

**CURRICULUM FOR
DIPLOMA IN
MINING ENGINEERING
SEM I, II, III, IV, V & VI**

PROGRAMME STRUCTURE

SET II

Semester - I

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN101	Communication Skills	-	-	2	2	-	-	50	50	100
GN102	Engg. Maths-I	4	2	-	6	75	25	-	-	100
GN103	Applied Physics-I	4	-	2	6	75	25	-	50	150
GN104	Applied Chemistry	3	-	2	5	75	25	-	50	150
GN204	Engg. Drawing	2	-	4	6	-	-	50	50	100
Total		13	2	10	25	225	75	100	200	600

Semester - II

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN201	Engg. Maths-II	4	2		6	75	25	-	-	100
GN202	Applied Physics-II	4	-	2	6	75	25	-	50	150
GN203	Environmental Studies	3	-	-	3	75	25	-	-	100
GN205	Engg. Materials	4	-	-	4	75	25	-	-	100
GN105	Computer Fund. & App.	-	-	4	4	-	-	50	50	100
GN106	Basic Engg. Skills	-	-	6	6	-	-	50	100	150
Total		15	2	12	29	300	100	100	200	700

GN 101 COMMUNICATION SKILLS

1. RATIONALE

This course deals with Student's proficiency in English by developing their skills in reading, writing and speaking. They will be able to appreciate the usage of grammar. Acquiring proficiency in English is absolutely essential for effective communication while serving on the job. It also deals with applications of the concepts and principles learnt. Using visuals in written communication and body language in oral communication highly enhances the effectiveness of the communication process. These and some other important aspects are discussed in this course. The practice-feedback-practice cycle is of utmost important for developing the communication competencies/skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		TH	TM	TW	PR/OR	
GN-101 Communication Skills		-	2	2	-	-	50	50	100

Minimum passing % : Practical 40%

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 - Fundamental of Communication skills

Definition, components (message, sender, receiver, transmission medium and protocol), types (verbal & non-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications (verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

Unit 2 – Presentation Skills

Methods and styles of presentations (seminars, speeches, etc), the plan, objectives, audience, structure (sequential, hierarchical, question oriented pyramid, meaty sandwich), tips for good beginning and end, aids to presentation (visual, verbal), delivery style (eyes, voice, expression, appearances, stance, etc), techniques for a good speech (repeat, draw (signs, pictures), jokes, etc).

Unit 3 - Technical Reports, Letter Writing, CVs

Functions of Reports (information, initiate action, recommend new procedures, recording, coordinating project), techniques (basic format, steps, appendices), types of reports (emphasis on progress reports, industrial visit reports, inspection reports, accident reports, survey report, report on seminars, workshop, technical gathering, etc).

Types of letters, format function, qualities of a good letter, examples of job applications, leave applications, complaints, purchase orders, enquiries replies etc.

Brief mention of importance of etiquette in email communication, importance of careful proofing the documents sent.

Curriculum Vitae – definition, sample, tips for a good CV, covering letter

Unit 4 - Soft Skills

Importance of values, attitude and etiquettes in communication, ethics and manners, courtesy, honesty and reliability; personal integrity, flexibility – adaptability, team skills – cooperation; ability to follow regulations; willingness to be accountable; Ability to relate to co workers in a close environment, non verbal communication, leadership skills – self directed, ability to direct and guide others, self-supervising; ability to relate to co workers in a close environment; positive attitude; positive work ethic, written communication Skills- basic spelling and grammar; reading and comprehension, personal hygiene and energy, interpersonal skills – communication skills with public, fellow employees, supervisors, and customers, motivation – willingness to learn; caring about seeing the company succeed; understanding what the world is all about; commitment to continues training and learning; critical thinking skills, grooming – good personal appearance.

Unit 5 - Language Workshop

The Reading, Listening, Writing, Speaking Skills will be tested

1. Reading Skills:

Articles from the newspapers, magazines, journals etc. will be given to the students to read aloud thus checking their pronunciation, clarity and their style of reading.

2. Listening Skills:

Passages, Topics, Stories, Speeches of eminent people will be read or played. The students have to listen and their listening skills will be tested.

3. Writing Skills:

- a) Students to write on any given topic
- b) Students to compose their own stories
- c) Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

4. Speaking Skills:

- a) Students to speak on any given topic
- b) Narrate a story written by them.

Group discussions in the classroom. This could include debates, discussion on current issues, role-playing.

4. List of Experiments :

- Oral presentation about technical products for five minutes.
- Seminar Presentation/Report writing and presentation on identified topics from science and technical subjects for short duration.
- Group discussion on science and technical topics.
- Organise mock interviews.
- Organise debates.
- Extempore speech for three minutes on a topic.
- Observe a process and reproduce orally in own words for three to five minutes.
- Arrange video recording of presentations for self-feedback.

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1	Wren and Martin	Practical English Grammar	1992
2	John Sinclair (ed.),	Collins Cobuild English Grammar	William Collins & Sons Cp., London 1990
3	Krishna & Mohan,	Effective English Communication	Tata McGraw Hill, New Delhi 2000
4	Randolf, Quirk & Sidney Greenbaum	University Grammar of English	1993
5	Tiwari, N.P. et al ,	Communication Skills for Technical Students – Book	Somaiya Publications, 1995
6	Tiwari, N.P. et al,	A Communicative Grammar of English	Somaiya Publications, 1989

GN 102 ENGINEERING MATHEMATICS- I

1. RATIONALE

There are variable and constant concepts in the engineering phenomena and problems, which need to be understood, analyze and predict their behaviour. For instance, motion and acceleration of an object under applied known force, effect of temperature and pressure under constant volume, etc. All these situations require modeling of constants and variables into a relationship known as formula (formulating) and solving problems of engineering by substituting the values of constants and variables. Thus mathematics is used to understand, analyse and find solutions. There are some standard principles and formulae, which should be understood by students and apply as per needs of situations in real life.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-102	L	T	P	C	TH	TM	TW	PR/OR	100
Engineering Mathematics	4	2	-	6	75	25	-	-	

Minimum passing % : Theory 40%

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

Unit 0	Fundamentals of algebraic mathematical operations
	<ul style="list-style-type: none"> • Use of scientific calculator • Recall of algebraic operations & formulae • Solving of simultaneous equations with two variables
Unit 1	Co-ordinate Geometry/ Analytic Geometry;
	<p>Purposes/Applications of Co-ordinate Geometry. Coordinate systems. <i>Straight Line</i>-Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.</p>

Unit 2 Trigonometry

Purposes/Applications of Trigonometry. Radian. Radian & degree. Area of sector & length of an arc. Trigonometric ratios of any angle & Trigonometric identities. Trigonometric ratio of allied angles, compound angles, & Multiple angles(only 2A). Sum & product formulae. Sine, Cosine rules. Solution of triangles

Unit 3 Limits & Functions

Functions- constants, variables. Kinds of functions (question not to be asked). Concepts of limits- algebraic, trigonometric, logarithmic & exponential functions (No question on method of substitution and Inverse Trigonometric function)

Unit 4 Differential Calculus

Purposes/Applications of Differential Calculus. Definition of Derivative. Derivatives of standard functions-applications. Derivative of sum, difference, product & quotient of a function. Derivative of composite, implicit & parametric functions with reference to - algebraic, logarithmic, trigonometric, inverse circular functions, exponential functions & logarithmic differentiations. Introduction to Second order derivatives.

Unit 5 Application of derivatives

Geometrical meaning of derivatives. Equation of tangent & normal to curves. Derivatives as rate, motion, related rates. Maxima & minima.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Co-ordinate Geometry	14	20
2	Trigonometry	17	16
3	Limits & Functions	8	12
4	Differential Calculus	15	20
5	Application of derivatives	10	07
		64	75

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P.,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewal B.S;	Engineering Mathematics	Khanna Pub., New Delhi1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi1997 or latest
4.	TTTI, Bhopal	Mathematics for Polytechnics Vol. – I & Vol. – II	TTTI, Bhopal Latest
5.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

GN 103 APPLIED PHYSICS-I

1. RATIONALE:

Being the basis of all engineering branches, the students must acquire knowledge of basic principles; laws and facts of Physics. This knowledge will improve their ability to apply it in solving engineering problems and overall growth of their disciplines.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)				Total Credit	Examination Scheme				Total Marks
						Theory Marks		Practical Marks		
GN-103 Applied Physics I	L	T	P	C	TH	TM	TW	PR/OR	150	
	4	-	2	6	75	25	50	-		

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 UNITS & DIMENSIONS

Fundamental and Derived Physical Quantities and their SI units. Dimensions and Dimensional formula, Principle of Homogeneity, use of Dimensional Analysis for checking the correctness of an equation. Definition of least count of Vernier Caliper, Micrometer Screw Gauge.

Unit 2 KINEMATICS

Vectors and Scalars-Definition, Difference between vectors and scalars, types of vectors with example.
 Definition - Displacements and distance, Velocity and speed, uniform and average velocity, Uniform acceleration and retardation, problems based on kinematic equations for uniform acceleration. $V=u+at$, $S=ut + \frac{1}{2} at^2$, $v^2 = u^2 + 2as$. Velocity- time diagram, Motion under gravity.

Unit 3 PROPERTIES OF MATTER

Definition of Elasticity, Stress, Strain and Elastic limit. Hooke's Law. Definition of Young's modulus, Bulk modulus, Rigidity modulus. Determination of Young's modulus by Searle's method. Behaviour of wire under continuously increasing stress. Definition of Yield Point, Breaking Stress, and Factor Of Safety. Adhesive and Cohesive forces. Angle of contact. Concept and definition of Surface Tension, Surface Tension by Capillary rise method. Application of Surface Tension. Definition and explanation of Viscosity. Statement of Newton's law of viscosity, Terminal Velocity (no derivation) Stokes Law. Determination of Viscosity by Stokes method. Streamlined and Turbulent flow. Definition of Critical Velocity, Reynolds Number.

Unit 4 HEAT

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of coefficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor
Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

Unit 5 ELECTROSTATICS

Coulomb's Law of Electrostatics, Electric Field, Intensity of Electric Field, Electric Potential and its unit, Potential difference between two points (no derivation), Potential of a sphere, Potential of Earth, Definition and units of Capacitance, Principle of Capacitor, Capacitors in series, Capacitors in Parallel.

Unit 6 MAGNETISM

Magnetic Effect of Electric current (Oersted's Experiment) Magnetic Field, Intensity of Magnetic Field. Coulomb's Law of Magnetism, Magnetic lines of Force, Magnetic Induction, Expression for Magnetic Induction at the centre of a Circular coil carrying current (no derivation), Force acting on straight conductor placed in Magnetic Field (no derivation).

Unit 7 (A) LAWS OF FORCES & FRICTION (MECHANICAL AND ALLIED GROUPS)

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components. Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose(only qualitative aspects)

OR

UNIT 7(B) : SEMICONDUCTORS (ELECTRONICS AND ALLIED GROUPS)

Energy Band structure of electronic material(conductor , semiconductor and insulator)
Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.
Types of semiconductors P- type and N- type, Structure of P- type and N- type, Extrinsic semiconductor using pure Si and Ge semiconductors.
Types of carriers; N- type and P- type
Process of recombination of carriers.
Formation of P-N junction and depletion region.

4.SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Units and Dimensions	5	5
2	Kinematics	9	12
3	Properties of Matter	13	14
4	Heat & Gas Laws	9	10
5	Electrostatics	12	12
6	Magnetism	8	10
7A	Laws of Forces & Friction	8	12
	OR		
7B	Semiconductors	8	12
	Total	64	75

7A-Mechanical and allied branches

7BFor Electronics and allied branches

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Use of Vernier Caliper
2	Use of Micrometer Screw gauge
3	Determination of Surface tension by capillary rise method using Travelling Microscope.
4	Determination of coefficient of viscosity by stroke's method.
5	Determination of acceleration due to gravity ('g') by simple pendulum.
6	Determination of Young's modulus by Searle's method.
7	Determination of Coefficient of thermal conductivity by Searle's method.
8A	Find resultant force using parallelogram of forces
8B	Draw and interpret band structure of Insulator, Semiconductor and conductor, Band structure of P-type & N-type extrinsic semiconductor, Drawing PN junction.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Halliday D and Resnick	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakar	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	Latest
8.	B.L. Thereja.	Engineering Technology	Latest
9.	Modern Publishers.	ABC of Physics	Latest
10.	V.K Mehta	Elements of electronic engineering	Latest
11	R S Khurmi	Applied Mechanics	Latest

GN 104 APPLIED CHEMISTRY

1. RATIONALE

Applied Chemistry is multi-disciplinary science having wide applications in all the branches of engineering and technology. In simple terms, it is the science of chemical phenomena in various engineering situations. An understanding of the basic concepts of applied chemistry is essential not only for all chemists but also for engineers. Therefore it forms an indispensable base for them. The emphasis is given more on applications of principles of chemistry to engineering situations rather than fundamental principles only. It also develops in the students the habit of scientific enquiry, ability to investigate the cause and effect relationship, ability to interpret and analyze the results under given conditions.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)				Total Credits	Examination Scheme			
						Theory Marks		Practical Marks	
GN-104 Applied Chemistry	L	T	P	C	TH	TM	TW	PR/OR	150
	3	-	2	5	75	25	50	-	

Minimum passing % : Theory 40%

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;
PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 Atomic Structure and Chemical Bonding

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells (1st three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, CaCl₂) covalent compounds (Cl₂, O₂, N₂, CO₂)and coordinate compounds (O₃, SO₂).

Unit 2 Electrochemistry

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series-concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCl using carbon electrodes, ii. aqueous NaCl using platinum electrodes iii. aqueous CuSO₄ using platinum electrodes iv. aqueous CuSO₄, using copper electrodes);

UNIT 3 Water and its treatment

Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) for industrial use - dyeing, textile, sugar, paper, bakeries, (ii) in boilers for steam generation with special reference to sludge and scale formation (no chemical equations), zeolite and ion exchange process for water softening, desalination by electro dialysis and reverse osmosis, concept of pH

Unit 4 Corrosion and Its Control

Definition, Atmospheric corrosion (direct chemical corrosion) - definition, Oxidation corrosion, the nature of the oxide film, stable, unstable and volatile, mechanism of oxidation corrosion, corrosion due to other gases. Immersed corrosion (electrochemical corrosion) - definition, factors necessary for electrochemical corrosion , Galvanic cell corrosion, concentration cell corrosion- metal ion concentration and differential aeration. Mechanism of electrochemical corrosion- Hydrogen evolution mechanism, Oxygen absorption mechanism, Protection of metals from corrosion; galvanising, tinning, metal spraying , proper designing , using pure metals, using metal alloys, Cathodic protection- sacrificial anode and impressed current .Modifying the environment- De-aeration, De-activation, De-Humidification and alkaline neutralization.

Unit 5 Lubricants

Definition, functions of Lubricants, Types of Lubrication, Fluid Film, Boundary, Extreme Pressure, Classification of Lubricant - solid, semi- solid, liquid synthetic oils. Characteristics of Lubricants, Definition and Its significance -Viscosity. Viscosity Index, Flash and Fire Point, Oiliness, Pour Point, Volatility, Acidity, Emulsification and Saponification Value. Selection of Lubricants for Delicate Instruments, High Pressure and Low Speed Machines, Extreme Pressure and Low Speed Machines, Mechanisms of Lubrications.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No.	Name of the unit	Hours	Marks
1	Atomic Structure and Chemical bonding	10	15
2	Electrochemistry	08	13
3	Water and its treatment	09	15
4	Corrosion and its control	16	25
5	Lubricants	05	07
	Total	48	75

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	Unit No.	List of Experiments
1.		Double titration of acid and base using phenolphthalein
2.		Double titration of acid and base using methyl orange
3.		Redox titration of potassium permanganate, ferrous sulphate and oxalic acid.
4.		Determination of degree of hardness of water by EDTA method
5.		Determination chloride content of water by Mohr's method
6.		Determination of total alkalinity of water sample
7.		Titration of strong acid and strong base using pH meter
8.		Determination of conductivity of water
9.		Titration of strong acid and strong base using conductometer
10.		Corrosion susceptibility of aluminium to acid or base.

6. SUGGESTED LIST OF ACTIVITIES

S.No.	Title
1.	Quiz on Electronic configuration of atoms.
2.	Demonstration of process of electrolysis
3.	Demonstration of purification of water by domestic/economical method.
4.	Identification and application of lubricants in different equipment/glasswares used in different laboratories
5.	Visit to some metallurgical industries for demonstration of different processes of metallurgy.
6.	Preparation of chart of different alloys of steel and their uses
7.	Seminar on different aspects of fuel, properties and usages
8.	Use of pH paper for testing different samples of water, blood etc.
9.	Demonstration and use of different samples of paints, varnishes, drying oils, pigments, thinners, dryers, fillers, plasticizers and anti-skinning agents.

