Metallurgical accounting.

UNIT -4 SEPARATION / CONCENTRATION (8 periods)

Newton's and Stoke's Laws of particle settlement, different concentration techniques – gravity, chemical froth flotation, wet & dry magnetic separation, electromagnetic, amalgamation, heavy media, jigging, shaking tables, sluicing, spirals, thickeners, filtration, etc., coal washing.

UNIT -5 SPECIAL METHODS (10 periods)

Chemical extraction, cyanide process, leaching, use of ion exchange, solvent extraction, pilot plant studies on ores, tailing dams; generalised plant practice/flow sheets for coal and other important ores – copper, aluminium, lead, zinc, silver, gold, uranium, iron, limestone, magnesite.

5. TEXT BOOKS

1. Jain, S.K., Ore Processing, Oxford – IBH Publishing, 1984.
2. Gaudin, A.M., Principles of Mineral Dressing – McGraw Hill Book Company,1971.
3. Taggart, A.F., Handbook of Mineral Dressing, John Wiley and Sons, New York,1990.
4. Wills, B.A. Mineral Processing Technology, Pergamon Press, 1985.
5. Vijayendra, H.G., Handbook on Mineral Dressing, Vikas Publishing House Pvt. Ltd.1995

6. INSTRUCTIONAL STRATEGY

- Lectures and readings that cover fundamental principles, processes, and techniques involved in mineral processing.
- Inviting industry experts to share insights on current practices, technological advancements, and challenges in the field.
- Engaging discussions, group projects, and presentations to encourage critical thinking, collaboration, and communication skills among students.
- Continuous assessment through quizzes, assignments, and examinations

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	6	12
2	8	20
3	10	25
4	8	18
5	10	25
Total	42	100

5.3	MINES SURVEYING -II	L T P
		2 0 6

1. COURSE OJECTIVES

The diploma holders in Mining Engg. will be responsible for various types of surveying methods used for preparing various types of plans and sections used in open cast as well as underground surveying.

The subject will provide him basic knowledge, triangulation, correlation, setting out curves, stope surveying. As far as possible teachers while teaching are supposed to give practical knowledge of surveying with timing fields as per course content.

2. COURSE OUTCOME(CO):

After completing the course student will be able to:

- Solve mathematical problems using algebraic and Trigonometric functions
- Demonstrate fundamental knowledge of the systems and processes used to construct the built environment.
- Perform basic land surveying instruments & Perform related calculations.
- Understand the basic concept of theodolite their types and their functioning.
- Substantiate the principles of tachometry, types & uses.
- Solve the problem related to triangulation
- Know the functioning of GPS & GIS.
- Can able to operate Total Station & also can identify the best use of total station

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	2	-	-	1	*	*
CO2	3	2	-	2	-	-	1	*	*
CO3	3	3	1	2	-	-	1	*	*
CO4	2	3	2	2	-	-	1	*	*
CO5	3	2	2	3	1	1	2	*	*
CO6	3	2	2	2	1	2	1	*	*
CO7	3	2	-	3	-	-	1	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENT

UNIT -1 THEODOLITE: (04 Periods)

Types of theodolite and their construction, measurement of horizontal & vertical angles. Theodolite traversing, traverse calculations, adjustment of the traverse, computation of co-ordinates, temporary & permanent adjustment.

UNIT -2 TACHOMETER: (04 Periods)

Principles of tachometer , types of tachometers, use of tachometer for determination of distances and levels , Tachometric surveying, problem solving.

UNIT -3 TRIANGULATION: (04 Periods)

Principles involved in triangulation, purpose of triangulation, base line measurement, method of measuring angles, reference direction, true magnetic meridian, booking readings, calculation of coordinates and plotting.

UNIT -4 CORRELATION: (04 Periods)

Needs for correlation, method of correlation of surface and underground surveying through inclines, one or two vertical shafts, steeply inclined shafts. correlation by magnetic needles.

UNIT -5 (4Periods)

(a) Total Station and laser profiling system -

(b) Astronomical Surveying:

Use of gyro theodolite for determination of true Norts, global positioning system and its application in mine surveying, drone based application in mine survey, Remote sensing and GIS system.

UNIT -6 MINE PLANS AND SECTIONS: (4 Periods)

Different type of mine plans and sections, concept of scale and R.F. , legal requirement to mine plans and sections, conventional signs, preparation and preservation of mine plans and sections. Enlargement of plans , use of ediographer and pantograph, represttation of geological and other features on mines plans sections plan to be checked on the change ownership, recopeining of mines.

UNIT -7 EDM: (04 Periods)

Principle of measurement , types , corrections, selection of equipment , Total station.

Ex. No.	Name of Experiment	Hours
1.	Study of the different parts of a theodolite.	**4**
2.	Reading of horizontal and vertical angles.	**4**
3.	Traversing and plotting by gales method.	**4**
4.	Testing and adjustment of a theodolite.	**4**
5.	Determination of tachometer constants.	**4**
6.	Determination of height of an inaccessible point by tachometric survey.	**4**
7.	Determination of distance between two inaccessible objects(base line method)	**4**
8.	Exercise on tachometric contouring.	**4**
9.	Base line measurement.	**4**
10.	Triangulation of small area.	**4**

11.	Maintaining the grade or roads by grade peg method.	**4**
12.	correlation by single shaft and double dhaft or incline.	**4**
13.	Setting out curves.	**4**
14.	Stop surveying by the method of tape triangulation.	**4**
15.	stop surveying by tying in the method.	**4**
16.	Study, sketch and use of a plan meter.	**4**
17.	Study and preparation of a mine plan per mining regulation.	**4**
18.	Determination of azimuth of line by method observing a start at equal altitude.	**4**
19.	Different problems on dip, faults and outcrops of a bed.	**4**
20.	Study of G.T. sheets and laying out.	**4**
21.	Surveying of small quarry.	**4**

5. INSTRUCTIONAL STRATEGY

- Use computer based learning aids for effective teaching learning.
- Students should be taken to various industrial units for clear conception of topics.
- Efforts should be made to relate the process of teaching with direct experiences in theindustry.

