Curriculum

Three Year (Six Semesters) Diploma Course In

MINING ENGINEERING

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3rd Semester to 4th 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

To be

Approved and Implemented by B.T.E.

U.P.

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THIRD SEMESTER

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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

Ravindra Kumar
Research Assistant/
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Dr. Atma Prakash Singh
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I.R.D.T. Kanpur

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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.

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

4. STUDY AND EVALUATION SCHEME

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	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.

* Advace 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.

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	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.

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

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 • Basic knowledge of the mining.
CO2 • Identify the different type of mineral and rocks.
CO3 • Apply the Knowledge gained in the context of exploration of mining geology.
CO4 • Study the different types of Mining industries.

3. 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.

4. 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.

5. 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

6. SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted(%)
1	**6**	**20**
2	**6**	**20**
3	**7**	**20**
4	**5**	**20**
5	**4**	**20**
Total	**28**	**100**

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

1. COURSE OJECTIVES

The diploma holders in mining engineering will be responsible for carrying out mining operation after locating a mineral rich area by exploration. The course content of the subject includes basic terminology, method of exploring a mineral, drilling and blasting methods. As far as possible teachers while teaching are expected to give practical examples of mining operations i.e. boring, drilling & blasting from time to time.

2. COURSE OUTCOME(CO):

After completing the course student will be able to:

CO1 • Understand different nomenclature & technical terminology used in mining Engg.

CO2 • Identify which mining system should be adopted according to the site condition and type of Mining.

CO3 • know of about principle and method of prospecting -kit- shaft, trend & patterns. Identify drilling equipments & tools & patterns & their selection.

CO4 • Know about classification & properties, storage & handling of explosives

CO5 • Calculate explosive quantity, powder factor, detonator factor. Understand different types of blasting. Know Sustainable method of mining (Sand, bagri, boulday & morrum) their guidelines. Sustainable sand mining guidelines 2016

3. 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.

4. INSTRUCTIONAL STRATEGY

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

5. 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

6. 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 diploma holders in mining Engineering will be responsible for the development mines and supervision of sampling, assay plan, geological mapping, estimation of ore reserves to get optimal output.
The course contents of the subject provides him basic knowledge about economic fuel geology, detailed aspects of metallic and non-metallic economic materials their characteristics and geological mapping etc.
The teacher while teaching supposed to conduct technical visits of mines, where, different techniques of ore reserves estimation and geological mapping are in practice justified in varied situation.

2. COURSE OUTCOMES (CO):

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

- Identify the important minerals & important rocks
- Think critically, formation and classification of mineral deposits in India.
- Know the origin & constituents of fossil fuels their occurrence in India.
- Substantiate the definition and scope of Stratigraphy.
- Understand geologic formation of India.
- Apply correct & efficient method to control Environmental pollution
- know about rivers ecology.

3. 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

4. INSTRUCTIONAL STRATEGY

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

5. 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

6. 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

To provide students of Mining Engineering with fundamental knowledge of mechanical engineering principles, including thermodynamics, fluid mechanics, IC Engines, Power transmissions devices and mechanical systems, with a focus on their applications in mining operations and equipment. The course aims to build an understanding of mechanical systems used in excavation, transportation, and processing of minerals, enabling students to effectively integrate mechanical concepts in the planning, operation, and maintenance of mining machinery and infrastructure.

2. COURSE OUTCOMES (CO):

After completing this course, students will be able to:

CO1 • Understand and apply basic principles of mechanical engineering to mining systems.

CO2 • Describe thermodynamic processes and apply them to mining engines and energy systems.

CO3 • Identify and explain components of power transmission and mechanical machinery used in mining.

CO4 • Demonstrate awareness of mechanical maintenance practices and safety protocols relevant to mining operations

CO5 • Understand fundamental knowledge of air compressors used in mines.

3. 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

4. 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 diploma holders in mining engineering will be responsible to supervise the working of the machinery at a mine site. purchase of machinery at the initial stage in any mining project with justification, suitability and efficiency of the machines according to the nature of mineralization, depth of occurrence type of mining and local geological condition.
This subject will provide him basic knowledge and skills of different type of machineries.
The teachers are supposed to give demonstration of functioning of working models in the laboratory as well as machineries in operation at the actual mining site.

2. COURSE OUTCOMES(CO):

CO1 • Know about face Machinery in detailed. Understand different modes of Transportation used in mining.
CO2 • Identify different open cast machinery and their working and safety. Know how communication doing in Mining industries
CO3 • Understand the concept of wire ropes. Identify and use the winding system.
CO4 • Understand the principal of tunnels, raises and shafts.
CO5 • Understand the use of different mine pumps and their characteristics

3. 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

4. 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

5. 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 theindustry

6. 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 content of the subject will provide him basic knowledge and skills about various types of machineries.
The teachers while teaching are supposed to give practical examples relating to mining fields. The diploma holders in mining engineering will be responsible to supervise the working of the machinery at a mine site.
This subject will provide him basic hand-on practice and skills of different type of machineries like face machineries pumps haulage, conveyors, locomotives etc.
The teachers are supposed to give demonstration of functioning of working models in the laboratory as well as machineries in operation at the actual mining site.