7. SUGGESTED LEARNING RESOURCES

Sl. No.	Author	Title	Publication and Year
1.	M.M. Uppal	A text book of Engineering Chemistry,	Khanna Publishers
2	V.P. Mehta	A textbook of Engineering Chemistry,	Jain Bros. Delhi
3	S.N. Narkhede	A Textbook of Engineering Chemistry	Nirali Prakashan
4	R.A. Banawat, S.K. Mahajan, S.K.Mehta	Textbook of Applied Chemistry	India Book House
	V.S. Godbole	Applied Chemistry	
5	R.S. Sharma	Textbook of Engineering Chemistry	Khanna Publishers
	P.C. Jain and M. Jain	Engineering Chemistry	
6	J.C. Kuriacose and J. Rajaram	Chemistry in Engineering	Tata McGraw Hill Publishing Co.Ltd., New Delhi
7	Dr.S. Rabindra and Prof.B.K. Mishra	Engineering Chemistry:	Kumar and Kumar Publishers (P) Ltd., Bangalore -40
8	S.S.Kumar	A Text book of Applied Chemistry-I	Tata McGraw Hill, Delhi
9	Sharma	A Text book of Applied Chemistry -I	Technical Bureau of India, Jalandhar
10	S.S.Dhara	A Textbook of Engineering chemistry	S.Chand & Company, New Delhi
11	Dr. G.H. Hugar	Progressive Applied Chemistry – I & II	Eagle Prakashan, Jalandhar

GN 204 ENGINEERING DRAWING

1. RATIONALE:

Drawing is a graphical language of engineering field. Engineering technician irrespective of his field of operation in an industry is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions on a piece of paper. Besides this he is also expected to possess a certain degree of drafting skill- depending upon his job functions-in his day-to-day activities. This course of Engineering Drawing for Diploma courses is aimed at developing basic knowledge and skills of engineering drawing and use of computer in the field of Engineering Drawing.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
GN-204 Engineering Drawing	2	-	4	6	-	-	50	50	100

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. DETAILED COURSE CONTENT

Unit 1 Introduction

- Importance of Engineering drawing as a means of communication.
- Introduction to drawing equipment, instruments and their uses.
- Planning of drawing sheet as per I.S. 696 - 1972.
- Indian standard practices of laying out and folding of drawing
- Different types of lines used in engineering drawing.
- Importance of scale in Engineering Drawings.
- Lettering

Unit 2 Dimensioning techniques and standard conventions

- Methods of dimensioning, Dimensioning terms and notation (use of I.S. code 696 and 2709), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc.
- Conventional representation of various materials.

Unit 3 Engineering Curves & Shapes

- Construction of an Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction
- Types of Engineering curves
- Construction of Engineering curves like
 - Ellipse- by focus & directrix method and arcs of circles method
 - Parabola- by focus & directrix method and rectangle or oblong method
 - Hyperbola- by transverse axis & Focus and directrix method
 - Cycloid- by generating circle rolling on a straight line
 - Involute of a triangle, circle & pentagon
 - Draw normal & tangents to the above curves from given point on the curve
- Practice problems of drawing various engineering curves

Unit 4 Orthographic projection

- Definitions of various terms associated with orthographic projections.
- Planes of projections.
- Concept of Quadrants.
- First and third angle method of projection.
- Projection of points
- Projection of lines
 - (i) Parallel to both Principal planes
 - (ii) Parallel to one and Perpendicular to other Principal plane.
 - (iii) Inclined to one plane and parallel to other plane.
- Projection of Triangle, Square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.
- Introduction to the following solids
Cylinder, cone, cube.

Right regular solids such as
 - (i) Prism: Triangular & Square
 - (ii) Pyramid: Square & Pentagonal.
 - Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane.
 - Conversion of simple pictorial views into orthographic views.

- Practice problems on projection of points, lines and planes.
- *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.*
- *Problems where apparent projection of plane are given, true shape & slope angle are to be drawn are excluded.*

Unit 5 Section of solids

- Concept of sectioning planes
- Auxiliary planes and true shape of section.
- Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)

Unit 6 Development of lateral surfaces

- Concept and importance of surface development in the engineering field.
Methods of development of surfaces-Radial & Parallel line method.
Development of surfaces for the following right regular solids-
- Cylinder
- Prism
- Cone
- Pyramids
- Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.
- *Practice problems on above with top & bottom of the solid is excluded*

Unit 7 Isometric Views

- Limitations of orthographic projections.
- Procedure for preparing isometric projections.
- Difference between Isometric projection & Isometric view.
- Isometric view of geometrical solids and simple machine parts.
- Conversion of orthographic views into isometric views.
- Construction of Isometric view for any real object. Conversion of orthographic views of simple components into isometric views.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No.	Unit	Teaching Hours / Semester
1	Introduction	1
2	Dimensioning techniques & standard conventions	1
3	Engineering Curves & Shapes	4
3	Orthographic projections	13
4	Section of solids	3
5	Development of surfaces	4
6	Isometric projections	2
-	Revision	4
	Total	32

Directorate of Technical Education, Goa State

5. SUGGESTED LIST OF ACTIVITIES

Following shall be the list of sheets to be prepared as Engineering drawing lab work

Sheet No.	TITLE	Contents	Hours
1.	TYPES OF LINES, LETTERING, DIMENSIONING.	All types of lines, Single stroke vertical capital letters, Methods of Dimensioning-Aligned & unidirectional System, Conventional representation of materials.	4
2.	GEOMETRICAL CONSTRUCTIONS	Construction of Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & hexagon	4
3.	ENGINEERING CURVES	Construction of ellipse, parabola, hyperbola by given methods. Involute, cycloid. Draw normal and Tangent to curves.	8
4.	PROJECTION OF POINTS & LINES	Drawing projection of points in all 4 quadrants. Drawing of projections of lines in following positions (i) Parallel to both Principal planes (ii) Parallel to one and Perpendicular to other Principal plane. (iii) Inclined to one plane and parallel to other plane.	6
5	PROJECTION OF PLANES	Drawing the projection of Triangle square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.	6
6	PROJECTIONS OF SOLIDS	Drawing projection of following solids Cylinder, cone, cube. Right regular solids such as Prism: Triangular & Square, Pyramid: Square & Pentagonal, when axis is inclined to one principal plane & parallel to other principal plane.	8
7	ORTHOGRAPHIC PROJECTIONS	Simple problems on conversion of pictorial into orthographic views. (atleast 2 problems each in 1 st angle and 3 rd angle)	4
8	SECTIONS OF SOLIDS	Drawing projections and section of solids like square prism, square pyramid, pentagonal pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other)	8
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9.	DEVELOPMENT OF LATERAL SURFACES	Draw the Development of surfaces for the following right regular solids- Cylinder, Cone, Prism & pyramids (square, triangular, pentagonal).	8
10	ISOMETRIC VIEWS	Conversion of orthographic views of simple components into isometric views.	8

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publisher
1.	BIS, India	IS. 696. (Latest revision).	BIS, India
2.	N.D. Bhatt	Engineering Drawing	Charoter Publisher, Anand
3.	R. K. Dhawan	Engineering Drawing & Machine Drawing	Kumar
4.	R.B. Gupta	Engineering Drawing	Satya Prakashan, Delhi
5.	P.S. Gill	Geometrical Drawing	Ketson & Sons
6.	P.S. Gill	Machine Drawing	Ketson & Sons
8.	TTTI, Bhopal	Work Book in Mechanical Drafting	TTTI, Bhopal
9.	T. Jeyapoovan	Engineering Drawing & Graphics Using AutoCAD 2000	Vikas Publishing House Pvt. Ltd, New Delhi.
10	N.D. Bhatt	Machine Drawing	Charoter Publisher, Anand

SEMESTER II

GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS

1. RATIONALE

The course on Computer Fundamentals & Applications will enable the students to understand the basic concepts related to computer fundamentals, Data Representation & Number Systems, Computer Languages, operating system, Computer Software and Internet Technology and will be able to apply the same in different areas of electronics engineering. Laboratory practice will help in developing the requisite skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
GN-105	L	T	P	C	TH	TM	TW	PR/OR	100
Computer Fundamentals & Applications	-	-	4	4	-	-	50	50	

Minimum passing % : Theory 40%

Legends:

L-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks;
PR/OR - End Semester Practical / Oral Examinations; **TW**- Term Work

3. DETAILED COURSE CONTENTS

UNIT 1 Computer Fundamentals

1. Introduction to Computer
2. History, Evaluation, Classification and Generations of computers
3. Organisation of the Computer System
4. Hardware
 - Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner Printers.
5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

UNIT 2 Operating System

1. Introduction to operating system

Definition Functions , Types, Examples, Comparisons of Various Operating Systems

2. Windows Operating System-

GUI(Graphical user Interface), desktop, Start Menu, Task Bar, Status Bar, Scroll Bar, Title Bar, Toolbar, Menu Bar. File Organization: Creating, Saving, Deleting, Renaming, Cutting, Pasting, copying, moving, Searching Files and Folders. Applications: My Computer, Recycle Bin, Windows Explorer, Control Panel.

UNIT 3 Application Software

1. MS Word

- Introduction
 - Starting MS Word
 - Creating, saving and opening a document
 - Editing commands-Cut, Copy, Paste, Paste Special
 - Text Formatting, Bullets and Numbering, Borders and shading etc.
 - Tabs, Style, Views
 - Insert Table, Picture, OLE Objects, etc.
 - Checking Spelling and Grammar, Thesaurus
 - Page Layout & Printing
 - Mail Merge.

2. MS Excel

- Create, Save and open a worksheet
- Entering data – text, numbers and formulae in a worksheet, Hyperlink
- Navigating within a Worksheet and also between different Worksheets of a Workbook
- Inserting and deleting cells, rows and columns in a worksheet
- Select, copy, paste and delete cell data within the worksheet

- Using various formulae and inbuilt functions like Trigonometric, Statistical, Logical, Data Sorting
- Update worksheets using special tools like spell check and auto correct.
- Setup the page and margins of worksheets for printing
- Enhance worksheets using charts & graphs

3. MS Power Point

- Introduction and starting the program
- Starting a presentation
- Adding new slide
- Saving and Opening presentation
- Text formatting options
- Copy, Move and delete slides and text
- Applying designs
- Using Animations
- Slide Transitions, Hyperlink
- Insert clip art
- Viewing the presentation

UNIT 4 The Internet

Networks, Advantages of networking, Types of networks.

- History and Functions of the Internet
- Working with Internet
- Web Browsers, World Wide Web, Uniform Resources Locator and Domain, Names, Issues related to web security.
- Uses of Internet
- Search for information, Email, Chatting, Instant messenger services, News Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

Email

- Manage an E-mail Account
E-mail Address, Configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book
- Downloading Files

4. SUGGESTED LIST OF EXPERIMENTS

S. No.	Unit No.	List of Experiments
1	1	Identify Input and output devices
2	1	Calculate capacity of different storage device
3	2	Identify OS and different application software s loaded on that OS
4	3	Load Windows operating system. Configure and load relevant device drivers
5	4	Practice on Windows 95/98/2000 ; <ul style="list-style-type: none"> o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows o Study of file organization: creating, copying, moving, renaming and deleting o Practice on Windows Accessories- Notepad, Word Pad and Paint o Editing document & formatting text, Previewing and printing document/Image file o Practice on Windows Explorer o Recycle bin o Shutting down windows
6	4	Practice on MS-Word ; <ul style="list-style-type: none"> o Create and format document o Edit and Modify text- changing font size type and style o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text o Open save and print a document o Insert, modify table o Insert graphics o Mail merge
7	5	Practice on Microsoft Excel <ul style="list-style-type: none"> o Create, save & format worksheet o Open and save worksheet file o Edit & modify data o Use formula and functions o Split windows and freeze pans o Data sort and security features o Create, edit, modify and print worksheet. o Create and edit charts
8	5	Practice on PowerPoint <ul style="list-style-type: none"> o Create, edit, insert, move, slides o Open and save presentation o Insert picture, audio slide layout, action button o Apply custom animation o Present slide show

9	6	<p>Practice on:</p> <ul style="list-style-type: none"> o Identification of type of Account. o Connecting to internet o Dial up access o Web browsing o Searching websites o Information searching o Email services o Creating email accounts & Receiving and sending mails
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5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	Norton Peter	Introduction to Computers (special Indian edition)	Tata McGraw Hills New Delhi, 6 th Edition, 2005 ISBN: 0070593744
2	Kahate Atul	Information Technology	Tata McGraw Hills New Delhi, ISBN-13:9780070593718
3	Williams Stalling	Using Information technology: A Practical Introduction to Computers and Communication	Tata McGraw Hills New Delhi,
4	Curtin	Information Technology: The Breaking Wave (book only)	Tata McGraw Hills New Delhi, ISBN:0074635581
5	Ravichandran, D	Introduction to Computers and Communication	Tata McGraw Hills New Delhi, ISBN: 0070435650
7	Douglas E.	The Internet Book	Prentice Hall of India, New Delhi, 3 rd Edition, ISBN: 812032286X
8	Basanbhara S.K.	Computer Today	Nita Mehta Publications, 2003 ISBN: 8186340742

GN 106 BASIC ENGINEERING SKILLS

1. Rationale:

A technician is expected to work on the shop floor. It therefore becomes essential for him to have a through exposure to safety aspects, fire fighting, first aid as he is the guide for the skilled and unskilled personnel working under him. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices etc. in addition to other engineering skills.

The course on Basic Engineering skills is aimed at providing him the knowledge and skills in all those areas through shop instructions, demonstrations and skill development exercises. This course is also aimed at providing the student the exposure to engineering equipment which will help him to assimilate the teaching which takes place at higher semesters.

2. Teaching And Examination Scheme

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		TH	TM	PR/OR	TW	
(GN106) Basic Engineering Skills	0	0	6	6	-	-	50	100	150

Legends: L-Lectures; P-Practical; C-Credits; TH-End Semester Theory; TM-Test Marks;

PR/OR-End Semester Practica/Oral Examinations TW- Term Work

3. Detailed Course Contents

Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid

Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.

Unit 2: Fitting Workshop Practice

Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob.

Unit 3: Carpentry Workshop Practice

Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine.

Unit 4: Electrical Workshop Practice

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Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings.

Unit 5: Basic Electronics Workshop Practice

Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits.

Note: during first 20 minutes of the practical session, Instructor shall provide theoretical knowledge as prescribed in the curriculum. (Shop Talk)

Unit No.	Topic	Hours/ Semester
1.	General Safety, Housekeeping, Fire Fighting & First Aid	06
2.	Fitting Workshop Practice	36
3.	Carpentry Workshop Practice	18
4.	Electrical Workshop Practice	18
5.	Basic Electronics Workshop Practice	18
	<i>Total</i>	96

GN201 ENGINEERING MATHEMATICS- II

1. RATIONALE :

Mathematics is the backbone of all areas of engineering and technology and hence technician / engineers need to study relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With above in mind, the necessary content for the engineering mathematics is derived to understand advance use of mathematics in solving engineering problems.

2. TEACHING AND EXAMINATION SCHEME :

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		TH	TM	TW	PR/OR	
GN-201 Engineering Mathematics-II	4	2	-	6	75	25	-	-	100

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks; PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT :

<p>Unit 1 Determinants Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule</p>
<p>Unit 2 Binomial Theorem - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s).</p>
<p>Unit 3 Mensuration - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule</p>
<p>Unit 4 Matrices Definition and Notations, Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable.</p>
<p>Unit 5 Integral Calculus Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration, area under a plane curve, volume of revolution.(simple sums only)</p>
<p>Unit 6 Differential Equations</p>

Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type $d^2y/dx^2 = f(x)$ only, Application of differential equation in engineering problems

Unit 7 Statistics (Mechanical and Allied Engg. Branches)

. Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode . Measures of dispersion for grouped and ungrouped data -range , mean deviation, standard deviation, variance and co-efficient of variation

OR

Unit 7 Complex Numbers. (Electronics engg and Allied branches)

Definitions, Argand diagrams , polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-moivres theorem, roots of a complex number- Cube roots of unity, n th roots of unity, , hyperbolic functions

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):

Unit No.	Topic	Teaching Hours/ Semester	Marks
1.	Determinants	5	7
2.	Binomial Theorem	7	10
3.	Mensuration	7	10
4.	Matrices	11	08
5.	Integral Calculus	17	20
6.	Differential equations	08	10
7.	Statistics	09	10 \$
OR			
7	Complex Numbers	09	10 #
	Total :	64	75

\$- for Mechanical and allied branches

- For Electronics and allied branches

5. SUGGESTED LEARNING RESOURCES :

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewa, I B.S;	Engineering Mathematics	Khanna Pub., New Delhi 1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi 1997 or latest
4.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

GN 202 APPLIED PHYSICS-II

1. RATIONALE:

Physics is one of the basic building blocks for engineering sciences. Therefore, the students need to describe and explain the basic principles, laws & facts of physics. These skills will enhance their ability to apply it in solving engineering problems related to their respective branches of engineering

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-202 Applied Physics-II	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% and Practical 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

Unit 1 FORCE, WORK, POWER, AND ENERGY

Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal.