6. RECOMMENDED BOOKS

1. Surveying vol.II&III — By- B.C.Punmia
2. Metalliferrous Mines regulation 1961. — By- Wini berg
3. Metalliferrous Mine Surveying. — ---do------
4. Answer to papers Mine Surveyor's 71nundation71 of 71nundation examination. — By- D.K.Jain
5. Mine Surveying vol.III — By- S-Ghatak

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	14
2	04	14
3	04	14
4	04	14
5	04	14
6	04	14
7	04	16
Total	28	100

5.4	SURFACE MINE, PLANNING AND DESIGN	L T P
		2 0 4

1. COURSE OJECTIVES

The diploma holders in mining engineering will have to prepare feasible planning & development in varied geological conditions with optimal output.
The course content of the subject will provide essential and detail knowledge about mine supports, subsidence and stowing technology.
The teachers while teaching are supposed to give demonstration of present mining technological situations and challenges in mining fields with reference to above mentioned mining technological aspects.

2. COURSE OUTCOME(CO):

After undergoing this course, the students will be able to:

CO1: Explain the basic concepts of opencast mining, stripping methods, pit layouts, and selection of HEMM.
CO2: Describe mining methods for building stones and apply appropriate blasting patterns and crushing techniques.
CO3: Analyze slope stability, identify types of slope failures, and recommend corrective measures using instruments and drainage systems.
CO4: Design and plan mine layouts, including haul roads, benches, overburden estimation, equipment selection, and mine runnage.

CO5: Explain mining, processing, and export of dimensional stones, and demonstrate knowledge of mechanized cutting, wire saws, hydraulic jacks, drills, block dressing, and controlled blasting.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	2	-	-	1	*	*
CO2	3	2	2	2	1	-	1	*	*
CO3	3	3	2	2	2	1	1	*	*
CO4	3	3	3	2	1	2	1	*	*
CO5	3	2	3	3	2	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT- 1 INTRODUCTION (05 Periods)

General information of mining, basic definition of various terms related to surface mining, concept of stripping method, operating and ultimate pits, continuous miners and bucket wheel Excavators, advantages & disadvantages. Opening up of deposits, driving of trenches, laying of communication routes, system of disposal of overburden, removal of cover rock. General opencast mining methods, basic layout, choice of mining methods, dumper- shovel scraper, ripper, selection and application of HEMM used in OCM..

UNIT- 2 MINING AND PROCESSING OF BUILDING STONES (05 Periods)

Mining of granite and sand stone for grits, boulders, stone, Bricks, etc. Blasting pattern in hard rocks and sand stones. Controlled blasting in sand stone areas, Stone crushing plant Types of stone crushers.

UNIT- 3 SLOPE STABILITY (06 Periods)

Slope Stability (Bench and dump), dump design, back filling, different types of slope failures, measures to be taken against slope failures. Instruments used to determine slope stability. Power distribution and open cast mines. Pumping and drainage system.

UNIT- 4 MINE DESIGN AND LAYOUT (06 Periods)

Different layouts for haul roads, design of mine benches for estimating over burden and extraction of minerals, concept of factor of safety, factors influencing equipment selection, mine runnage and its planning.

UNIT- 5 MINING OF DIMENSIONAL STONES : (06 Periods)

Resources of marble, granite, slate, sandstone, limestone as dimensions, their uses, marketing and export.

Conventional, diamond wire saw cutting, jet flame, helicoidal wire saw, Lorfman chain saw cutter, hydraulic jacks, track mounted rock drills, monoblade block dresser, mechanised crane, controlled blasting.

Ex. No.	Name of Experiment	Hours
1.	Sketch and diagram of various types of stone crushers	**5**
2.	Layout of crushing plant	**5**
3.	Layout of open cast mining	**5**
4.	Sketch and diagram of mechanical loaders.	**5**
5.	Sketch and diagram of tipper and dumpers	**6**
6.	Layout of mines composing loaders, machines and dumpers	**6**
7.	Sketch and diagram of blasting pattern in hard rock building Stone mines	**6**
8.	Sketch and diagram of blasting pattern of controlled blasting	**6**
9.	Sketch and diagram of wire saw	**6**
10.	Study of dragline	**6**

5. INSTRUCTIONAL STRATEGY

- Use teaching aids for classroom teaching
- Give assignments for solving numerical problems
- Arrange industry visits to augment explaining use of various machine components like belt, rope, chain, gear drives, action due to unbalanced masses, brake clutch, governors, fly wheels, cams and gear drives
- Video films may be used to explain the working of mechanisms and machine components like clutch, governors, brake etc.

6. RECOMMENDED BOOKS

1. Surface Mixing — By Samir Das
2. Elements of Mining I,II & III Vol. — By D. J. Deshmukh
3. Surface Mining — By G. B. Mishra
4. Surface Mining Planning & Designing — By S.P Mathur

Website for Reference:

http://swayam.gov.in
http://nptel.ac.in

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	20
2	05	20
3	06	20
4	06	20
5	06	20
Total	28	100

5.5	SKILL DEVELOPMENT (Survey Camp)	L T P
		0 0 0

*** Survey camp two weeks' duration to be organized during Vth Semester by the institute with collaboration of any mining industry.