2. COURSE OUTCOMES(CO):

CO1• Enhance operational efficiency by selecting and deploying appropriate mining machinery for specific tasks and conditions.
CO2• Ensure the safety of personnel by implementing proper maintenance procedures and safety features on mining equipment.
CO3• Optimize resource utilization through the efficient use of mining machinery, minimizing downtime and maximizing production output.
CO4• Improve environmental sustainability by employing advanced technologies and practices that reduce energy consumption and minimize environmental impact.
CO5• Facilitate technological innovation by researching and developing new mining machinery designs and technologies to meet evolving industry needs

3. 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 &	8

	vibrating conveyors, chain-conveyors	
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

4. 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. 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

4. 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.

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

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. 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.

4. 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.

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

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

1. COURSE OBJECTIVES:

The diploma holders in mining engineering will be responsible for the development of mines in scientific manner in hard as well as soft rock's area to achieve optimal output along with safety of workers, engaged in various activities related to mining. Subjects provide him basis as well as up to date knowledge & skills shaft sinking and tunnelling course contents also includes elementary aspects as mineral processing. It is expected from teachers to give typical examples and conduct technical visits to expose the students with mining technological aspects in the mining area.

2. COURSE OUTCOMES:

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

CO1 • Select appropriate site, size and shape of shafts. Understand different terminology related to shaft sinking. Perform shaft sinking, tunnelling and inclined development

CO2 • Select special methods of sinking in difficult ground.

CO3 • Know about different tunnel boring machines

CO4 • Substantiate Scope, object & limitation of elementary mineral processing.

CO5 • Use resources optimally and economically. Substantiate the theory and practice of crushing and grinding

3. 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

4. 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

5. 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

6. 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 diploma holders in mining engineering will be responsible to carry out survey of the mine area in open cast as well as underground so that efficiency planning for the development of the mining area & proper development of the mine be obtained.

The subject provides him elementary knowledge of surveying as chain survey, compass survey, level survey and Theodolite survey with reference to mining and mine surveying.

As far as possible teachers while teaching are supposed to give demonstration of different type of surveying and instruments used in each survey and preparation of survey plan.

2. COURSE OUTCOMES(CO)

At the end of the course, the students will be able to:

- CO1 • Understand difference between chain surveying & geodetic surveying.
- CO2 • Know about theory of errors
- CO3 • Know about different types of chain & tapes.
- CO4 • Perform leveling with dumpy level

3. 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.

4. 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

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:

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

6. 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 involves learning the fundamentals of mapping and measuring underground spaces. It encompasses understanding geological formations, spatial data collection techniques, and surveying instruments. Students delve into the principles of triangulation, levelling, and topographic mapping specific to mining environments. Practical applications include ensuring accurate excavation, monitoring ground stability, and adhering to safety regulations. Mastery in mine surveying is essential for effective resource extraction and hazard mitigation in mining operations.

2. COURSE OUTCOMES(CO)

- Measure bearing of line with help of Compass
- Calculate difference of level between two points with dumpy level and auto level.
- Prepare maps for closed mining sites and open mining sites with Survey instrument
- Measure long line with chain or table
- Accurate Mapping: Students proficient in mine surveying can produce detailed and precise maps of underground workings.
- Improved Safety: Through the application of surveying techniques, students can identify potential hazards such as unstable ground conditions or underground voids, contributing to enhanced safety protocols within mining operations.
- Resource Optimization: Knowledge gained in mine surveying allows for better estimation of mineral reserves and efficient planning of extraction methods, leading to optimized resource utilization and increased productivity.
- Environmental Preservation: Understanding the terrain and geological features enables students to implement strategies to minimize the environmental impact of mining activities, preserving ecosystems and minimizing disturbances to local communities.
- Compliance Assurance: With expertise in surveying regulations and standards, students ensure that mining operations adhere to legal requirements, maintaining compliance with safety, environmental, and land management regulations.

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. 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.

4. 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

5. 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.

6. 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. 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

4. 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.

5. 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. 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

4. 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

5. 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.

6. 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 competencythrough 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 associatedwith 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 fol-lowing 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 gobar gas.
- 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 robots' vehicles to mitigate hazards.

CO2• Differentiate coordinate systems and define the custom or user-defined coordinate frames.

CO3• Develop simple robot programs that incorporate various types of movements along with their respective parameters.

CO4• Integrate robot with different automation components i.e., PLC HMI, conveyor etc.

CO5• Create variety of innovative ideas and develop creative approaches to problem-solving.

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.

LEARNING OUTCOMES:

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

- Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upavedas, Vedangas, and Upangas.
- Relevance of science and spirituality, and contributions of ancient Indian science and technology.
- Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.
- Practical applications and case studies of the Indian Knowledge System's relevance today.

COURSE CONTENTS

UNIT 1: Introduction to Indian Knowledge System (16 Periods)

Overview of Indian Knowledge System

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

UNIT 2: Modern Science and Indian Knowledge System (06 Periods)

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

UNIT 3: Yoga and Holistic Healthcare (04 Periods)

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

UNIT 4: Case Studies / Assignment (02 Periods)

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

Assessment

Viva -Voce Exam

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	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.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1		
2		
3		
4		
5		
Total		**100**

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	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 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 <u>PRACTICUM (Practical External)</u>

	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**

	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 Pre Semester Examination**	**Practical Documentation and Micro Project**	**End Semester Examination**
Portion	2 units	50% Practical	2 units	50% Practical	All units	All Practical	All units
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	

4. EVALUATION METHOD for PRACTICUM (Theory External)

IA1 and IA2: A written assessment test worth 10 marks should be conducted for two units. 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**