Work-definition and units, Graphical Representation of workdone, Energy definition and units.

Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)

Unit 2 CURRENT ELECTRICITY

Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire. Principle of potentiometer. Comparison of EMF of a given cell by single cell method. Comparison of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance.

Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.

Unit 3 ELECTROMAGNETISM

Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.

Unit 4 LOGIC GATES

Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10
Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table

Unit 5 SOUND

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.
Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

Unit 6 CIRCULAR MOTION AND GRAVITATION

Definition of Uniform Circular Motion, Angular Displacement, Angular Velocity, Relation between Linear and Angular velocity, Definition and concept of Centripetal and Centrifugal Force.(No derivation), Expression for velocity of a vehicle moving on a curved Horizontal Road, Expression for Angle of Banking & Super Elevation of Road. Newton's Law of Gravitation, Force of Gravity. Acceleration due to Gravity, Expression for Acceleration due to gravity.

**Unit 7(A) FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES
(MECHANICAL AND ALLIED GROUPS)**

Definition of efforts, velocity ratio, mechanical advantage & efficiency of machine and their relationship. Laws of machines, examples of simple machine, definition of ideal machine, systems of pulleys (First & Second). Determination of velocity ratio ,Mechanical Advantage & Efficiency.

OR

**Unit 7 (B) RECTIFIERS
(ELECTRONICS AND ALLIED GROUPS)**

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation, $((V_{NL} - V_{FL}) / V_{FL}) \times 100$
Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation
Bridge rectifier, working, input and output waveforms, percentage regulation

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS(THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	FORCE, WORK, POWER & ENERGY	10	12
2	CURRENT ELECTRICITY	16	16
3	ELECTROMAGNETISM	6	8
4	LOGIC GATES & AWARENESS TO NANO SCIENCE	4	6
5	SOUND	8	9
6	CIRCULAR MOTION & GRAVITATION	10	12
7A	FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES	10	12
	OR		
7B	RECTIFIERS	10	12
	Total	64	75

7A- for Mechanical and allied branches

7B- For Electronics and allied branches

4. LIST OF EXPERIMENTS

1. Determination of Specific resistance of a material wire by Voltmeter and Ammeter.
2. Determination of Internal resistance of a given cell by using Potentiometer.
3. Calibration of Voltmeter by using Potentiometer.
4. Comparison of E.M.F. of two given cells by single cell method using potentiometer.
5. Determination of specific resistance by meter bridge.
6. Verify the law of resistances in series by meter bridge.
7. Verify the laws of resistances in parallel by meter bridge.
8. Determination of velocity of sound by Resonance tube.

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	
8.	B.L. Thereja.	Engineering Technology	
9.	Modern Publishers.	ABC of Physics	
10.	V.K Mehta	Elements of Electronic Engineering	

GN203 ENVIRONMENTAL STUDIES

1. RATIONALE

Due to various developmental activities carried out by man, our environment is continuously being abused and getting degraded. The air we breathe, water we drink, food we eat, land we live on, all are getting spoiled day by day. The purity of our environment is of prime importance for survival of human race on the earth. Man should not go for developmental activities at the cost of environment. This subject has been introduced in the Diploma Programme to bring about awareness towards the environmental purity amongst the students.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/Week (In Hours)				Total Credits	Examination Scheme			
						Theory Marks		Practical Marks	
GN203 Environmental Studies	L	T	P	C	TH	TM	TW	PR/OR	100
	3	-	-	3	75	25	-	-	

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hrs.

3. DETAILED COURSE CONTENT

Unit 1 Multidisciplinary Nature Of Environmental Studies.

Definition, scope and importance. Need for public awareness.

Unit 2 Natural Resources

Renewable and nonrenewable resources. Natural resources and associated problems.

- Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, droughts, conflicts over water, dams- benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer & pesticide problems, water logging, salinity, case studies.

- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- Land resources: Land as a source, land degradation, man induced land slides, soil erosion and desertification.

Role of an individual in conservation natural resources. Equitable use of resources for sustainable life styles.

Unit 3 Ecosystems.

Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and Decomposers. Energy flow in the ecosystem. Ecological succession. Food chains. Food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: (a) Forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, and estuaries).

Unit 4. Biodiversity And Its Conservation.

Introduction – Definition: genetic, species and ecosystem diversity.
Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Unit 5. Environmental Pollution.

Definition. Causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, Thermal pollution, Nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquakes, cyclone and landslides.

Unit 6. Social Issues And The Environment.

From unsustainable to sustainable development. Urban problems related to energy. Water conservation rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns; case studies. Environmental ethics: Issues and possible solutions. Climatic change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; case studies. Wasteland reclamation. Consumerism and waste products. Environmental protection act. Air (Prevention and control of pollution) Act. Water (Prevention and control of pollution) Act. Wildlife protection Act. Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Unit 7. Human Population And The Environment.

Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV / AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies.

Unit 8. Field Work.

Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours).

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours	Marks
1)	Multidisciplinary Nature Of Environmental Studies.	01	03
2)	Natural Resources.	10	12
3)	Ecosystems.	06	08
4)	Biodiversity And Its Conservation.	06	09
5)	Environmental Pollution.	08	12
6)	Social Issues And The Environment.	07	12
7)	Human Population And The Environment.	04	09
8)	Field Work.	06	10
		48	75

5. MANDATORY ACTIVITIES

In addition to the class room instruction, visits should be arranged in any 2 of the following areas:

1. Visit to NIO or Science Centre.
2. Visit to Selaulim/ Anjunem Dam.
3. Visit to study ecosystem (Pond, Stream, River, and Forest).
4. Visit to show Hill cuttings, mining areas.
5. Visit to show Rain water harvesting project / Vermicomposting plant / Watershed management project. (Krishi Vigyan Kendra – Old Goa)
6. Visit to water treatment/ waste water treatment plant.

6. SUGGESTED VIDEOS

In addition to the class room instruction, video films on environment may be shown.

7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Erach Bharucha	Textbook of Environmental Studies for Undergraduate courses	University Press
2	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)
3	S. Deswal & A. Deswal	A Basic Course in Environmental Studies.	Dhanpat Rai & Co.
4	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
5	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions.	S. Chand & Co
6	Centre for Environmental education	Video Film	Thaltej Tekra, Ahme
7	Dr. S.K. Dhameja	Environmental Studies	

GN 205 ENGINEERING MATERIALS

1. RATIONALE:-

Adequate knowledge of different types of engineering materials, their properties & applications are very essential for the engineers. This course content is designed to provide basic insight knowledge regarding engineering material and their applications which will be useful for the students to learn subjects of higher semesters. The range of materials available for engineering applications is quite vast, hence only the basic groups of ferrous non-ferrous, non-ferrous & other engineering materials with their general properties and uses have been stressed upon.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
G-205 Engineering Materials	4	-	-	4	75	25	-	-	100

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. COURSE CONTENTS

Unit 1 Introduction to Engineering Materials

Classification of Materials

- Metal, Non-metal
- Ferrous Metal & Non-ferrous Metals.

Differences between Metals & non-metals.

Properties of Materials.

- Physical properties – Melting point, freezing point, boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity.
- Mechanical properties – Strength, Elasticity, Plasticity ductility,

Malleability, Toughness, Brittleness, Hardness, fatigue, creep.

- Electrical properties – Resistivity, conductivity, Temperature coeff. of resistance, dielectric strength, Thermo electricity, super conductivity.
- Magnetic properties – permeability, coercive force, magnetic stresses.
- Chemical properties - Corrosion resistance, chemical composition, acidity, alkalinity.

Unit 2 Ferrous & Non-Ferrous Metals & its Alloys

➤ **Ferrous alloys.**

- Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
- Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
- Alloy steels.
 - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
 - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
- Tool steel – composition, HSS, High carbon steel, properties & uses.

➤ **Non-ferrous Metals & alloys**

- Aluminium – Properties & uses.
- Aluminium alloys – constituents of alloy & their effect on properties of metal
- Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
- Copper – Properties & uses.
- Copper alloys – Constituents of alloy & their effect on properties of metal.
- Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes.
- Properties & uses of lead & its alloys.

Unit 3 Non – Metallic materials

- Refractory
 - Desirable properties.
 - Difference between acid, basic & neutral refractories.
 - Properties & uses of Fire clay refractory, silica refractory.
 - Plastic
 - Classification table only.
 - Properties & uses of Thermosetting & Thermoplastic.
 - Natural & Synthetic abrasive materials.
- Introduction, Properties & uses.
 - Rubber
- Properties & uses of natural, neoprene, synthetic & butyl rubber.

- Vulcanization process.
 - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.
 - Introduction to composite materials. Classification diagram only.

Unit 4 Conductor, Semi Conductor, Insulating and Magnetic Materials.

- Classification of Materials as conductor, Semiconductor and Insulating materials.
- Conductor Materials.
 - High conductivity materials
 - Copper, Aluminium, Carbon, Silver, Lead, Brass, Bronz, Tungsten & Gold.
 - Their properties as conducting materials and applications.
 - High resistivity materials
 - hichrome, constantan, manganin
 - Their applications
- Insulating materials
 - Introduction
 - Characteristics of Good Insulating materials
 - Solid Insulating materials
 - Wood, paper, rubber, mica, glass fibre, porcelain, varnish, PVC, Resins.
 - Their characteristics as insulating materials and applications.
 - Liquid insulating materials
 - Mineral oil, its properties as insulating material and applications.
 - Gaseous insulating materials like air, Nitrogen, Sulphur hexafluoride & their applications.
- Semiconductor Materials.
 - Silicon & Germanium. Their specifications as semiconductor material and uses
- Magnetic Materials.
Classification as:
 - * Dia Magnetic
 - * Para Magnetic
 - * Ferromagnetic
 - * Non magnetic

List of these materials and their applications.

Unit 5 Construction Materials

- Building Stones : Classification of rocks, Characteristics of good building stones, common building stones & their uses.
- Cement: Chemical composition of port land cement, outline of manufacturing process, types of cements, uses.
- Bricks: Bricks – Constituents, properties, classification, special bricks – refractory and flyash bricks; uses.
- Other materials:
 - Lime – Sources. Properties, uses.
 - Clay – Different building products from clay like tiles, pipes etc.
 - Timber – Common varieties of timber, uses wood products, veneer, plywood, etc.
 - Sand – Sources: rivers, crushed aggregates, characteristics uses.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Introduction to Engineering Materials	04	09
2	Ferrous & Non-Ferrous Metals & its Alloys	16	18
3	Non – Metallic materials	12	12
4	Conductor, Semi Conductor, Insulating and Magnetic Materials.	16	18
5	Construction Materials	16	18
		64	75

BOARD OF TECHNICAL EDUCATION , GOA STATE

PROGRAMME STRUCTURE for DIPLOMA IN MINING ENGINEERING

SEMESTER – III

Course code	Name of course	L	T	P	C	Theory Marks		Practical Marks		Total Marks
						TH	TM	TW	PR	
MN301	Mine Development	3	1	-	4	75	25	25	-	125
CS307	Elements of Mech. Engg	3	-	2	5	75	25	25	-	125
MN302	Mining Technology	3	-	2	5	75	25	25	-	125
MN303	Mining Geology – I	3	-	2	5	75	25	25	-	125
CE301	Surveying – I	3	-	4	7	75	25	50	25	175
CS305	Computer Aided Drafting	-	-	4	4	-	-	50	50	100
MN304	Rock Mechanics	3	-	2	5	75	25	25	25	150
Total		18	1	16	35	450	150	225	100	925

MN 301 MINE DEVELOPMENT

1. RATIONALE:

Mining Development is one of the basic subjects of mining engineering. The course introduces mining to the beginners in topic one & further topics deal with underground opening & developments. The subject gives the basic knowledge of the methods of mining & skills for further learning of mining processes & Technology..

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN 301	L	T	P	C	TH	TM	TW	PR/OR	
Mine Development	3	1	-	4	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

SN	CONTENTS	HRS	MKS
1	INTRODUCTION Definition;-Mining, Mining engineering, mine, mineral, rock, ore, Metallic ores, Nonmetallic minerals, Fossil fuels, gangue, waste, history of mining, mining contributions to societies, development of mining techniques, specific characteristics of mining industry, mineral extracted by mining, use of minerals, minerals resources in India and their distribution, stages in the life of mining, methods of mining, unit operations of mining, nature of minerals deposits and coal seam	5	8
2	SURFACE MINE DEVELOPMENT Definition of surface mining terms, classification, suitability conditions, unit operation, cycle of operation, auxiliary operations. Elements of opencast mine, Boxcut: definition, formation, types, location, development of bench from Boxcut; Entry system – Definition, type, suitability condition, formation, advantages and disadvantages of entry	12	18

	<p>system.</p> <p>Bench parameters: bench, types of bench, types of slicing, sequence of bench development; stripping ratio – definitions, types, calculation, factors affecting stripping ratio; advantages and disadvantages of opencast mining, factors affecting selection of open cast mining method</p>		
3	<p>UNDERGROUND MINE DEVELOPMENT</p> <p>Definition of common U/g mining terms, classification of methods, unit operation, Mining Methods.</p> <p>Mine entries – Definition, types, shaft, adit, incline, tunnel- definition, suitability condition, shape, size, number, construction, location , advantages and disadvantages; comparison, selection of mine entry</p> <p>Primary & secondary development: Drivage of drift and main heading, conventional method – Drilling, blasting, mucking, transportation, Lighting, ventilation, high speed methods. Special methods through loose, fractured, flowing and water bearing ground. High speed drivages.</p> <p>Tunneling;-shape, size, factors in selection of tunnels; Methods of semi-mechanised tunnels- Bench method, Pilot heading method; temporary & permanent support; Tunnel boring machines, Regulations on development headings</p>	13	20
4	<p>UNDERGROUND COAL MINE DEVELOPMENT</p> <p>Classification of coal seam – on basis of thickness .inclination, gassiness.</p> <p>Bord and pillars method – Definition, elements and suitability condition, unit operation, system of working, layouts whole working and panel working, panel size. Size and shape of gallery & pillar, and factors affecting them, method of development: Dip development, level development, cross cut development, mechanized development, solid blasting and coal cutting machine development, production, and main reason for low production, advantages and disadvantages.</p> <p>Longwall mining –Definition, suitability conditions, description of method, panel development, ventilation, transportation, lighting, advantages and disadvantages, comparison between Bord & pillar method and long wall method.</p>	12	18
5	<p>UNDERGROUND METAL MINE DEVELOPMENT</p> <p>Common term used in metaliferrous mining, origin of mineral deposits, classification of ore deposits, mining stage, purpose of development, principles of development, methods of development, Elements of a block/stope, level interval, factors affecting level interval, sequence of level opening.</p> <p>Opening ore deposits- gently dipping, inclined, steeply inclined, large, scattered deposits. comparison between coal mining and metal mining</p>	06	11

4. LIST OF PRACTICALS

1. Mineral Resources in India & their distribution (Any five) – Marking of the map
2. Sketching of box cut & determination of volume of excavation
3. Determination of various stripping ratios
4. Plan & section of an opencast mine based on parameters given
5. Report of field visit to opencast mine
6. Sketching of methods in tunneling & determining the progress rate
7. Calculation of output from a district/ panel of Bord & Pillar & sketch of panel

REFERENCES

1. Elements of Mining Technology Vol-I & II – D J Deshmukh
2. Society of Mining Engineers Vol-I & Vol-II – Hartman
3. Introduction to Mining Engineering – Hartman
4. Winning & Working – S. Ghatak
5. Surface Mining – G B Mishra

CS307 ELEMENTS OF MECHANICAL ENGINEERING

1. RATIONALE:-

In this modern scientific era, the field of engineering and technology is continuously expanding, with many newer branches of engineering being added day by day. Under present circumstances it is highly essential for an engineer and technician to acquire basic knowledge of some other relevant engineering fields, along with his own discipline of study. Also the technician carrying out plant maintenance requires basic knowledge of functions of mechanical elements & machines from operational and safety point of view. Hence this subject is being introduced in the curricula as an interdisciplinary subject to provide basic knowledge of mechanical engineering to the students of other engineering disciplines.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)				Total Credits	Examination Scheme				Total Marks
						Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR		
CS307 Elements of Mechanical Engineering	3		1	4	75	25	25	-	125	

Minimum passing % : Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

Unit 1 Mechanical Power Transmission (No mathematical treatment)

Introduction. Belt drives – classification & applications, technical specifications (power & cross sectional area). Chain drives – Types of chains and their applications. Gear drives – classification and applications, gear trains (simple & compound only) and their speed ratio. Couplings – rigid coupling (marine type only), flexible coupling (bush pin type only), fluid coupling. Bearings – Definition & function of bearings, rolling and sliding contact bearings (their functions and applications), bearing specification (4 digit bearing number).