5.6	INDIAN CONSTITUTION	L T P 2 0 0

1. 1 COURSE OBJECTIVES:

This course aims to help students understand the origin, development, and importance of the Indian Constitution. It introduces students to their fundamental rights and duties, while explaining the structure and functions of the legislature, executive, and judiciary in India. The course also promotes democratic values such as equality, justice, and the rule of law, and encourages students to develop a sense of responsible citizenship, civic awareness, and active participation in nation-building.

2. COURSE OUTCOMES (CO):

After successful completion of this course, the students should be able to

CO1: Understand the historical background, philosophy, and process involved in the making of the Indian Constitution.

CO2: Analyze the structure and functioning of the Union Government, including the roles, powers, and relationships of the President, Prime Minister, Council of Ministers, Lok Sabha, and Rajya Sabha.

CO3: Explain the organization and working of the State Government.

CO4: Evaluate the system of Local Administration in India by understanding the structure and functions of District Administration, Municipal Corporations, and Zila Panchayats.

CO5: Understand the role, powers, and significance of the Election Commission of India in ensuring free and fair elections in a democratic system.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	-	2	-	2	*	*
CO2	3	3	2	-	2	1	2	*	*
CO3	3	2	1	-	2	1	2	*	*

CO4	3	3	2	-	3	2	2	*	*
CO5	3	2	-	-	3	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. COURSE CONTENT

Unit 1 – The Constitution - Introduction **(6 Period)**

The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation. State Policy Principles

Unit 2 – Union Government **(6 Period)**

Structure of the Indian Union, President – Role and Power, Prime Minister and Council of, Ministers Lok Sabha and Rajya Sabha

Unit 3 – State Government **(8 Period)**

Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat

Unit 4 – Local Administration **(4 Period)**

District Administration Municipal Corporation, Zila Panchayat

Unit 5 – Election Commission **(4 Period)**

Role and Functioning Chief Election Commissioner State Election Commission

5. RECOMENDED BOOKS:

S. No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L. Fadia	Sahitya Bhawan; New edition (2017)
3.	Introduction to the Constitution of India	DD Basu	Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.html

b. http://www.legislative.gov.in/constitution-of-india

c. https://www.sci.gov.in/constitution

d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

6. SUGGESTED DISTRIBUTION OF MARKS

SR No	Topic Time Allotted (periods)	Marks Allotted %
1	6	21
2	6	21
3	8	28
4	4	15
5	4	15
TOTAL	28	100

6.1	ENTREPRENEURSHIP AND START-UP	L T P
		2 0 0

1. 1. COURSE OBJECTIVES:

Explore the Objectives of Entrepreneurship, including innovation, wealth creation, and societal impact, and learn how Entrepreneurs foster economic growth. Entrepreneurship drives the economy and is the very fundamental to all innovation and development.

2. COURSE OUTCOMES (CO):

After successful completion of this course, the students should be able to

CO1: Understand the basic of Entrepreneurship and Business Structures

CO2: Planning and implementation of Business ideas

CO3: Understanding Strategical Market Analysis

CO4: Manage Organizational roles

CO5: Understanding various Financial schemes

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	1	-	-	-	2	*	*
CO2	2	3	3	2	1	3	2	*	*
CO3	2	2	2	2	1	-	2	*	*
CO4	2	1	2	-	2	3	2	*	*
CO5	3	2	2	2	2	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. COURSE CONTENT:

Unit 1 : **Introduction to Entrepreneurship and Start – Ups (02 Periods)**

- Definitions, Classification of Entrepreneur
- Traits of an Entrepreneur, Intrapreneurship, Motivation
- Types of Business Structures- On the Basis of size and On the basis of ownership
- Similarities/differences between entrepreneurs and managers

Unit 2 : **Business Ideas and their implementation** **(06 Periods)**

- Discovering ideas and visualizing the business
- Activity map
- Business Plan (Case Study)

Unit 3 :**Ideas to Start-up** **(06 Periods)**

- Marketing and Accounting- Definition and Importance.
- Market Analysis – STP (Segmentation, Targeting, Positioning)
- Competition evaluation and Strategy Development – Vision, Mission, Goal, Objectives.
- Risk analysis- SWOT Analysis.

Unit 4 : **Management** **(04 Periods)**

- Definition Concept and Functions of Management
- Company's Organization Structure- Concept and Classification
- Recruitment and Selection- Definition,
- Training and Development- Importance.

Unit 5 : **Financing and Protection of Ideas** **(10 Periods)**

- Financing methods available for Entrepreneurship/ Startups in India (Government Scheme, Banking, NBFCs, SHG and Micro Financing).
- Intellectual Property Rights- Overview of - Copyrights, Trademark, Geographical Indicators, Patenting and Licenses
- Communication of Ideas to potential investors – Investor Pitch.

Succession, Dissolution and Harvesting strategy**:** Ways of succession **,**Types of Dissolution

5. RECOMMENDED RESOURCES:

S. No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN – 978-0984999392
2.	Entrepreneurship Development (A new Venture creation)	Vasant Desai	Himalya Publication
3.	Entrepreneurship Development	Khanka S.S.	S Chand & Company Limited New Delhi
4.	Entrepreneurship Development	Gupta and Srinivsan	S Chand & Company Limited New Delhi

5	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN – 978-0755388974
6	The Lean Startup: How Today's Entre- preneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN – 978-0670921607
7	The Innovator's Dilemma: The Revolu- tionary Book That Will Change the Way You Do Business	Clayton M. Chris- tensen	Harvard business ISBN: 978-142219602

SUGGESTED SOFTWARE/LEARNING WEBSITES:

a. https://www.fundable.com/learn/resources/guides/startup
b. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate-structure/
c. https://www.finder.com/small-business-finance-tips
d. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/
e. NPTEL Course on Entrepreneurship https://onlinecourses.nptel.ac.in/noc23_mg74/preview
f. National Geographic Channel you tube Video on "GI Tag Crafts of Bharat"

6. INSTRUCTIONAL STRATEGY:

Introduce each unit with a structured exposition of fundamental concepts, definitions, and classifications, emphasizing the roles, traits, and functions of entrepreneurs and managers. Practical applications, including case studies, business plan development, market analysis, and risk assessment, shall be demonstrated to illustrate real-world entrepreneurial processes. Students shall engage in guided exercises, group activities, and simulations to apply theoretical knowledge in developing business ideas, strategies, and investor communication skills. Assessment shall be conducted through presentations, discussions, and project-based evaluations to monitor understanding, provide feedback, and cultivate entrepreneurial competence.