Unit 2 Internal Combustion (I.C.) Engines (*No mathematical treatment*)

Introduction, classification & basic engine components. Construction and working of 4 stroke and 2 stroke engines (petrol & diesel). Difference between petrol and diesel engines. Difference between 2stroke and 4 stroke engines. Technical specification of I.C. engines – Stroke volume, speed (rpm) & torque, power. Criteria for selection of I.C. Engines.

Unit 3 Thermal Engineering

Introduction. Basic components of a thermal power station and their function (Condenser, Turbine, Boiler).

Boiler – Introduction, function, classification (water tube, fire tube), Construction and working of Babcock & Wilcox boiler and Cochran boiler. Comparison between fire tube and water tube boiler. Boiler mountings and accessories like- Safety valve, water level indicator, Economiser and superheater. Awareness to Indian Boiler Regulations i.e. IBR (Brief introduction only).

Unit 4 Refrigeration & Air conditioning (*No mathematical treatment*)

Introduction. unit of refrigeration (Ton), Working and operation of simple vapour compression system (p-h & t-s diagrams to be excluded).

Air Conditioning- definition, working of Window and split Air conditioner, procedural steps in installation of Air conditioner.

Unit 5 Pumps (*No mathematical treatment*)

Introduction, working principle, classification. Centrifugal and reciprocating pump - construction & working. Common faults in working of pump and troubleshooting. Technical specifications - power, discharge, head.

Unit 6 Maintenance Engineering (*No mathematical treatment*)

Definition, types -preventive, breakdown and predictive maintenance. Necessity of lubrication. Common types of lubricants. Methods of lubrication – wick/drip type, grease gun, grease cup. Importance of lubrication schedule. Maintenance tools and their functions (no construction & working) – bearing puller, spanners (open end & ring type), screw jack, gauges, screw driver, torque wrench, allen key, chain pulley block, tripod.

Note to paper setters:-

Internal details of subcomponents of the following should not be asked-

- i) I. C. Engine systems.
- ii) Pumps.
- iii) Turbines and condensers

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No	Name of the Unit	Hours	Marks
1	Mechanical Power Transmission	8	15
2	Internal Combustion (I.C.) Engines	12	18
3	Thermal Engineering	8	12
4	Refrigeration & Air Conditioning	8	12
5	Pumps	06	09
6	Maintenance Engineering	06	09
	TOTAL	48	75

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	UNIT No.	LIST OF EXPERIMENTS
1	1	Study of different types of gears.
2	1	Removal and mounting of belt. Checking tension in the belt.
3	1	Demonstration of mounting and removal of ball/roller bearing.
4	2	Study of petrol/diesel engine construction.
5	2	Study of petrol/diesel engine working.
6	3	Study of water tube and fire tube boiler (Babcock & Wilcox and Cochran).
7	4	Study of any one refrigeration Air conditioning equipment working on simple vapour compression system.
8	5	Study of centrifugal and reciprocating pumps.
9	6	Literature survey and seminar (A brief power point presentation of around 15 min on any topic relevant to mechanical engineering). It may be done individually or in groups depending on class strength. OR Field visit to maintenance work shop and detailed report on maintenance to be presented by students.

6. SUGGESTED LEARNING RESOURCES

Sr. No.	AUTHOR	TITLE	PUBLICATION & YEAR
1	R.K. Rajput	Elements of mechanical engineering	Laxmi pub.
2	A.A. Karad & K.B. Kale	Elements of mechanical engineering	Technical Pub., Pune.
3	R.K. Rajput	A text book of Hydraulic Machines	S. Chand
4	K.R. Gopalkrishna	A text book of elements of Mechanical Engineering.	Subhash pub., Bangalore
5	S.N. Bhattacharya	Installation, Servicing & Maintenance	S. Chand
6	H.P. Garg	Industrial Maintenance	S. Chand
7	V. K. Manglik	Elements of Mechanical Engineering	PHI

MN 302 MINING TECHNOLOGY

1. RATIONALE:

Mining Technology is one of the basic subjects of mining engineering. The subject deals with basic processes of mining. For effective extraction of mineral drilling & blasting is essential. The subject deals with the type of drilling for production, characteristics of explosives & accessories and the blasting features. The subject also deals with the types of supports used in underground workings as well as sinking of a shaft which has become an efficient mode of entry.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
MN 302	L	T	P	C	TH	TM	TW	PR/OR	
Mining Technology	3	-	2	5	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	COURSE CONTENTS	Hrs	Mks
1	DRILLING:	8	12
	Purposes of drill holes, methods of drilling, principles & mechanism of rotary & percussive drilling, factors governing selection of drilling method, components & surface arrangements of percussive & rotary drill, coal drill & Jack Hammer drill, Wagon drill.		
2	EXPLOSIVE AND ACCESSORIES	10	16
	Definition of Explosive, essential constituents of explosive, properties of explosive, chemistry of explosive, classification of explosive based on Indian explosive rule, Risk of initiation & strength of explosive; description of common explosives -gun powder, Nitro-glycerin, TNT, ANFO, Slurry, emulsion, HANFO, LOX, permitted explosive, Booster. Safety fuse, detonation fuse, Plain detonator, electric detonator- Low & high tension; advantages of delay detonator; electronic detonator, detonating relay; Nonel; crimper; Pricker; Exploder; Circuit Tester; Crack Detector; Shot firing cable; Storage of explosive, magazine, transport of explosive; disposal of old & damaged		

Directorate of Technical Education, Goa State

	explosive; related mine regulations. Substitute for explosive:- purpose, various substitutes such as cardox, hydrox, hydraulic buster, Armstrong air buster etc., regulations on use of explosive		
3	BLASTING	10	16
	<p>Theory of blasting, Mechanics of rock blasting, preparation of charge & charging; direct & inverse initiation, various blasting patterns – wedge cut, pyramid cut, fan cut drag cut, burn cut, coromant cut, ring drilling etc. solid blasting- advantages & disadvantages. Regulations on shot hole blasting</p> <p>Blasting pattern used in opencast mines, blasting circuits, stemming, subgrade drilling, secondary blasting – pop & plaster shooting, Deck charging, controlled blasting, pulsed infusion shot firing, Muffle blasting.</p> <p>Burden; spacing; selection of hole diameter; calculation of explosive requirement; powder factor, delay factor, mine regulations in blasting.</p> <p>Impacts of blasting: Energy distribution, precautions against Ground vibration. Flying fragments; airblast, noise, misfire, blown out shot, blown through shot, other safety aspects</p>		
4	ROOF SUPPORTS	10	15
	<p>Theory of roof control, Pressure arch theory, properties of various types of roof, testing of roof, classification of supports, material used for support, description of prop & bar support, setting of prop, arrangement for yield, preservation of timber, Fore poling,</p> <p>Description of Cog support, friction prop, hydraulic prop, arch, girder etc. Safari support, Principle of roof bolting & types, cable bolting, roof stitching, powered supports on longwall face;</p> <p>Systematic support rules, supporting of junction, support of places of excessive height in B&P, Sylvester prop withdrawer, Introduction to instrumentation to ascertain strata pressure, Regulations on supports.</p>		
5	SHAFT SINKING & RAISING	10	16
	<p>Preliminary considerations for shaft sinking; shape & size of shaft, marking center of shaft; surface arrangements in sinking shaft, drilling & blasting; removal of debris; kibble; temporary lining; permanent lining: brick, concrete, tubbing; walling scaffold, rider; folding doors; shaft centering arrangement; dealing with water, ventilation & lighting, regulations on shaft sinking.</p> <p>Special methods of shaft sinking – caisson. Piling, freezing, cementation methods; Deepening of shaft, widening of shaft.</p> <p>Raising:- purpose, various methods used such as two compartment method, long hole drilling & drop raising; use of alimack raise climber. Raise borers; main difficulties. Winze: Purpose, problems associated with winzing.</p>		
	TOTAL	48	75

4. LIST OF PRACTICALS

1. Study of drill bits & drill rods
2. Study of explosives & their comparison
3. Study of blasting accessories
4. Drill hole connections & checking continuity of circuit
5. Calculation of powder factor & detonating factor of shot holes
6. Blast design in an opencast mine
7. Visit to a blasting site & making report of the same
8. Study of Friction & Hydraulic Prop
9. Study of temporary/ Brick wall lining
10. Study of methods of Raising

5. REFERENCES

1. Elements of Mining Technology – Vol-I - D J Deshmukh
2. Winning & Working- Vol-I – S. Ghatak
3. Surface Mining – G B Mishra
4. Explosives & Blasting Techniques – G K Pradhan

MN 303 MINING GEOLOGY- I

1. RATIONALE:

The course content has been carefully structured to provide the basic knowledge of Mining Geology to diploma engineer which will help them in field. The study of the occurrence, mineralization & properties of minerals are included to understand the basics of Geology for a mining engineer. Further the study of types of formations & geological disturbance will help him to understand the implication on methods of mining.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
MN 302	L	T	P	C	TH	TM	TW	PR/OR	
Mining Technology	3	-	2	5	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

CONTENTS	HRS	MKS
1. THE SCIENCE OF GEOLOGY	5	8
Brief introduction on the origin and age of earth, Internal structure of earth, Fundamental relationship between rock units, Geological time scale. Earth Science: Subdivision of Geology, Allied Sciences. Scope of Engineering Geology: Geology in construction jobs, Geology in water resources development, Geology in town and regional planning, Geology in mining.		

2. MINERALOGY 10 16
Mineralogy: Introduction, Definition, Formation of mineral, minerals from magmas, minerals from gases, minerals from solutions and minerals due to recrystallisation, Classification of chief rock forming minerals in brief with respect to general description, chemical composition, atomic structure, crystallization, classification, physical properties: Silicate Group, Feldspar Group, Pyroxene Group, Amphibole Group, Mica Group, Oxides minerals, Carbonates minerals
3. PROPERTIES OF MINERALS 12 18
Crystallography: Introduction, Elements of crystals, Symmetry of crystals, Crystallographic axis, Parameters, Indices, symbols, Crystal forms, Crystal classes and systems in brief: Cubic, Tetragonal, Hexagonal, Orthorhombic, Monoclinic, Triclinic. Physical properties: Introduction, Properties of minerals in brief: Colour, Luster, Streak, Hardness, Cleavage, Fracture, Habit, Structure, Sp. gravity, Form, conductivity, surface tension. Optical properties: General introduction, Light, Ordinary light, polarized light, Refractive index, Dispersion, Total refraction, Birefringence, Isotropic substances, Optic axis, Optic signs, Polarising microscope.
4. PHYSICAL AND STRUCTURAL GEOLOGY 8 12
Introduction to weathering and erosion, Physical weathering, Chemical weathering, Biotic weathering, Agent of weathering, Factors effecting weathering, Weathering structures, Introduction to earthquakes and volcanism. Faults and faulting: Terminologies, Types of faults, Effects of faults: On out crop, On topography. Recognition of faults Causes of faults, Engineering consideration of faults. Joints and jointing: Introduction, Terminologies, Types of joints, Occurrence of joints, Origin of joints, Engineering consideration. Fold and folding: introduction, Terminologies of folds, classification of folds, causes of folds, Engineering consideration. Unconformities: Definition, Origin, Types, Detection of unconformities, Engineering consideration. Elementary knowledge of sill, dyke, strike, dip, outcrop, inlier, outlier.
5. PETROLOGY 13 21
Definition of rocks, Three main categories of rocks: Igneous rocks: Definition, Introduction, Composition, Texture and structure, Classification of igneous rocks, Formation of igneous rocks, Crystallization, Importance of igneous rocks, Engineering importance. Sedimentary rocks: introduction, Formation, Environment of formation, Mineralogical composition, Texture of sedimentary rock, Classification of sedimentary rock, Importance of sedimentary rock, Engineering importance Metamorphic rocks: Introduction, Factors of metamorphism, Kinds of metamorphism, Metasomatism, Effects of metamorphism, Texture, structure and composition of metamorphic rocks, Classification of metamorphic rock, Importance of metamorphic rocks, Examples of metamorphism on igneous, sedimentary and metamorphic rocks.

4. LIST OF PRACTICALS (ANY 12)

1. Megascopic identification of major rock forming minerals with the help of their physical properties in hand specimens (10 minerals) – (2 Practicals)
2. Completion of horizontal and incline maps and drawing the vertical section along X-Y line. (4 Practicals)
3. Study of Crystallography with the help of crystal models (3 Practicals)
4. Optical mineralogy: identification of minerals under polarized microscope (2 Practicals)
5. Geological problems based on (a) strike, true dip, apparent dip (1 Practical)
(b) Graphical solution of structural problems (1 Practical)
6. Important points in reading Geological maps and symbols (2 Practicals)
7. Field report (1 Practical)

5. REFERENCES

1. Engineering & General Geology by Parbin Singh.
2. Essentials of Geology by Lutgens & Tarbuck.
3. Elements of Geology by James Zumberge.
4. A Text Book of Geology by P. K. Mukherjee.
5. A Text Book of Mineralogy by Dana E.S.
6. Rutley's Elements of Mineralogy by H.H. Read.
7. Principles of Petrology by Tyrrel G.W.
8. Principles of Physical Geology by Arthur Holmes.
9. A Geology for Engineers by Blyth and Freitas
10. A Text Book of Geology by Mahapatra G.B.
11. A Text Book of Physical Geology by Mahapatra G.B.
12. Structural Geology by Marland P. Billings.
13. Manual of problems in Structural Geology by Gokhale .N.W.

CE301 SURVEYING I

1. RATIONALE: Surveying is one of the core subjects for civil engineering course wherein principles and method of different types of survey are studied. The course content is designed to: Train the students to study and carry out surveying & levelling operations independently on the field. Develop the ability to apply knowledge to the solution of day to day problems on construction site; To develop the skills in handling various survey instrument.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
SURVEYING -I	L	T	P	C	TH	TM	TW	PR/OR	
		3	-	4	7	75	25	50	25

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. DETAILED COURSE CONTENTS

<p>Unit 1 Introduction Scope of surveying, classification of survey, general principles of survey</p>
<p>Unit 2 Chain Surveying Study of 30m chain. Instruments for marking stations, ranging rods, pegs, arrows, cross staves. Ranging-Direct and indirect ranging, chaining on sloping ground. Triangulation, selection of survey stations, baseline; check-line, tie line, taking offsets to locate ground features; Conventional signs on survey maps viz. Cutting, embankment, marshy land, road, railway, stream, river etc. Calculation of areas from recorded observation in chain and cross-staff survey.</p>
<p>Unit 3 Compass Surveying Prismatic compass – Component parts, construction and use. Bearing of a line – Fore bearing and back bearing, whole circle and quadrantal system, reduced bearing, conversion of bearing, finding included angles from bearings; Open and close traversing. Local attraction-Reasons, error due to local-attraction. Correction of bearings affected by local attraction. Simple problems.</p>
<p>Unit 4 Levelling Definition – Level surface, level line, horizontal line, vertical line, datum surface, reduced level, benchmark & its types – temporary, permanent, GTS benchmark. Dumpy level & its component parts, fundamental axes of dumpy level. Levelling staff – Telescopic type; Terms used in levelling-Fore sight, backsight, Intermediate sight, change point and height of collimation; Classification of levelling-Simple, differential, profile levelling and cross-sectioning, fly levelling. Recording in levelling book-Height of collimation method, rise and fall method, arithmetic checks, problems in H.I. method. Sources of errors, precautions to eliminate the errors.</p>
<p>Unit 5 Plane Table Survey Principles of plane table survey, Accessories required. Setting of Plane table, levelling, centering and orientation. Method of plane table surveying – radiation and intersection, Use of Telescopic alidade. Merits & demerits of plane table survey.</p>

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Introduction	2	4
2	Chain Surveying	8	16
3	Compass Surveying	14	22
4	Levelling	20	27
5	Plane Table Survey	4	6
		48	75

5. TERM WORK & PRACTICALS

Practicals shall include following:

1. Study of Chains–20m,30m,tapes–metallic,steel ,fibre glass,ranging rods,arrows,pegs,cross staff (all with sketches)
2. Direct ranging – measuring a distance on a sloping ground.
3. Reciprocal ranging,ranging & chaining a distance across obstacles.
4. Study of prismatic compass,measurement of bearings and calculation of included angles.
5. Study of dumpy level (Ready made sketch of the instrument to be refered & no drawing of instrument required).
6. Practice on simple levelling & differential levelling
7. Profile levelling and cross levelling – fly levelling & checks.
8. Study of plane table,adjustments.Plane table methods of intersection & radiation.

6. LEARNING REFSOURCES

S.No.	Author	Title of Books	Publication
1	N.N.Basak	Surveying and Levelling	McGraw Hill Education (India) Private Limited.
2	B. C. Punmia	Surveying (Volume – I & II)	Laxmi Publication Ltd.
3	S. K. Duggal	Surveying (Volume – I & II)	McGraw Hill Education
4	S S Bhavikatti	Surveying and Levelling(Volume – I & II)	I.K.International Publishing House Pvt Ltd.
5	S.V. Kulkarni, T.P. Kanetkar	Surveying and Levelling(Volume – I & II)	Vidyarthi Griha Prakashan
6	K.R. Arora	Surveying (Volume – I & II)	Standard Publishers Distributors

MN 304 ROCK MECHANICS

1. Rationale:

The subject Rock Mechanics deal with the problems posed by the rock during excavation in both underground mining & open cast mining. The supporting systems in underground mines are designed based on study of properties of rock. In opencast mines the angle of benches & overall pit slopes are designed optimally so that no mineral is lost or there is no danger to the safety of men & machinery.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				
	L	T	P		Theory Marks		Practical Marks		Total Marks
MN 302 Rock Mechanics	3	-	2	C 5	TH 75	TM 25	TW 25	PR/OR 25	

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

CONTENTS	HRS	MKS
1. Introduction:	6	12
Definition of rock mechanics, important terms used in rock mechanics, History, objectives & problems in rock mechanics. Application of rock mechanics in mining , classification of rocks, use of underground and open cast mine space, Rock index and application in mining practice.		
2. Technological Properties of rocks	10	15
Physical Properties: Mineralogical composition, specific gravity unit weight , porosity, void ratio, Natural moisture content, saturation moisture content, Degree of Saturation, Permeability.		
Chemical Action: Hardness of water, Gases, Acid, Electrical properties, radioactive properties		

Thermal properties: Heat, Heat Capacity specific heat Latent heat of fusion. Thermal conductivity, α – efficient of thermal expansion & contraction

Mechanical Properties of Rock: hardness, Durability, Permeability of water, Elasticity, deformability strength in site strength & their determination effect of joint & structure on strength, mechanical defect in rock- fracture, fissure, Bedding plane, stratification joints, fault plane, fold void & cavity

Dynamic Properties: propagation of elastic wave in rock media, determination of dynamics strength & elastic content

3. **Stress concentration around mine working & failure Criteria** 12 18
Stress field, primary stress in sound rock, in situ state of stress. Secondary stress in rock, stress strain diagram. Stress concentration around excavation, pressure arch theory, stress around shaft, roadways, wide excavation, pillar, support pillar, barriers, stress analysis applied to mining problems, theoretical basis for stress analysis, stress analysis techniques & Instrumentation, Criteria of rock failure: theories of rock failure – maximum tensile stress criteria, maximum shear stress criteria, coulomb, Mohr's & Griffith Criteria, stress relief techniques
4. **Engineering problems associated with underground working** 12 18
Subsidence;-Definition, theories of subsidence, terms in subsidence;- subsidence basin, partial subsidence, full subsidence, maximum subsidence, critical area, sub critical area, super critical area, angle of draw, factors affecting angle of draw, factors affecting subsidence, impact of subsidence, subsidence investigation, measure to minimize subsidence damage

Rock burst & coal bump;- definition, mechanism, types, effect, prevention & precaution measures

Creep and local fall;- definition, mechanism, creep deformation & strength, behavior, creep test and rheological models
5. **Slope stability & slope stabilization** 8 12
Slope, pit slope geometry, types of open pit slope, mechanism of pit slope failure, types of slope failure, factors contributing for slope failures, prediction & hazards of slope failure, Aims of slope stability, technical input data for slope stability analysis, Basic concept applied to slope stability, factor of safety concept, Slope stability analysis methods and instrumentation, slope stabilization methods(open pit and dump);- slope stabilization methods, selection of stabilization method, slope monitoring and maintenance.
4. **LIST OF PRACTICALS (ANY 10)**
1. Preparation of rock sample for testing in laboratory;
2. Determination of compressive strength of a given rock sample,
3. Determination of tensile strength of a given rock sample
4. Determination of shear strength of a given rock sample
5. Determination of Uniaxial and triaxial strength of a given rock sample
6. Determination of Porosity of rock of a given rock sample;
7. Determination of water content of a given rock sample
8. Determination of Abrasivity of rock;

9. Determination of Modulus of elasticity and Poisson's ratio;
10. Determination of Slake durability of rock;
11. Determination of consolidation and compaction of soil;
12. Determination of in situ stresses in rock.
13. Mine field visit report
14. Determination of point load strength index
15. Determination of protodyakanov index of a given rock sample
16. Determination of slake durability index
17. Determination of slope movement & factor of safety

5 REFERENCES

1. Jumikis, A.R. Introduction to Rock Mechanics, Oxford & IBH Publishing Company, New Delhi.
2. Obert, L and Duvali, W. I. Rock Mechanics and design of structure in Rock John Wiley and Sons Inc., New York 1967.
3. Vutukuri, V.S. and Lama, R. D. Handbook on Mechanical Properties of Rocks, Vol. I, II, III, and IV, Transtech Publication, Berlin, 1974/78.
4. Peng, S.S Ground Control, Wiley Publications, New York, 1987
5. Brady, B.H.G. and Brown, S.T. Rock Mechanics for Underground Mining, Chapman and Hall 1993.
6. Hoek, E and Brown S.T. Underground Excavation in Rocks Institute of Mining Metallurgy. London 1980.
7. Jeremic, M.L Ground Mechanics in Hard Rock Mining Oxford & Publishing Company New delhi, 1987.
8. Goodman R.E introduction to Rock Mechanics, John Wiley & Sons, 1989.
9. John A Hudson and John P Harrison, Engineering Rock Mechanics- An Introduction to the Principles, Pergamon Press, 1997

(CS 305) COMPUTER AIDED DRAFTING

1. RATIONALE:

The market driven economy demands frequent changes in product design to suit the customer needs. With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. This course has been introduced at Diploma level to develop the skills in student so that they can generate various digital drawings as required using various CAD software.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS305 Computer Aided Drafting	L	T	P	C	TH	TM	TW	PR/OR	100
			4	4	-	-	50	50(P)	

3. COURSE CONTENTS:

1.	Intr
roduction and CAD Preliminaries.	2
hours	
•	Co
omputer aided drafting concept.	
•	Har
oftware and various CAD software available.	
•	Co
omponents of a CAD software window such as Titlebar, Standard toolbar, Menu bar, Object properties toolbar, draw tool bar, Modify toolbar, Cursor cross hair, Command window, status bar, Drawing area, UCS icon.	
•	File
eatures: New file, Saving the file, Opening an existing drawing file, Creating Templates, Import and Export of file, Quit.	

•	Sett
ing up new drawing : Units, Limits, Grid, Snap.	
•	Un
doing and Redoing action.	

<p>2.</p> <p>wing using CAD software: hours</p> <ul style="list-style-type: none"> • 	<p>Dra</p> <p>10</p> <p>Dra</p> <p>wing basic objects : Point, Line, Circle, Arc, Ellipse, Parabolas, polygon, Rectangle, Multiline, Doughnut, Drawing with precision, Drawing construction lines and rays, Calculating distance and angle, Use of measure, Divide, Inquiry commands, redraws and Regenerating screen display.</p> <p>Met</p> <p>hods of specifying points, Absolute coordinates, Relative Cartesian, and Polar coordinates.</p> <p>Usi</p> <p>ng Object snap: Endpoint, midpoint, Intersection, Centre Point, Quadrant point, Nearest Perpendicular, Apparent Intersection, etc.</p>
<p>3.</p> <p>t/modify features and viewing drawings. hours</p> <ul style="list-style-type: none"> • • • 	<p>Edi</p> <p>10</p> <p>Obj</p> <p>ect Selection : selection set with its options like Pick box, Window, Crossing, Previous, Last drawing, etc.</p> <p>Edi</p> <p>ting Commands like : Zoom all, Zoom Previous, Zoom Extents, Zoom window, Zoom real time, Zoom Dynamic, Zoom Pan.</p> <p>Mo</p> <p>dify commands: Erase, Copy, Mirror, Offset, Array, Move, Scale, Stretch, Lengthen, Trim, Extend, rotate, break, join, chamfer, fillet.</p>
<p>4.</p> <p>anising Drawing: hours</p> <ul style="list-style-type: none"> • 	<p>Org</p> <p>6</p> <p>Co</p> <p>ncepts of layers: creating layers, naming layers. making layers ON/OFF, freeze-thaw layers, lock/unlock layers, setting the properties of layers like</p>

colour, line type, line weight.

- Co

concept of blocks : Creating, inserting, redefining and exploding blocks.

- Co

concept of Hatch: Selecting hatch pattern, Hatch styles, Hatch Orientation, associative hatch, Boundary hatch, Hatching Object.

- Pol

polylines: Drawing polylines, editing polylines, drawing spline curves, editing splines.

<p>5.</p> <p>Dimensioning and Tolerancing</p> <p>hours</p> <ul style="list-style-type: none"> • Dimensioning : Types of dimensioning, Linear, Horizontal, Vertical, Aligned, rotated, Baseline, continuous, diameter, radius, angular dimension, Leader. • Dimension scale variable, adding geometric tolerances • Dimensioning dimensions • Single line text, Multiline text. • Text styles: selecting font, size, arrows, alignment, etc. 	<p>Di</p> <p>8</p> <p>Di</p> <p>Di</p> <p>Edi</p> <p>Sin</p> <p>Tex</p>
<p>6.</p> <p>3D features</p> <p>hours</p> <ul style="list-style-type: none"> • Right hand rule/local global co-ordinate system. • Specifying 3D coordinates • Using UCS • Defining user coordinate system using UCS command with its options. • Viewing in 3D 	<p>3D-</p> <p>2</p> <p>Rig</p> <p>Usi</p> <p>Def</p> <p>Vie</p>
<p>7.</p> <p>Isometric Drawing:</p> <p>hours</p> <ul style="list-style-type: none"> • Settings for isometric drawing, isometric Snap mode, switching between isometric planes, isocircles, simple isometric drawings 	<p>Iso</p> <p>10</p>

8.		Soli
	d Modeling	12
	hours	
	•	Co
	ncept of solid modeling	
	•	Cre
	ating predefined solid primitives such as box, cone, cylinder, sphere, torus, wedge.	
	•	Co
	nstructing a region, creating an extruded solid, creating a revolved solid.	
	•	Cre
	ating composite solids using union, intersection and interface commands.	

<p>9.</p> <p>del space, Paper space, viewports and layouts</p> <p>hours</p> <ul style="list-style-type: none"> • • • 	<p>Mo</p> <p>2</p> <p>Co</p> <p>Cre</p> <p>Shi</p>
<p>10.</p> <p>nting/ Plotting drawing.</p> <p>hours</p> <ul style="list-style-type: none"> • • 	<p>Pri</p> <p>2</p> <p>Sta</p>

4. PRACTICALS

1. Drafting of common template for all the following assignments with Institute logo and standard title block.
2. Five problems on different geometrical shapes.
3. Dimensioning of above figures.
4. Three problems with polar and rectangular arrays.
5. Three problems on 2D entity generation, which involve the use of layers and blocks.
6. Two problems on orthographic views for various Engineering drawing objects covering dimensioning, text, etc.
7. Two problem on isometric drawing of Engineering drawing object.
8. Create at least two solid models, which cover all the features available in solid modeling.
9. Drafting project:
 - a) Civil Engineering. & Architectural Engineering: Plan, elevation and section of a single story residential building.

- b) Electrical & Electronics Engineering.: Electrical layout of components like bulbs, fan, A.C., T.V. point, telephone point, etc. for a single story house.
- c) Mechanical Engineering.: Industrial components such as machines, automobiles , jigs and fixtures with dimensioning, tolerancing ,text, title block, etc.
- d) Shipbuilding Engineering.: Body plan of a ship.
- e) Mining Engineering.: Plan and section of an opencast mine benches, Plan and section of an underground mine.
- f) F.T.E.E. : Front View and Bottom View of a Simple truss like Saw Tooth truss, King-Post truss, Snow Tooth truss. (Any one of the three)

5. LEARNING RESOURCES

- 1. AutoCAD for Engineering drawing made easy – P. Nageshwar Rao- Tata McGraw Hill.
- 2. Mastering AutoCAD – George Omura- BPB Publication.
- 3. AutoCAD 2004 – Sham Tickoo- Galgotia Publications, New Delhi.
- 4. AutoCAD 2000 – Devid Frey- BPB Publication.
- 5. An Introduction to AutoCAD 2000 – A. Yarwood- Longman publication.
- 6. Using AutoCAD 2000 – Ron House – Prentice Hall.
- 7. Latest AutoCAD Manual – Autodesk Inc. – Autocad Inc.
- 8. CATIA V6 Essentials by Jones & Bartlett learning.
- 9. Inside Catia by Paul Carman, Paul Tigwell.
- 10. CATIA Tutorials by Nader G. Zamani.
- 11. ProE/Creolelements or any equivalent reference/text books.

DIPLOMA PROGRAMME IN MINING

SEMESTER – IV

Course code	Name of course	L	T	P	C	Theory Marks		Practical Marks		Total
						TH	TM	TW	PR	
MN401	Surface Mining	3	-	2	5	75	25	25	25	150
CE401	Surveying – II	3	-	4	7	75	25	50	25	175
MN402	U/g Mining Methods	3	1	-	4	75	25	25	-	125
MN403	U/g Mining Machinery	3	-	2	5	75	25	25	-	125
MN404	Mining Geology – II	3	-	2	5	75	25	25	25	150
CS302	Elements of Elect. & Electronics	3	-	2	5	75	25	25	-	125
CS501	Entrepreneurship Dev	-	-	2	2	-	-	50	-	50
		18	1	14	33	450	150	225	75	900

(MN401) SURFACE MINING

1. RATIONALE:

Surface Mining is the most important means of mining all over the world. The method is practiced in Goan mines where almost all the students prefer joining. The course gives description of the method of mining supplemented by mine visits. The course deals with the rock excavation, formation of benches, working of face & transport machinery. It also covers the principles of dump formation & its management.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN 401	L	T	P	C	TH	TM	TW	PR/OR	
Surface Mining	3	-	2	5	75	25	25	25	150

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENT	Hrs	Marks
1.	INTRODUCTION;- Nature of coal and mineral deposits, open mining system, classification of surface mining methods, Feasibility study;- definition, objective, factors, open pit feasibility studies, Planning;-Definition, objective, types, input factors, planning frequency, planning process, Design of a new mines: factors, stages, process ,optimum size of mine and open pit parameters, bench parameters, factors affecting bench parameters, permissible bench parameters as per regulation, stages in open pit mining, unit operation & cycle of operations in surface mining, open pit mine layout: types, factors affecting mine lay out	10	15
2	GROUND & ROCK PREPARATION FOR EXTRACTION: Clearing of brush and tree logging: definition, methods & their suitability conditions, Grubbing: definition, methods & their suitability conditions, scarification: definition, methods, operation machines, stripping: definition, methods, operation, machines,	12	18

	<p>Rock preparation: Definition, purposes, methods, mechanical methods, Ripping;- definition, suitability condition, rock rippenability, ripper;- definition, use, ripper component, selection of ripper tips, ripper types, methods of ripping, capacity, guidelines for efficient ripping. Ripper production calculation.</p> <p>Drilling: purpose, types, Methods of drilling used in opencast mines, selection of drilling methods, drill components, drill bits, selection of drill bit, selection of drill machine, operation, factors affecting drill performance, types of drilling patterns, organization of drilling, number of drill machine calculation for given production.</p> <p>Blasting: Types of explosive used in opencast mines, selection of explosive, exploitability of rock, blast hole parameters, blast hole design, blast hole pattern and firing sequence, blasting cost, organization of blasting, various blasting techniques: inclined hole blasting, deck blasting, controlled blasting, chamber blasting, coyote blasting, cast blasting, under water blasting, nuclear blasting; blast performance evaluation. Calculation of powder factor, delay factor, detonator factor & cost of basting.</p>		
3	<p>EXCAVATION & LOADING;-</p> <p>Excavation and loading machines- Types, application, advantages, disadvantages, selection of excavation and loading machine, types of face, types of cut made by excavating machine, excavation ability, Dozer: definition, use, application, types of dozer, dozer blade, cutting & dozing methods, capacity, guidelines for efficient dozing, comparison between wheel mounted and crawler mounted Scrapper: definition, use, application, types, methods of scrapping, capacity , guidelines for efficient scrapping,</p> <p>Power shovel: types ,use, application, parameters, types of face & cut, overcastting & stripping operations, output, factors affecting output, types of face, types of cut, comparison between various types of shovel, advantages and disadvantages, selection of shovel, calculation of bucket capacity & number of shovel for a given product</p> <p>Dragline: types, use, application, parameters, types of face & cut, overcasting & striping operations, output, factors affecting output, types of face, types of cut, comparison between dragline & shovel, advantages and disadvantages,</p> <p>Bucket wheel loader: types ,use, application, types of face & cut, overcastting & striping operations, output, factors affecting output, types of face, types of cut,</p> <p>Bucket wheel excavator & Bucket chain excavator;- types ,use, application, parameters, types of face & cut, overcastting & striping operations, output, factors affecting output, types of face, types of cut, comparison between dragline, Bucket wheel excavator & shovel, advantages and disadvantages, Organization and automation of extraction</p>	13	21
4.	<p>TRANSPORTATION IN OPEN PIT;-</p> <p>Purpose, types, selection of transportation system, dumper;- types, suitability conditions, advantages & disadvantages, truck positioning at faces & dump, calculation of number of dumper & type of dumper for given production, haul road;- haul road geometry, haul road lay out,</p>	8	12