7. SUGGESTED DISTRIBUTION OF MARKS:

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	2	17
2	6	14
3	6	20
4	4	17
5	10	32

Total	**28**	**100**

6.2.1	**INSPECTION & QUALITY CONTROL(Theory)**	**L T P** **3 0 0**

1. COURSE OBJECTIVES:

This course is designed for individuals in the quality and manufacturing sectors, aiming to enhance their skills in inspection and quality control through the use of various measurement instruments. It offers a comprehensive, entry-level introduction and practical exposure to the measurement tools frequently used in inspections, with a special emphasis on hand-held devices. Upon successful completion of the course students will qualify as Quality Control Inspectors or Quality Assurance Technicians.

2. COURSE OUTCOME(CO):

On successful completion of this course, student will be able to

CO1: Explain the principles of industrial safety, proper handling of tools and equipment, fire extinguisher usage, and occupational safety practices.

CO2: Describe the stages and importance of quality control, quality assurance, inspection types, and international quality standards such as Six Sigma, Lean Manufacturing, and TQM.

CO3: Apply metrology principles, measurement techniques, and error analysis using handheld measuring instruments such as Vernier Calipers, Micrometers, and Gauges.

CO4: Demonstrate the use, calibration, and application of height gauges, profile projectors, protractors, and digital/analog indicators for inspection purposes.

CO5: Interpret engineering drawings and apply Geometric Dimensioning & Tolerancing (GD&T) principles for part and assembly inspection in manufacturing.

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	2	2	-	1	*	*
CO2	3	2	2	2	2	-	1	*	*
CO3	3	3	2	3	1	1	2	*	*
CO4	3	2	2	3	1	1	2	*	*
CO5	3	2	3	3	1	1	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. COURSE CONTENT:

UNIT 1 : Introduction to Industrial Safety Practices, Inspection and Quality Standards

(06 Periods)

Safely handling Tools & Equipment, Fire Extinguishers & its Types, Use of proper Tools & Equipment & its maintenance, OSH & practices to be observed as a precaution.

UNIT 2 : Inspection and Quality Standards (8 Periods)

Different Stages of Quality Control in the production process**,** Quality Assurance vs quality control**,** Importance of Quality control in minimizing defect and optimizing production**,** Types of Inspection Visual Inspection, Dimensional Inspection, Functional Inspection, Destructive Vs Non-Destructive Testing, International Quality Standards**,** Six Sigma**,** Lean Manufacturing**,** Total Quality Management

UNIT 3 : Importance of Metrology in Quality Control (08 Periods)

Importance of Quality Control in engineering sector, Basic principles of measurement, Measurement Terminology, Precision, Accuracy, Tolerances and error analysis. Types and classifications of handheld measuring instruments, Vernier Calipers (Digital, Dial and Vernier Scale), Micrometer and Gauges

UNIT 4: Height Gauges, Profile Projector, Protractors and Gages (10 Periods)

Height Gages: Structure, reading techniques, applications, and calibration, Types of Height Gauges, Use of Height Gauges, Profile Projector components, working of Profile Projectors, Importance of

profile projector in inspecting surface profile, contours and shapes. Protractors and Gages: Universal Bevel Protractor, Thickness, Radius, and Thread Pitch Gages - specific uses, advantages, and limitations, Digital and Dial Indicators: Structure, digital vs. analog readouts, applications, and calibration

UNIT 5: Engineering Drawing and Its importance in Inspection & Geometric Dimensioning and Tolerancing (GD&T) (08 Periods)

Drawing symbols, Types of Dimensions (Linear, Angular, Geometric dimensions (GD&T). Inspection based on Engineering Drawing, inspect parts and assemblies based on Engineering Drawing, Use of Drawing for Quality in Manufacturing, GD&T Symbols, Types of Tolerances, Interpreting GD&T on Engineering Drawing

5. RECOMMENDED BOOKS

1. Production Management by C.L. Mahajan; Satya Parkashan Company Limited, New Delhi.
2. Industrial Engineering and Management by T.R. Banga and SC Sharma; Khanna Publishers, Delhi.
3. Industrial Engineering and Management by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
4. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
5. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

6. INSTRUCTIONAL STRATEGY:

1. Use computer based learning aids for effective teaching-learning.

2. The subject can Lecture Cum Demonstration basics.

3. Students should be taken to various industrial units for clear conception of various topics.

4. Efforts should be made to relate the process of teaching with direct experiences in the industry.

5. Demonstrate use of various measuring instruments while imparting theoretical instructions.

7. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	19
2	8	19
3	8	19
4	10	24
5	8	19
Total	42	100

6.2.2	ADVANCED ENGINEERING MATHEMATICS	L T P
		3 0 0

1. COURSE OBJECTIVES:

Mathematics is essential for engineering students to understand core engineering subjects. It provides the framework for engineers to solve problems in engineering domains. Understand the concepts of eigen-values and eigen-vectors of matrices. Learn the notation of partial differentiation and determine the extremities of functions of two variables. Acquire knowledge in vector calculus which is significantly used to solve engineering problems. Formulate and solve differential equations. Understand Laplace transformation and its engineering applications.