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	traffic capacity of a road, haul road construction material, construction , maintenance & repair of haul road, Railway& locomotive transportation;- suitability conditions, track layout at bench & dump, organization of movement, Belt conveyor ;-types, carrying capacity, selection of belt , high angle belt conveyor, belt loader, automation in loading & unloading. operating cost ,combine & special pit transportation system.		
5.	STORAGE OF MINERAL & WASTE DUMP CONSTRUCTION;- Storage;- Definition, Methods of storage, storage layout, Methods of waste disposal, Types of dump, layout, construction by;- bulldozer, power shovel, dragline , multibucket excavator ,stacker , spreader , selection of dump site, dump slope stabilization,	5	9
	Total	48	75

4. LIST OF PRACTICALS (ANY TEN)

1. Determination of bench parameters & overall pit slope of a opencast mine.
2. To calculate various stripping ratios of a mine
3. To calculate ripper production
4. To calculate bulldozer production
5. To calculate number of drill machine for a given production
6. Blast design of a open pit
7. To calculate powder factor, delay factor & detonator factor of a blast
8. To calculate cost of blasting
9. To calculate bucket capacity & number of power shovel for a given production
10. To calculate shovel & dumper combination
11. Selection of belt conveyor for a given production
12. To calculate dump capacity

5. LIST OF REFERENCES

1. G.B. Mishra, Surface Mining, Dhanbad Publishers, 1978
2. W.Huustrulid and M. Kuchta, Open Pit Mine Planning and Design, A.A. Blakema Publishers
3. S.K.Das, Surface Mining Technology, Lovely Prakashan, Dhanbad, 1994.
4. D.J.Deshmukh, Elements of Mining Technology, Vol.I, Central Techno Pub, Nagpur, 1998.
5. R.T. Deshmukh, Opencast Mining –M. Publications, Nagpur, 1996
6. Howard L. Hartman, Element of Mining Engineering

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(MN402) UNDERGROUND MINING METHODS

I. RATIONALE:

Person intending to work in underground coal & metal mines requires advance knowledge of various methods, This course is designed to give exposure to the student of the methods of underground mining.

II. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				
	L	T	P		TH	TM	TW	PR/OR	Total Marks
MN 402 Underground Mining Methods	3	1	-	4	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

III. DETAILED COURSE CONTENT

CONTENTS	HRS	MKS
1. INTRODUCTION	10	16

Classification of coal seam with respect to thickness, depth and inclination, classification of mining methods. Bord & Pillar method - A quick revision of development.

Depillaring: Types of depillaring, Preparatory arrangement before depillaring, Methods of pillar extraction by caving, sequence of extraction & diagonal line of face, Machine and man-power requirement, layout, production calculation, various depillaring operations, depillaring with caving and stowing, Roof control- normal & premature collapse, local & main fall, airblast & precautions; systematic support rules, different layouts. Stowing: Conditions favouring depillaring with stowing, Methods, selection of material, hydraulic stowing, stowing plant, stowing pipes and their layout, Hydraulic profile & H:L ratio, U/G stowing arrangements and operation; Pneumatic and Mechanical stowing, problems in stowing. Bord & Pillar under special conditions. Regulations on Bord & pillar development & depillaring.

2. LONGWALL MINING

10

16

Applicable conditions, Elements of longwall face, development of gate roads, operation of Road header, setting of longwall face, cyclic working of longwall face, advantages and disadvantages of longwall advancing and retreating. Factors affecting Panel size/ length of face.

Non cyclic operations: Mechanized loading and cutting operations- Selection of cutting machine, coal plough, suitability conditions of shearer, Types of Shearer (DERDS & SERDS), Parts of shearer, types of cutting, types of sumping; Mode of transportation - AFC, parts of an AFC, working, capacity & power calculations; Hydraulic supports – elements of supports, Types, advancing of supports; Regulations on longwall mining

3. THICK SEAM MINING

08

12

Definition of thick seam, problems and difficulties in thick seam, Methods adopted in thick seam, Thick seam working by Bord & Pillar method, thick seam working by longwall method in several slices, sublevel caving.

Blasting gallery method- Application, advantages, layout, Method, drilling & blasting, transportation, induced caving & supports; shield mining. Regulations on thick seam mining.

4. METAL MINING METHODS (SUPPORTED)

12

20

Factors affecting choice of methods, Classification of stoping methods, Elements of a stope;

Application, Layout, Development, extraction, support, comparison, advantages and disadvantages of Overhand & underhand stopings;

Application, Layout, operation, support of Breast stoping, Room & Pillar stoping & Long hole stoping;

Sub level stoping: Application, Layout, construction of draw point, production drilling, blasting, advantages & disadvantages.

Shrinkage stoping: Application, Preparation, extraction, ore handling, chute arrangements, Ventilation, advantages & disadvantages.

Cut and fill stoping: Application, Preparation, Layout, Chute construction, cable bolting, Barricades, handling of ore, selection of filling material, ventilation, advantages & disadvantages

Square set Mining – application, elements of set, sizes and arrangements of additional sets, filled and non- filled.

5. CAVING METHODS & SPECIAL METHODS

08

11

Application, Development, extraction, mechanization, support, ventilation comparison advantages and disadvantages of Block caving, Sub level Caving & Top slicing; Cavability index.

Extraction & layout of Blast hole stoping, Vertical crater method, Post Pillar stoping, Working of narrow vein, Methods adopted in Deep Mining: granite packing, chathy stoping, Back hole stoping etc. Regulations of methods.

IV. LIST OF TUTORIALS: (Any SIX)

1. A coal seam of 3 mts. in thickness is to be mined using panel system. Using LHD/ SDL and conveyor belt. Give a layout for the same explaining the support system ventilation on the face and sequence of operation.
2. Describe a suitable method for extraction of pillars in a district with 30-m x 30-m huy 76 centre to centre pillars. What percentage of recovery you will expect in the method.
4. Sketch a block diagram of DERDS. Explain the significance of each part, types of cutting, types of stumping.
5. Sketch and study the constructional features of an armoured face conveyor. Calculate the capacity & Power requirements
6. A coal seam of ___ mts in thickness having an inclination of ___ is to be worked with longwall retreating with caving. Describe the method with suitable sketch giving details of sequence of operation, support, and transport system. Production expected from the face.
7. Sketch & study working a thick seam by slices in a descending order, which includes sublevel caving.
8. A thick coal seam developed by bord & pillar method is to be extracted by blasting gallery method. Describe the method with suitable sketches giving details of sequence of operation, drilling, loading, transport system, support, production expected from the face. Assume your own conditions.
9. Sketch and study sublevel stoping method.
10. Sketch and study cut & fill stoping method.

V. LIST OF REFERENCES:

1. Elements of mining Technology, Vol-2 by D.J. Deshmukh.
2. Mining Engineering Handbook Vol-1 & 2 by Pele.
3. S.M.E. by Hartman.
4. Mining of Mineral Deposits by L. Shevyakov.
5. Blasting Techniques by S.K. Das.
6. Mining of Ores & Non-metallic Minerals by Agoshkov, Borisov.

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(MN403) UNDERGROUND MINING MACHINERY

1. RATIONALE:

Mining Diploma holder is required to supervise various operations in underground mines. With the mechanization of mines it has become essential for him to understand the machines for its proper use and productive performances. This course includes study of various machinery used for haulage of mineral & men. The latest developments in face machinery are also included.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN 403 Underground Mining Machinery	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENT	Hrs	Marks
1.	INTRODUCTION; - mode of power, power terminology, comparison between power mode, mechanical & hydraulic transmission of power, types of engineering material (ferrous & non ferrous),Machinery use in underground coal & metal mines, selection of machines, purpose & advantages of mechanization, Automation and Remote Control of Mining machinery,. Safety and regulations related to underground mining equipment. Equipment maintenance;- role of maintenance in mining, types of maintenance, effective maintenance system, management information system for mine equipment maintenance.	6	9
2.	FACE MACHINERY; Drills: Types of drill machines and their application Construction, application & working of coal drill, jack hammer ,jumbo, simba, cavo, ring & mobile high capacity drills, roof bolting & cable bolting machine. Types, construction ,working & suitability conditions of coal cutting machines, shearer, coal plough, road headers , tunnel Boring Machines and continuous minor. Loading Machinery- types, suitability conditions ,construction and working of rocker shovel, SDL, LHD, gathering arm loader, scraper loader, flight loader, Mine Regulations on face machinery,	9	15

3.	<p>HAULAGE SYSTEM :- Underground transportation arrangement & methods of transportation, Rope Haulage:- suitability conditions of rope haulage, Gravity, direct, main and tail, endless, mono rail, their construction, application, layouts, advantages and disadvantages; tensioning arrangement of endless haulage , , Essential of good haulage track, rail track gauge, sleeper, Balast, Rails, curve, crossing, super elevation, safety devices in haulage,. Types& construction of mine tub and cars, Haulage calculation involving number of tubs, power of motor, diameter of rope & drum, Ideal gradient, super elevation. . Mine Regulations on rope haulages.</p> <p>Locomotives :- suitability conditions ,types, construction, working, application, advantages and disadvantages of Diesel, Battery, Electrical and compressed air locomotives; battery charging station, exhaust conditioners, calculation involving tractive effort , ideal gradient, draw-bar pull, horse power ,braking effort, Regulations on locomotives. .</p> <p>Conveyor system;- suitability conditions ,types, construction, working, application, advantages and disadvantages, calculation of carrying capacity, motor power</p> <p>Other system;- shuttle cars, pneumatic transport, gravity transport, low profile dump trucks, Man-riding Systems</p>	13	21
4.	<p>WINDING;- The elements of winding system, Headgear- purpose , construction, material , type, advantages & disadvantages of various types, principles of design, height, fleet angle & position of drum, pulley, cage and cage accessories, shaft fitting, suspension gear, , detaching safety hook, safety catches, shaft guides, kepgear, use of floating and hinged platforms guides;-purpose, types, arrangements, advantages & disadvantages shaft signaling arrangement, types of winding system, .skip winding ;- application ,types, construction , advantages & disadvantages drum winding :suitability conditions, drum profile;-types ,application, advantages & disadvantages, various types of drum winding system, torque time diagrams, drives, speed control & safety devices, Friction winding :suitability conditions, application , principle, various types of winding system , advantages, disadvantages, , construction of ground mounted, tower mounted, multi rope winding, advantages, disadvantages,. Pit Top & Bottom layout , description of run round, shunt back, lofco, traverse, turn table arrangements, tippers , Mine Regulations on winding.</p>	<i>13</i>	21
5.	<p>WIRE ROPES;- Composition of wire ropes, manufacturing, basic properties, types & construction of wire ropes; stranded & non stranded ropes, rope lay, selection of wire ropes, rope for various purposes examination of wire rope, care of wire rope during storage and use, Testing of wire ropes, rope splicing, rope cattles and process of capping, method of changing a winding rope, calculation of breaking strength, space factor, mass, factor of safety, fill factor, construction efficiency, diameter. Mine Regulations on wire ropes.</p>	7	9
Total		48	75

4. LIST OF PRACTICALS (ANY TEN)

1. To identify rope component, numbers of wires & strand, core type, lay, types of rope
2. To calculate breaking strength, space factor, mass, fill factor, construction efficiency, diameter of wire ropes.
3. To identifying coal drill & jack hammer drill component and working system
4. To calculate number of tubs & motor power direct rope haulage & endless rope haulage
5. To calculate tractive effort, ideal gradient, draw- bar pull, horse power, braking effort of a locomotive
6. To calculate least gradient & number of tubs per set in gravity haulage
7. To calculate carrying capacity, motor power of a conveyor system.
8. To calculate static & dynamic torque in different drum profile
9. To calculate power rating of winders
- 10.** To calculate radius of curve and super elevation of a haulage track
11. Study of rope capping procedure
12. Study of rope splicing procedure

5. LIST OF REFERENCES

1. S. Ghatak, Mine Pumps Haulage and Winding, Lovely Prakashan Pub
2. C. F. Statham Coal Mining Practice-Vol II, Caxton Eastern, Calcutta
3. R.D.Singh, Principles and practices of modern coal mining, New Age International
4. R.T. Deshmukh, Winning and Working Coal in India, ISMAG Co op. Store Ltd., Dhanbad
5. Howard L. Hartman, Element of Mining Engineering
6. D.J.Deshmukh, Element of mining technology vol. III,

(MN404) MINING GEOLOGY - II

1. RATIONALE:

Mining Technology is one of the basic subjects of mining engineering. The subject deals with basic processes of mining. For effective extraction of mineral drilling & blasting is essential. The subject deals with the type of drilling for production, characteristics of explosives & accessories and the blasting features. The subject also deals with the types of supports used in underground workings as well as sinking of a shaft which has become an efficient mode of entry.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN 404	L	T	P	C	TH	TM	TW	PR/OR	
Mining Geology - II	3	-	2	5	75	25	25	25	150

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks

PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	Content	Hrs	Mks
1.	<p>ELEMENTS OF ECONOMIC GEOLOGY</p> <p>Types of Ore minerals and Gangue minerals, Tenor of ores; National mineral resources and their statistics; utilization of mineral resources including coal; Metallogenic epochs, Metallogenic provinces; Classification of minerals deposits.</p> <p>Process of formation of mineral deposits-Magnetic Concentration; Contact metasomatism; Hydrothermal process; Sedimentation and evaporation; Residual and mechanical concentration; Oxidation and supergene enrichment; Metamorphic processes. Gossans and cappings ore shoots and bonanza. Nature of mineral deposits: form and shape, size and extent, lay, depth, mineralogical composition, physicommechanical properties and geological disturbance.</p>	18	28

	Principal Indian Metalliferous deposits. A brief outline on their mode of occurrence mode of origin, and distribution of major deposits in India ; Iron, Manganese Copper, Chromite, Gold, Lead & Zinc, Aluminium.		
2.	MAJOR GEOLOGICAL FORMATIONS OF INDIA A brief review of their distribution, lithology, and classification with special emphasis on their economic importance. The Dharwar system; The Aravali system; The Cuddapah system; The Delhi system; The Gondawana system and the Deccan traps. An introduction to the stratigraphic succession of rocks, formation in Goa. Distribution of mineral/ buildings material such as granite, basalt, dolerite, quartzite, clay, quartz, silica, sand, lime shell, lime stone, building stone etc with specific reference to areas in and around Goa.	9	14
3.	GEOLOGY OF COAL AND PETROLEUM Coal, Stages in coal formation; Origin of coal and coal seams; Constitution of coal; Chemical composition of coal; Physical properties of coal; Varieties and rank of coal; Important structural features of coal seams; Indian coal and list of important coal fields of India. State wise (Geology of individual coal fields excluded) Proximate and ultimate analysis. Introduction to petroleum, formation of petroleum, mode of occurrence, reservoir rock, origin of petroleum, chemical composition of petroleum, physical properties of petroleum.	10	16
4.	PALEONTOLOGY Fossils – fossils, significance, classification, Types of fossilization, Conditions which favour the preservation of fossils; Uses of fossils; The index fossils; The nummulitic fossil; Understanding technical terms of different phyla.	4	6
5.	SAMPLING- Definition and principles of sampling; Types of sampling techniques; Errors in sampling, sample, Size of sample, significance of sample, Collection and preservation of samples; Preparation of samples for assay; Sampling records; Assay maps; salting – definition, purpose and types of salting.	7	11

4. LIST OF PRACTICALS

1. Identification of some major economic (metallic & non-metallic) minerals with the help of their physical properties.
 - a) Iron:-Hematite, Magnetite, Lemonite, Geothite, & Pyrite.
 - b) Manganese:- Pyrolusite, Psilomelane.
 - c) Copper:- Chalcopyrite, Malachite.