2. COURSE OUTCOMES:

On successful completion of this course, student will be able to

- Find eigen values and corresponding eigenvectors of a square matrix.
- Apply the knowledge of partial differentiation to evaluate Jacobian and extremities of two variable function
- Evaluate the gradient of a scalar field and the divergence and curl of vector fields.
- Solve ordinary differential equations using various techniques.
- Use Laplace transforms to solve first-order ordinary differential equations.

3.SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	-	-	-	1	*	*
CO2	3	3	1	-	-	-	1	*	*
CO3	3	2	1	-	-	-	1	*	*
CO4	3	3	2	-	-	-	1	*	*
CO5	3	3	2	-	-	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

UNIT 1 : EIGEN VALUES AND EIGEN VECTORS (08 Periods)

Characteristic equation – Eigen-values of 22 and 33 real matrices – Eigen-vectors of 22 real matrices – Properties of eigen-values (excluding proof) – Cayley-Hamilton theorem (excluding proof) – Simple problems.

UNIT 2 : FUNCTIONS OF SEVERAL VARIABLES (08 Periods)

Partial derivatives of two variable and three variable functions (up to second order) – Homogeneous functions and Euler's theorem (excluding proof) – Jacobian matrix and determinant – Maxima and minima of functions of two variables – Simple problems.

UNIT 3: VECTOR CALCULUS (08 Periods)

Scalar field and Vector field – Vector differential operator – Gradient of a scalar field – Directional derivative – Divergence and curl of a vector field (excluding properties) – Solenoidal and irrotational vector fields – Simple problems.

UNIT 4 : DIFFERENTIAL EQUATIONS (10 Periods)

Differential equation – Formation – Order and degree – Solution of a differential equation – Equations of first order and first degree – Variable separable method – Leibnitz's Linear equations – Second order equations of the form aD2+bD+cy=enx where a,b,c and n are constants and the auxiliary equation am2+bm+c=0 has only real roots) – Complementary function – Particular integral – General solution – Simple problems

UNIT 5 : LAPLACE TRANSFORMS (08 Periods)

Definition of Laplace transform – Laplace transforms of standard functions - Linearity and change of scale property (excluding proofs) – First shifting property – Laplace transforms of derivatives – Properties (excluding proofs) – Inverse Laplace transforms – Properties (excluding proofs) – Solving first order ordinary differential equation using Laplace transforms – Simple problems.

4. RECOMMENDED BOOKS

1. John Bird, Higher Engineering Mathematics, Routledge, 9th Edition, 2021.

2. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.

3. Arumugam, S., Thangapandi Isaac, A., & Somasundaram, A., Differential Equations and Applications, Yes Dee Publishing Pvt. Ltd., 2020.

4. Duraipandian, P., & Kayalal Pachaiyappa, Vector Analysis, S Chand and Company Limited, 2014.

5. Narayanan, S., & Manicavachagom Pillai T.K., Calculus Volume I and II, .Viswanathan Publishers Pvt. Ltd., 2007

5. INSTRUCTIONAL STRATEGY:

The basic instructional strategy to teach basic mathematics, Binomial theorem, trigonometry, differential equations etc. should be conceptual with real world applications of relevant branch. More numerical and theory examples can be used for clear understanding of the content.

6. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted(Periods)	Marks Allotted(%)
1	8	20
2	8	20
3	8	20
4	10	20
5	8	20
Total	42	100

6.2.3	FINANCE FUNDAMENTALS (Theory)	L T P
		3 0 0

1. COURSE OBJECTIVES

The objective of this course is to enable the student to identify different ways to save money for future, understand various techniques to raise capital, get acquainted with the essential terminologies used in finance language, get exposed to banking, credit, investments, assets, different types of budgeting, instill the concept of costing and its impact on profitability. It also encompasses study of money, banking, credit, investments, assets, liabilities that make up financial systems and improves overall financial literacy.

2. COURSE OUTCOMES(CO):

Students will be able to:

CO1: Manage financial resources effectively to achieve personal goals
CO2: Ensure that the business has enough money to meet its obligations and that it can recover in the future
CO3: Exhibit financial literacy through the usage of different terminologies appropriate to the context
CO4: Differentiate different types of budgeting and allocate the resources
CO5: Apply the idea of marginal costing in decision making

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	1	-	1	-	2	*	*
CO2	3	2	1	-	1	-	2	*	*
CO3	3	1	1	-	1	-	3	*	*
CO4	3	2	2	-	1	-	2	*	*
CO5	3	2	1	-	1	-	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

4. CONTENTS

UNIT-1 PERSONAL FINANCE (07 Periods)

Personal Finance – Meaning, Objectives and advantages – Individual Perspective – Family Perspective – Time Value of Money – Personal Savings: Meaning, Different modes of Saving – Bank Deposit, Online Investments, Insurance, Stocks, Gold, Real Estate – Returns Vs Risk – Financial Discipline – Setting Alerts for commitments (With Real time Examples)

UNIT-2 BUSINESS FUNDING (07 Periods)

Sources: Personal Savings – Borrowings - Venture Capital – Venture Capital Process – Commercial Banks – Government Grants and Scheme

UNIT-3 FINANCE LANGUAGE (10 Periods)

Capital – Drawing – Income – Expenditure – Revenue Vs Capital Items – Assets – Fixed Assets – Current Assets – Fictitious Assets – Liabilities – Long-term Liabilities – Current Liabilities – Internal Liabilities –

External Liabilities – Share holders fund: Equity Share capital, Preference Share Capital, Reserve & Surplus – Borrowings: Debentures, Bank Loan, Other Loan – Depreciation – Reserve Vs Provision.