- d) Lead :- Galena.
- e) Zinc:- Sphalerite.
- f) Chromium:- Chromite.
- g) Aluminium:- Bauxite.
- h) Other economic minerals.
- i) Asbestos, Barytes, Beryl, Calcite, Coal (bituminous), Dolomite, Fluorite, Graphite.
- j) Garnet, Gypsum, Lignite, Mica, Magnetise and Talc.

2) Sketching labeling & identification of fossils / shells.

- a) Phylum:- Mollusca, class Lamellibranchia – Maretrix, Arca, cardium, trigonia, Gryphea.
- b) Phylum:- Mollusca, Class Gastropoda – Turritella, Murtex, Conus Solarium, Cyprea.
- c) Phylum:- Mollusca, Class Cephalopoda, - Nautilus, Belemnite.
- d) Phylum:-Echinodermata, Class Echinoidea, - Schizaster, Micraster.
- e) Phylum:- Brachipoda, Class Articulata (inarticulata)
- f) Phylum:- Arthropoda, Class Trilobita – Phacops.
- g) Plant fossils- Glossopteris, Neuropteris, Fossil wood.

3) Solution of geological maps.

- a) Topographical map and geological map.
- b) Important points in map reading and interpretation.
- c) Maps on horizontal strata.
- d) Maps on inclined strata.
- e) Maps on unconformities.
- f) Estimation of ores on a map of India

5. LIST OF REFERENCES:

1. Economic Mineral Deposits by Alan M. Bateman.
2. Elements of Mineral Exploration IBM Publication.
3. Introduction to India's Economic Minerals Ore Deposits of India - Gokhle & Rao.
4. India's Mineral Resources by S. Krishnaswamy.
5. Dana's Manual of Mineralogy by Cornelius S. Hurlbert.
6. Geology of India by D.N. Wadia.
7. Elements of Mineralogy by H.H. Reed.
8. Fundamentals of Historical Geology by Ravindra Kumar (Wiley Eastern edition)
9. Geology of India & Burma by M. S. Krishna C.B. S. Publishers.
10. Courses in Mining Geology by R. N. P. Arogyaswamy (Oxford & IBH Pub)
11. Manual of Geological maps by Gokhale, C.B.S. Publishers.
12. A book of Geological maps by Chada S.K.C.B.S.Publishers.
13. Mining Geological by H.E. Mekinsby, Asia Publishing House.

(CE401) SURVEYING –II

1. RATIONALE:

The course content has been designed to- Enable the students to acquire skills in handling theodolite in day to day survey work. Use the plane table and its accessories. Provide the student the knowledge of tacheometric survey.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CE401 SURVEYING -II	L	T	P	C	TH	TM	TW	PR/OR	175
	4	-	4	7	75	25	50	25	

Minimum passing %: Theory 40%

Duration of theory paper: 3 Hrs.

Legends:

L-Lecture; *T* - Tutorial; *P* - Practical; *C*- Credit; *TH*- End Semester Theory; *TM* – Test Marks

PR/OR - End Semester Practical / Oral Examinations; *TW*- Term Work

3. DETAILED COURSE CONTENTS

UNIT 1

THEODOLITE

Parts of theodolite and their functions; Temporary adjustments. Swinging the telescope, transiting the telescope, face-left, face-right observation. Measurement of horizontal angles by repetition and reiteration method. Measurement of deflection angle. Measurement of magnetic bearing of a line by a Theodolite. Measurement of vertical angle. Prolonging of straight line – Sources of errors in theodolite work. Permanent adjustments of a transit theodolite. Traversing with a theodolite - Method of included angles, locating details, checks in closed traverse, calculation of bearings from angles. Traverse computation – Latitude, departure, consecutive co-ordinates, errors of closure, distribution of angular error, balancing the traverse by Bowditch’s rule, transit rule, and Gale’s traverse table. Simple problems on above topic. Study, purpose and use of digital theodolite. & use of Total Station instrument.

UNIT 2 TACHEOMETRIC SURVEY

Principles of tachometric survey. Use of Theodolite as tacheometry with vertical staff and fixed hair system. Horizontal sight only. Determination of tachometric constants. Simple numerical problems on above.

UNIT 3 CONTOURING

Definition of contour, contour interval horizontal equivalent; Uses of contouring, characteristics of contour lines, direct and indirect methods of contouring, interpolation of contours and establishing grade contours.

UNIT 4 CURVES

Types of curves used in road and rail alignments. Notation for simple circular curve and corresponding calculations. Methods of setting out curves by offset from long chord method, Rankine's tangential angle. Commonly used radii and degree of curves for roads and railways.

UNIT 5 INTRODUCTION TO MODERN SURVEYING INSTRUMENTS

Definition ,Principles, and applications ,

- i) Digital Level
- ii) Digital planimeter
- iii) E.D.M
- iv) Total stations
- v) GPS and DGPS

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	THEODOLITE	18	25
2	TACHEOMETRIC SURVEY	8	15
3	CONTOURING	8	15
4	CURVES	8	12
5	INTRODUCTION TO MODERN SURVEYING INSTRUMENTS	6	8
		48	75

5. PRACTICALS

- i. Contouring by direct method.
- ii. Contouring by indirect method.
- iii. Study of parts of Theodolite, temporary adjustments. Practice of reading Vernier /or Micrometer.
- iv. Measurement of horizontal angles by repetition method. Measurement of vertical angles. Measurement of deflection angles. Observation of magnetic bearing. v) Prolonging a line. Locating a contour by using theodolite as Tacheometer.
- v. Setting out simple curves by offsets from long chord. Setting out simple curve by Rankine's method.

TERM WORK

Drawing on an imperial or near metric size sheet finished in pencil on any two of the following project-works- Contouring by indirect method- suitable area, Theodolite traverse for a minimum 5 sided plot, computation by Gale's traverse, Plane table survey of minimum 5 sided traverse by method of intersection.

The term work shall include appropriate field book / level book containing various observations taken at the time of field-work.

6. LEARNING REFSOURCES

Sl. No.	Author	Title of Books	Publication
1	T. P. Kanetkar.	Surveying and levelling Vol. I and II	
2	Husain and Nag raj	Surveying and Levelling	
3	B. C. Purnima.	Surveying and levelling Vol. I and II	
4	Davis and Foote	Surveying	

(CS501) ENTREPRENEURSHIP DEVELOPMENT

1. RATIONALE

The course on Entrepreneurship Development focuses on creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects related to setting up of enterprise. This can be helpful in motivating technical students to start their own small-scale business/enterprise.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credi ts	Examination Scheme				
	L	T	P		Theory Marks		Practical Marks		Total Marks
CS 501 Entrepreneurship Development	L	T	P	C	-	-	PR/OR	TW	50
	-	-	2	2	-	-	-	50	

Minimum passing % Practical 40%

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – *Prepare a detailed project report for an identified product/service.*

4. DETAILED COURSE CONTENT

<p><u>Unit 1:Introduction</u> (7 Hours, 12 Marks)</p> <p>Meaning of entrepreneurship, need in the present scenario, definition of an entrepreneurship, qualities of an entrepreneur, functions of an entrepreneur, risks and rewards of entrepreneurship.</p> <p>Definition of Micro, Small And Medium Enterprises (MSME).Classification of Micro, Small And Medium Enterprises (MSME). Types of Enterprises - manufacturing, service and franchisee.</p>
<p><u>Unit 2:Forms of Business Organisation</u> (2 Hours, 9 Marks)</p> <p>Main features of Sole Proprietorship, Partnership, Private Limited Company, Public Limited Company, Co-operative Society.</p>

Unit 3: Entrepreneurial Support System

(6 Hours, 9 Marks)

Central Government Agencies: Functions of Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC), Micro, Small And Medium Enterprises -Development Institute (MSME- DI), Technology Business Incubator (TBI), Khadi & Village Industries Commission (KVIC).

State Government Agencies: Functions of District Industries Centre (DIC), Goa Industries Development Corporation (GIDC), Economic Development Corporation (EDC), Financial Institutions-Banks, Goa Handicrafts and Rural Small Scale Industries Development Corporation (GHRSSIDC), Rural Development Agency (RDA), Khadi and Village Industries Board (KVIB).

Unit 4: Business Opportunity Identification

(7 Hours, 6 Marks)

Evaluation of business opportunity:- selection of industry, initial prospects study, product marketing concept, decision to proceed, feasibility study, project evaluation.

Unit 5: Market Research

(6 Hours, 12 Marks)

Definition of demand, factors affecting demand, law of demand, demand curves

Definition of supply, factors affecting supply, law of supply, supply curves.

Preparation of questionnaire. Data collection for setting up a small enterprise.

Unit 6: Legal Aspects

(4 Hours, 9 Marks)

Procedure of registration of Micro, Small And Medium Enterprise (MSME), meaning and registration of Value Added Tax (VAT), Service Tax, PAN. Slabs of Income tax.

Unit 7: Project Report

(16 Hours, 18 Marks)

Need for project report, importance of Project report,

scope of project report: Economic aspects, technical aspects, financial aspects, managerial aspects, production aspects.

List the contents of a project report.

Proforma of a project report which includes:- Introduction, scheme, profitability and projections, infrastructure, break- even point, names and addresses of suppliers, remarks.

Project Profile.

Project appraisal criteria:- technical feasibility, financial feasibility, economic viability, commercial viability, managerial competency, political and labour considerations.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction	7	12
2	Forms of Business Organisation	2	9
3	Entrepreneurial Support System	6	9
4	Business Opportunity Identification	7	6
5	Market Research	6	12
6	Legal Aspects	4	9
7	Project Report	16	18
TOTAL		48	75

6. MANDATORY ASSIGNMENTS

1. Preparation of a Case Study on leading entrepreneurs of Goa. (To be taken while conducting Unit 1)
2. Preparation of a Case Study on leading entrepreneurs of India. (To be taken while conducting Unit 1) Unit 1)
3. Filling of template of “Business Model Canvas”
4. Preparation of Project Profile.
5. Preparation of Project Report.

7. SUGGESTED ACTIVITIES:

1. Visits to related departments (DIC,Banks,Tecnology Business Incubators, MSME-DI, NSIC, KVIC, KVIB).
2. Study visits to industries.
3. Organise entrepreneurship related event / activities.
4. Organise lectures/seminars with successful entrepreneurs.
5. Organise brainstorming sessions on ideation.
6. Establish an Entrepreneurship Development Cell.

8. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1.	<i>Sharad jawadekar, shobha dodlani,</i>	<i>Business entrepreneurship</i>	<i>Suvichar prakashan mandal pune,</i>
2.	<i>S.S. Khanna</i>	<i>Entrepreneurship development</i>	<i>S. Chand & Co. Ltd, New Delhi,</i>
3.	<i>Vasant Desai</i>	<i>Management of small Scale Industry in India</i>	<i>Himalaya Publishing House</i>
4.	<i>Dilip Sarwate</i>	<i>Entrepreneurial development Concepts and practices</i>	<i>Everest Publication House, Pune</i>
5.	<i>CB Gupta and P Srinivasan</i>	<i>Entrepreneurship Development</i>	<i>S. Chand and Sons, New Delhi</i>
6.	<i>PM Bhandari</i>	<i>Handbook of Small Scale Industry</i>	

(CS302) ELEMENTS OF ELECTRICAL & ELECTRONICS ENGINEERING

1. RATIONALE:

A Mechanical Engineering Diploma holder in his job in industry has to interact with many electrical machines and electronics based controls in operation of various machine tools and machine control systems. Therefore a basic knowledge about electrical and electronics engineering relevant to his job requirement of operation and maintenance in industry is mandatory to perform his job efficiently.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
CS302 ELEMENTS ELECTRICAL AND ELECTRONICS ENGINEERING.	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing % :Theory 40%

Duration of Theory Paper: 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. Unit- I–AC Fundamentals

(2hrs) (3marks)

Sinusoidal AC voltage waveform.

Definition of terms related to AC wave-- average value, RMS value.

Definition of power factor and its significance.

Unit- II – Distribution of Electrical Energy

(9hrs) (15marks)

Voltage levels in the various stages in the flow of electrical power from 110KV substation to 11KV/440V distribution transformer(using single line diagram only).

Method of laying underground cables for distribution of power.

Voltage levels for commercial and domestic use.

Conduit wiring system- surface and concealed, its advantages and disadvantages.

Definition of Earthing, its necessity .

Types of Earth electrodes—Pipe and Plate electrode.

Methods of reducing earth resistance.

Unit- III – Cables , Switching and Protective Devices

(8hrs) (15marks)

Construction of three phase PVC insulated power cables.

Specifications of PVC cables.

Colour codes of single phase and three phase PVC cables.

Functions and symbols of Switch-Fuse Unit, Fuse-switch Unit, Contactors, MCB, MCCB and ELCB.

Fuses- Construction and Applications of Rewirable fuses and HRC fuses.

Construction and operation of a simple electromagnetic relay and limit switches.

Unit- IV – Transformers

(4hrs) (06marks)

Principle of operation and basic construction of a single phase transformer (core and winding only).

EMF equation(no derivation and no numericals).

Losses in a transformer, efficiency and voltage regulation(no derivation and nonnumericals).

Significance of KVA Rating of transformer.

Unit- V – DC Motors

(6hrs) (09 marks)

Working principle of DC motors, main parts of DC motor and their functions,.

Classification of DC motors (shunt, series and compound and their applications).

Necessity of a starter for DC motors (No study of starters).

Methods of reversal of direction of rotation of DC shunt and series motor.

Unit- VI – AC Machines

(6hrs) (09marks)

Principle of operation of three phase induction motor.

Main parts of three phasesquirrel cage & Slip Ring Induction motors.

Applications of induction motors.

Necessity of starter, Names of starters used, reversal of direction of rotation.

Working principle of an alternator.

Directorate of Technical Education, Goa State

Unit- VII – Basic Electronic Devices

(9hrs) (12marks)

Semiconductor theory-Construction of Intrinsic and extrinsic semiconductor, P and N type semiconductors, working principle of Diode, diode V-I characteristics, Full wave centre-tap and bridge rectifiers- circuit diagram,operation and waveforms, capacitor filter to reduce ripple voltage.

Transistor -NPN and PNP, construction , symbol and operation. Transistor CE Amplifier-circuit diagram and operation using waveforms only. Applications of transistors (naming only)

Unit- VIII – Digital Logic Gates

(5hrs) (06marks)

Binary number system, Symbols and Truth Tables of AND, OR,NOT,NAND,NOR,X-OR,X-NOR Gates

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	AC Fundamentals	2	03
2	Distribution of Electrical Energy	9	15
3	Cables,Switching and Protective Devices	8	15
4	Transformers	4	06
5	DC Motors	6	09
6	AC Machines	6	09
7	Basic Electronic Devices	8	12
8	Digital Logic Gates	5	06

5. SUGGESTED LIST OF EXPERIMENTS

(Any 8-10)

Sr. No.	LIST OF EXPERIMENTS
1	Identification of various components of a Diesel-Engine Generator set and study its operation.
2	Connection of a single phase Transformer and measurement of Input and Output voltages, currents and power for different loads.
3	Simulation of fuse failure on any one primary phase of a 3-phase transformer and study its effect on the secondary voltages.