UNIT-4 BUDGETING (08 Periods)

Budgetary Control – Meaning – Preparation of various budgets – Purchase budget – Sales Budget – Production budget – Cash Budget – Flexible budgets. (With Problems)

UNIT-5 MARGINAL COSTING (10 Periods)

Marginal Costing – Meaning – Marginal Costing Vs Absorption Costing – Concepts of Variable Cost, Fixed Cost and Contribution – PV Ratio – Break Even Point – Margin of Safety – Key Factor – Application of Marginal Costing in decision making – Make or Buy – Shutdown or Continue – Exploring New Markets (With Problems)

5. TEXT BOOKS/REFERENCE BOOKS

1. S. K. Sharma, Fundamentals of Financial Management, Sultan Chand & sons, New Delhi, 2024

2. L. Natarajan, Banking Theory, Law & Practice, 1st edition, Margham Publications, 2019

3. T.S. Reddy and Dr. Y. Hariprasad Reddy, Management Accounting, 1st edition, Margham Publications, 2005

4. T.S. Reddy and Dr. Y. Hariprasad Reddy, Cost Accounting, 1st edition, Margham Publications, 2012

5.Web resource: **https://archive.nptel.ac.in/courses/110/107/110107144/**

6. INSTRUCTIONAL STRATEGY

This course gives a deep insight into the finance fundamentals such as money management and the process of acquiring needed funds. The teacher should actively engage students to boost their learning confidence, incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts, utilize demonstrations and plan interactive student activities for an engaging learning experience. The teacher employs a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.

7. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	7	17
2	7	17
3	10	23
4	8	20
5	10	23
Total	42	100

6.3.1	DIMENSIONAL STONE TECHNOLOGY(Practicum)	L T P
		2 0 3

1. COURSE OJECTIVES

Dimensional Stone Technology is an essential field within civil engineering, mining engineering and materials science, focusing on the extraction, processing, and application of natural stones like granite, marble, and limestone. These stones, prized for their durability and aesthetic appeal, are meticulously cut and finished for use in construction and architectural projects. The subject delves into advanced quarrying techniques, precision cutting, and sustainable practices to meet modern engineering demands. With a rich history dating back to ancient civilizations, dimensional stones continue to play a vital role in contemporary infrastructure and design. This course provides comprehensive knowledge on the properties, processing methods, and diverse applications of these valuable materials.

2. COURSE OUTCOME

CO1: Demonstrate understanding of the geological properties, types, and classifications of various dimensional stones.

CO2: Apply advanced quarrying and extraction techniques using modern tools for efficient processing of natural stones.

CO3: Perform precise cutting, shaping, and finishing operations to meet specific design and structural requirements.

CO4: Analyze environmental impacts and implement sustainable practices within the dimensional stone industry.

CO5: Integrate engineering principles for planning and executing construction projects using dimensional stones.

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3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	1	1	-	1	*	*
CO2	3	2	2	3	2	1	1	*	*
CO3	3	2	3	3	1	1	1	*	*
CO4	3	2	2	2	3	1	2	*	*
CO5	3	2	3	2	2	3	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

***** PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

3. CONTENT

UNIT 1 INTRODUCTION (4 Periods)

Resources of Marble, Granite, Slate, Sandstone and Limestone as Dimensional stones in India vis a vis world, uses, marketing, export. Geological, mineralogical and physico mechanical properties of dimensional stones.

Ex. No.	Name of Experiment	Hours
1	Study of Marble & Granite Deposits	**3**

UNIT 2 MINING AND BLASTING TECHNIQUES IN DIMENSIONAL STONE MINES (8 Periods)

Conventional mining of Sandstone, Limestone, Marble and Granite; Recent developments- wire saw including blind cut technique, chainsaw, belt saw, hydraulic splitting, flame jet cutting, water channelling etc. Various types of explosives used, controlled blasting for providing horizontal & vertical cut; Splitting by swelling material.

Ex. No.	Name of Experiment	Hours
1.	Development and analysis of a flowsheet for a marble processing plant	**3**

2.	Determination of the physico-mechanical properties of various marbles and granites	**3**
3.	Observation and analysis of the operations of wire saws, chain saws, and belt saws at nearby mines	**3**
4.	Study of exploration and application of various methods for splitting rocks	**3**

UNIT 3 SPLITTING TECHNIQUE (4 Periods)

Insite splitting technique used in compact limestone (Kota stone) for utilization of waste as dimensional stone. Various types of loaders cranes and hydraulic excavator used in dimensional stone mines.

Ex. No.	Name of Experiment	Hours
1	Analysis of various types of cranes used in dimensional stone mining and processing, and their applicability	**3**

UNIT 4 PROCESSING (8 Periods)

Dressing- Mono block dresser; Sawing- gang saws, circular saws; Preparation and mounting of blades/discs and segments; slab repair by resin Polishing - Manual, Mechanical; Various types of polishing machines; Abrasives- type, use and selection, shaping.

Ex. No.	Name of Experiment	Hours
1	Study of gang saw operations and determination of the cutting rate for various dimensional stones.	**3**
2	Examination of various abrasives used in dimensional stone processing and their applications	**3**
3	Observation and analysis of the jet flame technique for granite mining at a nearby industry	**3**

UNIT 5 ENVIRONMENTAL IMPACTS (04 Periods)

Environmental impacts of mining and processing of dimensional stones; Secondary use of quarried land and waste of the industry.

Ex. No.	Name of Experiment	Hours
1	Design a mechanized marble quarry for a 200m x 200m lease area in hilly terrain.	**3**

5. INSTRUCTIONAL STRATEGY

Instructional strategy includes lectures, hands-on labs, practical demonstrations, and case studies to enhance understanding of control systems.

6. SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	4	15
2	8	28
3	4	15
4	8	28
5	4	14
Total	28	100

6.3.2	PROCESS AUTOMATION (Practicum)	L T P
		2 0 3

1. COURSE OBJECTIVES

The objective of this course is to enable the student to

- Design and operate pneumatic circuits.
- Design and operate fluid power circuits.
- Use PLC system and its elements for process control.
- Familiarize the working of function blocks in PLC.
- Use ON-OFF Delay timer to control a motor.
- Use counter function block (Up counter and Down counter) .
- Control the automatic operation of pneumatic cylinder using PLC.

2. COURSE OUTCOMES (CO):

On successful completion of this course, the student will be able to

CO1: Understand the fundamental principles and technologies used in process automation systems.

CO2: Design and implement automated control systems for various industrial processes.

CO3: Analyze and optimize the performance of automated systems to enhance efficiency and reliability.

CO4: Utilize modern tools and software for programming and configuring process automation equipment.

CO5: Apply safety standards and best practices in the deployment and maintenance of process automation systems .

3. SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and	PO2 Problem	PO3 Design/	PO4 Engineering	PO5 Practices for	PO6 Project	PO7 Life Long	PSO1	PS O2

	Discipline Specific Knowledge	Analysis	Development of Solutions	Tools	Society, Sustainability and Environment	Management	Learning		
CO1	3	2	1	2	-	-	1	*	*
CO2	3	2	1	2	1	-	1	*	*
CO3	3	3	2	2	1	-	1	*	*
CO4	3	2	2	3	-	1	2	*	*
CO5	3	3	3	3	1	2	2	*	*

CO1-CO3→Unit 1
CO4-CO5→Unit 2

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

3. CONTENT

UNIT -1 HYDRAULICS AND PNEUMATIC SYSTEMS (14 Periods)

Pneumatic systems: Elements-FLR Unit-Direction Control Valves-Flow Control Valves-ISO Symbols of Pneumatic Components-pneumatic circuits for various industrial applications.
Hydraulic Systems: Elements – comparison of Pneumatic systems and Hydraulic systems-service properties of hydraulic fluids-ISO symbols of hydraulic Components-hydraulic circuits for various industrial applications.

Ex. No.	Name of Experiment	Hours
1	Operation of double acting cylinder with quick exhaust valve. (**Pneumatics Lab)**	4
2	Speed control of a double acting cylinder using metering-in and metering-out circuits. (**Pneumatics Lab)**	4
3	Automatic operation of double acting cylinder in single cycle - using limit switch **(Pneumatics Lab)**	4
4	Direct operation of the double acting cylinder. **(Hydraulics Lab)**	4
5	Speed control of double acting cylinder metering-in and metering-out control. **(Hydraulics Lab)**	4

UNIT-2 LOGIC GATES AND PLC (14 Periods)

Features of PLC - PLC Block diagram - PLC scan. Fixed and Modular PLC. Ladder logic - Basic principles of Ladder diagram, Analog I / O and Digital I /O, NO, NC contacts - Coils - AND logic, OR logic. - Applications - Timer - Counter.

Ex. No.	Name of Experiment	Hours
6	Direct operation of a motor using a latching circuit, AND, OR, logic	5

	circuits. **(PLC Lab)**	
7	On-Delay control of a motor and Off –Delay control of a motor. **(PLC Lab)**	5
8	Automatic operation of Double acting cylinder-Multi cycle. **(PLC Lab)**	5
9	Sequential operation of a double acting cylinder and a motor. **(PLC Lab)**	5
10	Automatic operation of DAC, Forward time delay return. **(PLC Lab)**	5

4. INSTRUCTIONAL STRATEGY

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

EVALUATION METHODOLOGY

1. EVALUATION METHOD for THEORY

	Internal Assessment (40 marks)				External Assessment (60 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Written Test**	**Written Test**	**Attendance and Assignments**	**Pre – Semester Examination**	**End Semester Examination**
Portion	2 units	2 units	Regularly	All units	All units
Duration1hr	1hr	1hr	-	3hrs	3hrs
Exam Marks	20	20	20	60	60
Converted to	10	10	15	15	60
Tentative Schedule	5^{th} Week	10^{th} Week	Regularly	12^{th} -13^{th} Week	

IA1 and IA2: A written assessment test worth 20 marks should be conducted for two units. The marks earned (20 marks) will be converted to 10 marks. The best of the two assessments will be evaluated for an internal 10-mark assessment.

IA3: Assignments given after the completion of each unit, along with attendance throughout the semester, will be assessed for a total of 15 marks.

IA4: The pre-semester examination should follow the end-semester examination question pattern. The marks should be adjusted to 15 for internal assessment.

2. EVALUATION METHOD for PRACTICAL

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Practical Test and Quiz – Viva Voce**	**Practical Examination**
Portion	50% Practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	3 hrs	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: Complete all exercises and experiments as outlined and retain them for the practical test. The test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be internally evaluated for a total of 20 marks.

IA3: Maintain a practical file for each exercise while ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, and practical test along with a valid certificate (Progress Card). This will be assessed for 20 marks.

IA4: The pre-semester practical examination, quiz, and viva-voce should follow the end-semester practical examination pattern, with marks adjusted to 20 for internal assessment.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Practical Test	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

3. EVALUATION METHOD for PRACTICUM (End Exam-Practical)

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Micro Project**	**Practical Examination**
Portion	50% practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	Regularly	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

- **IA1 and IA2:** Complete all exercises and experiments as instructed and retain them for the practical test. The test should be conducted according to the evaluation scheme. The best of the two practical tests will be internally assessed for a total of 20 marks.
- **IA3:** Maintain a practical file for each exercise, ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be evaluated by 20 marks.
- **IA4:** Submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be assessed by both the laboratory supervisor and an internal examiner. This evaluation will contribute 20 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Mini Project	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

4. EVALUATION METHOD for PRACTICUM (End Exam-Theory)

	Internal Assessment (40 marks)						External Assessment (60marks)
	IA 1		IA 2		IA 3	IA 4	
Mode	**Written Test**	**Practical Test**	**Written Test**	**Practical Test**	**Attendance and Practical Documentation**	**Pre Semester Examination and Micro Project**	**End Semester Examination**
Portion	2 units	Practical related to the units	2 units	Practical related to the units	All unit	All Practical	All unit
Duration	1hr	3hrs	1hr	3 hrs	3hrs	Regularly	3hrs
Exam Marks	10	20	10	20	60	60	60
	30		30				
Converted to	10		10		15	15	60
Tentative Schedule	5th Week		10th Week		Regularly	12th -13th Week	

IA1 and IA2: A written assessment test worth 10 marks should be conducted for two **UNIT**s. Complete all exercises and experiments as outlined and retain them for the practical test worth 20 marks. The practical test should be conducted in accordance with the evaluation scheme. The total marks earned (30 marks) will be converted to 10 marks. The best of the two assessments will be internally evaluated for a total of 10 marks.

IA3: Attendance and the pre-semester examination should follow the end-semester examination question paper pattern. The marks should be adjusted to 15 for internal assessment.

IA4: Maintain a practical file for each exercise. Submit the required documents for the practical file, quiz/viva-voice, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be assessed for 40 marks. Additionally, submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be evaluated by both the laboratory supervisor and an internal examiner. The total of 60 marks will be converted to 15 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION FOR IA4

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Circuit Diagram	**5**
C.	Procedure and Connections	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Attendance & Mini Project	**10**
	Total	**40**

(ANNEXURE-I)

PROCEDURES / FORMATS FOR ORGANIZING INTERNSHIPS.

STUDENT INTERNSHIP PROGRAM APPLICATION

Complete and submit to the TPO/ Internship Program Coordinator.

1. Student Name:		Enroll. No.:	
2. Campus Address:		Phone:	
3. Home Address:		Phone:	
4. Student email address:			
5. Branch:		6. Internship Semester: _____	
7. Internship Preferences			
	Company/Industry	Core Area	Location
Preferance-1			
Preferance-2			
Preferance-3			
Faculty mentor Signature: _____Date_____.			
Student Signature: _____Date_____. Signature confirms that the student agrees to the terms, conditions, and requirements of the Internship Program			

Signature with seal
HOD/Principa

(ANNEXURE-I)

REQUEST LETTER FROM INSTITUTE TO INTERNSHIP/INDUSTRIAL TRAINING PROVIDER

Ref. No.: _____ Date: _____

To,
The HR Manager/Training Coordinator
……
……

Subject: Request for Internship/Industrial Training for Diploma Students

Sir/Madam,

We are pleased to introduce……., a premier institution affiliated with Board of Technical Education, Uttar Pradesh, offering diploma programs in various diploma disciplines.

As a part of the curriculum, our students are required to undergo Internship/Industrial Training to gain practical exposure and enhance their technical competencies. Therefore, we kindly request your esteemed organization to provide Internship/Training opportunities to our students during the period from …… to ……..

S. No.	Name	Enroll. No.	Semester/Year	Discipline

Yours sincerely,

(Head of Department/Principal)

(ANNEXURE-II)

PROFORMA FOR EVALUATION OF INTERNSHIP BY INDUSTRY

Student Name: ……Evaluation Date: ……
Industry Supervisor Name: …… Company/Organization: …… Title of the Project: ……

Please evaluate your intern by indicating the frequency with which you observed the following behaviors:

Parameters	Max. Marks	Marks Given
Attendance and Punctuality	20	
Discipline and Professional Behavior	20	
Technical Knowledge and Understanding of Processes	30	
Practical Skills and Quality of Work	20	
Ability to Apply Theoretical Knowledge	20	
Problem Solving and Analytical Ability	10	
Communication and Interpersonal Skills	20	
Teamwork and Collaboration	10	
Internship Report/Documentation	20	
Presentation and Viva-Voce	30	
Total Marks	200	

Additional comments, if any:

Signature with seal of Industry supervisor
HR Manager

(ANNEXURE-II)

INTERNSHIP REPORT

STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and got ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

INTERNSHIP REPORT

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

i. Originality.

ii. Adequacy and purposeful write-up.

iii. Organization, format, drawings, sketches, style, language etc.

iv. Variety and relevance of learning experience.

v. Practical applications, relationships with basic theory and concepts taught in the course.

MONITORING & EVALUATION OF INTERNSHIP

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.

2. Evaluation by faculty supervisor of Industry.

3. Evaluation through seminar presentation/viva-voce at the Institute.

1. EVALUATION BY INDUSTRY

The industry will evaluate the students based on the Punctuality, eagerness to learn, Maintenance of Daily Diary and skill test in addition to any remarks.

2. MONITORING/ SURPRISE VISIT BY TPO/ STAFF/ FACULTY MENTOR

TPO/Staff/ Faculty Mentor of the institutes will make a surprise visit to the internship site, to check the student's presence physically, if the student is found absent without prior intimation to the T & P Cell, entire training will be cancelled. Students should inform the TPO, faculty mentor as well as the industry supervisor at least one day prior to availing leave by email. Students are eligible to avail 1-day leave in 4 weeks and 2 days leave in 6 weeks of the internship period apart from holidays and weekly offs.

3. EVALUATION THROUGH SEMINAR PRESENTATION/VIVA-VOCE AT THE INSTITUTE

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

• Quality of content presented.

• Proper planning for presentation.

• Effectiveness of presentation.

• Depth of knowledge and skills.

• Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students.