3	Connection, Starting, speed control and reversal of direction of rotation of DC shunt motor
4	Connection and Starting of three phase induction motor using manual and automatic star delta starter
5	Connection, starting, running and speed control of Slip Ring induction motor
6	Calculations for selection of PVC cables for different currents.
7	Identification of Fuses ,MCBs and ELCBs and study of operation of MCB and ELCB for different simulated faults.
8	Circuit assembly, measurement of input and output voltages and fault simulation and trouble shooting of Bridge and Centre-tap Rectifiers
9	Circuit assembly for ON/OFF control of single phase loads such as lamps, home appliances,etc. using transistorized circuit and a Relay.
10	Verification of truth tables of Logic Gates

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	B.L. Thereja.	Text book of Electrical Technology	Latest
2	V.K. Mehta	Principles of Electronics Engineering	Latest

Directorate of Technical Education, Goa State

SEMESTER – V

Course code	Name of course	L	T	P	C	Theory Marks		Practical Marks		Total Marks
						TH	TM	TW	PR/OR	
MN501	O/c Mining Machinery	3*	-	2*	5	75	25	25	-	125
MN502	Mine Safety & Leg	4*	-	-	4	75	25	-	25	125
MN503	Mine Ventilation	3*	-	2*	5	75	25	25	25	150
CS602	Business Comm.	-	-	2*	2	-	-	50	50	100
IT501	Industrial Training	-	-	16	16	-				Grade
Total		10	-	22	32	225	75	100	100	500
*Workload shall be doubled										

SEMESTER – VI

Course code	Name of course	L	T	P	C	Theory Marks		Practical Marks		Total
						TH	TM	TW	PR	
MN601	Mineral Processing	3	-	2	5	75	25	25	25	150
MN602	Mine Management & Economics	4	-	-	4	75	25	-	25	125
MN603	Computations in Mining & Allied Engineering	-	-	2	2	-	-	50	50	100
E1	Elective - I	3	1	-	4	75	25	-	-	100
E2	Elective – II	2	-	2	4	75	25	25	-	125
MN604	Project	-	-	6	6	-	-	50	50	100
Total		12	1	12	25	300	100	150	150	700

LIST OF ELECTIVE SUBJECTS

E1 ELECTIVE – I

MN611 Mine Surveying

MN612 Exploration Engineering

MN613 Ocean Mining

MN614 Mine Planning & Design

MN615 Mine Systems Engg

E2 ELECTIVE – II

MN621 Mine Environmental Pollution & Control

MN622 Advanced Mining

MN623 Mine Disasters Rescue & Recovery

MN624 Computer Applications in Mining

SEMESTER V

(MN501) OPENCAST MINING MACHINERY

- RATIONALE:** Mining diploma holder is required to supervise various operations in mineS with the Mechanisation of mines. It has become essential for him to understand the machines for its proper use and productive performances. On completion of this course the diploma holder is expected to be able to choose suitable machinery for certain works and to ensure its safe and efficient performance.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN501	L	T	P	C	TH	TM	TW	PR/OR	
Opencast Mining Machinery	3	-	2	5	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENTS	HOURS	MARKS
1	Transmission of Power	10	15
	<p>Elements of mechanical transmission, Types of fluids, Properties of fluid, Principle of hydraulics, Cylinders and accumulators. Different types of valves, Fluid coupling, Torque converter, Hydraulic pump used in HEMM, Compressor- Types, components, factors for selection of compressor, Air motor</p> <p>Drilling Machines:</p> <p>Principles & mechanism of drilling, Types of drill bits, selection of drill bits. Drill rig- components & types, surface arrangement , applications, Thermal drilling,</p>		

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	<p>Types of core barrels, fishing tools, drilling fluids, feed mechanism – hydraulic, mechanical. Bore hole deviation- causes, preventive measures, and measurement techniques.</p> <p>Major types of blast hole drills used in India (DTH, WAGON DRILL). Principle of operation, components of drill machine</p>		
2	FACE MACHINERY	11	18
	<p>Excavation and loading machines:</p> <p>Shovel -Classification, construction, operation, technical details, maintenance, hydraulic system diagrams, undercarriage, and comparative study of shovels.</p> <p>Front end loader - classification, components, operation, Hydraulic system for bucket operation, maintenance, technical specifications, Wheel loaders, comparison of a crawler mounted with wheel mounted shovel,</p> <p>Dragline - classifications, construction, operation, technical specifications, maintenance, walking mechanism of a dragline.</p> <p>Bucket Wheel excavators - classification, construction, operation, technical specifications, maintenance</p> <p>Surface Miner: Construction, Types, milling drum, conveyors, capacity</p>		
3	TRANSPORT MACHINERY	11	17
	<p>Dumpers - General classification, construction, operation, suspension system, power transmission system including differential, hydraulic brakes, steering mechanism, hoisting activity, Air system, parking brakes, safety devices, Technical Specifications, Maintenance. Tyres - types, construction, parts, causes of tyre damage and their remedies; Comparison of various types of Dumpers CMR REG: 95 (a), 96,97.</p> <p>Conveyors - Classification, Belt conveyor: construction details – Types of Belt, pulley, idlers, loop take up systems, hold back system, coupling, belt joining, design of belt, drive system, maintenance. Brief introduction of booster belt conveyor, cable belt conveyor, high angle belt conveyor CMR REG:- 92</p> <p>Aerial ropeways: Types, applicability, construction : Trestles, traction & track rope, carriage, Driving gear, tensioning arrangement, output calculations, advantages & disadvantages.</p>		

4	AUXILIARY MACHINERY	6	10
	<p>Bulldozer - classification, components, operation; Dozer blades - types, selection: maintenance, Technical specification, and hydraulic system.</p> <p>Ripper - classification, construction; types of shank, shank components, ripper tip selection, maintenance, Technical specifications.</p> <p>Grader – Classification, movement of blade, components, functions</p> <p>Brief description and specifications of scrapper, clamshell, lump breaker, stacker, spreader, crane.</p>		
5	MINE PUMPS	10	15
	<p>Types of pumps used in mines, Reciprocating pump, principle, parts, operation, Basic components of centrifugal pump- impeller, casing shaft, wear ring, stuffing box, bearings, valves and accessories, construction of Turbine pump, starting and stopping of pumps, priming, water hammer, cavitation, Air vessels, axial end thrust, hydraulic balancing disc. Characteristic curves of turbine pumps,-selection of pumps. Care and maintenance of pumps. Submersible pumps:- construction advantages and disadvantages. Numerical problems based on H.P., no of stages, head, quantity, efficiency</p>		
	Total	48	75

4. LIST OF PRACTICALS: (Any Ten)

1. Visit to a drill site to study operation of blast hole drills.
2. Calculation of the rate of drilling of a drill machine.
3. Study of Maintenance of a shovel in a nearby mine workshop.
4. Visit to a mine workshop to study the maintenance procedure of dumpers.
5. On site study of safety arrangements of Heavy earth moving machines.
6. Sketch and study of dragline.
7. Visit to a conveyor site to study the operation of conveyor belt.
8. Sketch and study of tensioning and loop take up mechanism in a belt convey or.
9. Sketch and study of mono cable aerial ropeway.
10. Study of characteristic curves of centrifugal pump.
11. Sketch and study of submersible pumps
12. Visit to a mine to study the pump characteristics.

5. LIST OF REFERENCE BOOKS:

1. Surface Mining by G. B. Mishra
2. Mine Pumps, Haulage and Winding by S. Gbaiak.
3. Latest Developments of HEMM by Amitosh De
4. Surface Mining Technology by S. K. Das.
5. Heavy Construction Equipment by Jagman Sing
6. Elements of Mining Technology Vol – I & III – D.J. Deshmukh

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(MN502) MINE SAFETY & LEGISLATION

1. **RATIONALE:** Mine Legislation is complicated & most important course in Mining Engineering Course. Diploma holders are placed on supervisory capacity in mines after completion of diploma. As supervisor and further manager of mining enterprise, this is essential for him to be well versed in his role in industry, to get the production safely & lawfully. After completion of this course a diploma student may be able to understand the rules & regulations applicable to mines & perform safe working

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN502	L	T	P	C	TH	TM	TW	PR/OR	
Mine Safety & Legislation	4	-	-	4	75	25	-	25	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3 DETAILED COURSE CONTENT

	CONTENTS	HOURS	MARKS
1	ACCIDENTS	11	13
	<p>Definition of event, Incident, accident, injury, dangerous occurrence, disaster, unsafe act, unsafe condition, hazard; Theories & Principles of accident causation, Classification of accident by place, cause etc., cost of accident, causes and remedial measure of various accidents, principle of accident prevention</p> <p>Accident notice, enquiry and investigation, Accident report, accident compensation. Types of guards, their design and selection, Personnel Protective Equipments, classes of fire – fire extinguishers, Basics of First Aid, Emergency evacuation</p>		

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2	SAFETY ORGANISATION	14	16
	<p>Safety Policy, objectives, planning of safety, Budgeting for safety, factors affecting safety in mines, safety organisation in mining, organisation chart of safety department, safety awareness, Safety campaign - Safety suggestion schemes. Safety competitions. Safety incentive schemes, Audio visual publicity, Other promotional methods like safety week celebration;</p> <p>Safety and productivity, safety education and training, safety sampling, accidents record and statistics, Accidents rates- frequency and severity rates; inter-industry and international comparisons, Time charges scheduled as per Workmen's Compensation Act, Accident analysis, Zero/ Minimum accident potential, Job Safety Analysis, Risk Analysis, Legislations administered by DGMS, National Safety Conferences</p>		
3	THE MINES ACT 1952 & THE MINES RULES 1955	14	17
	<p>The Mine Rules 1955: Committee; certifying surgeons; Medical examination employed or to be employed in mine; Workmen inspector and safety committee; Health and sanitation provision; First aid and medical appliances; Employment of person; Leave with wages & overtime; Welfare amenities; Registers, notices and returns; Forms as given in Schedule</p>		
4	THE CMR- 1957/ MMR-1961	12	14
	<p>Notice of opening: Monthly return, annual return, notice of amendment and discontinuance, Notice of reopening, notice of accident & disease; Board of Mining Examinations, submission of application, age, general qualification & practical experience of candidates; Duties, responsibilities and-qualifications of manager, asst manager, safety officer, surveyor, engineer, foreman, shotfirer, mate, magazine in charge, attendance clerk, competent person, lamp room in charge, winding engine man,, practical experience for manager, foreman, surveyor, shotfirer. CMR regulation Nos. 66, 67, 68, 69,70,191,191(D), 193,197, 199(A)</p> <p>(A comparision between CMR & MMR may be made)</p>		
5	MMDR Act 1957, MCR 1960, MCDR 1988	13	15
	<p>General Restrictions On Undertaking Prospecting And Mining Operations, Procedure For Obtaining Prospecting Licences Or Mining Leases In Respect Of Land In Which The Minerals Vest In The Government, Rules For Regulating The Grant Of Reconnaissance Permits, Prospecting Licences And Mining Leases, Special Powers Of Central Government To Undertake Prospecting Or Mining Operations</p>		

	<p>In Certain Cases, Development Of Minerals, The First Schedule - Specified Minerals, The Second Schedule - Rates Of Royalty, The Third Schedule - Rates Of Dead Rent</p> <p>Include The Mines and Minerals (Development and Regulation) Amendment Ordinance, 2015</p> <p>MCR 1960: Grant of Reconnaissance Permit, Grant of Prospecting Licences in Respect of Land in which the Minerals Vest in the Government, Grant of Mining Leases in Respect of Land in which the Minerals Vest in the Government, rocedure for Obtaining a Prospecting Licence or Mining Lease in Respect of Land in which the Minerals Vest in a Person Other than the Government, Grant of Prospecting Licences and Mining Leases in Respect of Land in which the Minerals Vest Partly in the Government and Partly in Private Persons</p> <p>MCDR 1988: Reconnaissance Operations, Prospecting Operations, Mining Operations, Plans and Sections, Environment, Employment of Qualified persons, Notices and Returns</p>		
	Total	64	75

4. LIST OF REFERENCE BOOKS:

1. The Mines Rule 1955.
2. The Coal Mines Regulations 1957
3. Mine Management, Legislation & General Safety - S.K. Ghatak.
4. Legislation in Indian Mines: A Critical Appraisal Vol I & II - Rakesh & Prasad.
5. The Mines Act 1952.
6. Mine Management, Legislation & General Safety - B.Ghosh.
7. The Intent & Content of Legislation - L.C. Kaku
8. Safety & Opencast Mines by Rezisky
9. MMRD/ MCDR/ MCR

(MN503) MINE VENTILATION

- RATIONALE:** Mine ventilation is an important aspect in underground mining. With increased depth, it has gained importance in open cast mine also. This course is intended to study all aspects of mine ventilation including & the measurement of various parameters. On completion of this course a diploma holder who intends to work in underground metal & coal mines will also be able to look after the ventilation aspects.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN503	L	T	P	C	TH	TM	TW	PR/OR	
Mine Ventilation	3	-	2	5	75	25	25	25	150

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENTS	Hours	Marks
1	MINE ATMOSPHERE	12	18
	<p>Atmospheric air, different types of gases found in the mines, their sources, physical, chemical and physiological properties of various gases, gassyness of mine, cowards diagram, methane layering, gas blowers. Instruments used for detection of various gases — flame safety lamp (FSL), methanometer, multi-gas detector, CO-detector, collection of air samples, Accumulation test & percentage tests by FSL, permissible concentrations of gases as per mine regulation.</p> <p>The objectives & standards of mine ventilation; the atmospheric pressure, absolute & guage pressure, Fortin and Aneroid Barometers, manometers, sources of heat in mines. Moisture content in air, saturation point, Effect of humidity at the work places, heat stroke, whirling hygrometer, Cooling power of mine air, kata thermometer.</p> <p>CMR: -116, 121, 130, 136 (a), 141, 142,143, 144, 145, 146, 147. 155, 156, 157, 158.</p>		

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2	MODES OF VENTILATION	9	14
	<p>Various factors causing NVP, The motive column, Effect of surface temperature on NVP, limitations of NVP, numerical examples</p> <p>The fan house, mine regulations related to it, forcing & exhaust system, central and bound ventilation system, assential and descential ventilation, homotropical and antitropical ventilation, air leakage and their prevention; ventilation structures for regulation and direction of air current - stopping, door, air-lock, closing of shaft top, regulator and air crossing, CMR 131, 138</p>		
3	LAWS OF MINE AIR FLOW	10	16
	<p>Pressure loss due to flow and pressure difference, measurement of the pressure difference by inclined manometer, measurement of air velocity by different instruments, pitot tube, angle of yaw, laminar flow, turbulent flow , atkinsons formula on pressure loss, , the resistance to flow of air, friction losses & shock losses, galleries in parallel and series, numerical problems on frictional resistance and mine resistance, purpose of splitting, advantages and disadvantages, equivalent orifice, numerical examples.</p>		
4	MINE FANS	10	16
	<p>Centrifugal fan and axial flow fan, principle of action and comparison, air reversal arrangement. The fan laws, theoretical depression, Horsepower, manometric, mechanical and overall efficiencies. The evasee: construction, design and its functions, savings in head due to evasee, numerical problems, mine characteristic curve, characteristic curves of fans, Comparison of characteristic curves of fans with mine characteristic curve and location of operating point, fans in series and parallel CMR: 132,133,134, 135, 136, 140,</p>		
5	AUXILIARY VENTILATION & VENTILATION SURVEY	7	11
	<p>Ventilation of narrow headings by auxiliary fans, different methods. Contra rotating axial flow fan, rigid and flexible ducts, purpose of installation of booster fans, Location of booster fan, neutral line, critical pressure of booster fan, advantages and disadvantages.</p> <p>Objectives of ventilation survey, survey interval, survey stations & records, ventilation plans, pressure survey with aneroid barometer and with inclined manometer, quantity survey, precautions and duties of ventilation officer. CMR: 132, 137, 139</p>		
	Total	48	75

4. LIST OF PRACTICALS (ANY TEN)

1. Measurement of absolute pressure with the help of Fortin barometer and Aneroid barometer and to study changes in pressure with change in temperature and humidity.
2. Measurement of relative humidity with Whirling hygrometer & to study Kata thermometer
3. To sketch various ventilation appliances such as stopping doors, Air locks, regulators and air crossing
4. Measurement of air velocity with vane-anemometer and to counter check air measured with velometer and vice versa.
5. Measurement of pressure difference with inclined manometer keeping various inclinations.
6. Measurement of air velocity with pitot tube.
7. Sketches of installation of centrifugal fan and axial flow fan.
8. Study of fan laws by changing the speed of rotation.
9. Sketches of installation of auxiliary fan and booster fan.
10. To study the effect of changing pitch in axial flow fan
11. Sketches of general ventilation layout.
12. Study of pressure loss in ventilation ductings.

5. LIST OF REFERENCES

1. Element of Mining Technology, Vol.- II by Shri D. J. Deshmukh.
2. Mine Ventilation by A. Skochinsky
3. Numerical problems on Mine Ventilation by Shri L. C. Kaku.
4. Mine Ventilation by Shri G. B. Mishra
5. Mine Ventilation (Question & paper) by B. Ghosh.
6. Mine Environment & Ventilation by Shri G. B. Mishra.
7. The Coal Mine Regulation - 1957.

(CS602) BUSINESS COMMUNICATION

1. RATIONAL :

The course on Business Communication will help in development of speaking, listening, writing, and reading skills in students, with special reference to business environment like writing business letters, notes, reports, documents, holding meetings and discussions, working in groups, etc. . Special provision has been made for language workshops where the communication skills of the students can be enhanced.

2. Teaching and Examination Scheme :

Course Code & Course title	Periods per week in hours			Total credits	Examination scheme				
	L	T	P		C	Theory Marks		Practical Marks	
	L	T	P	C	TH	TM	PR/OR	TW	
Cs602 Business Communication	-	-	2	2	-	-	50	50	100

3. Competences to be developed through this course :

The course content should be taught and implemented with the aim to develop different type of skills leading to the achievement of the competency “Communicate effectively in given Business situations”.

4. Detailed Course Content :

<p>Unit 1.1: Communication Skills in the work place</p> <p>Communication within the organizational, Types of communication, functions of Internal & external communications</p> <p>Definition, components, importance of effective communication skills, types- verbal-non verbal, methods and hints to improve communication skills, body language, Précis and comprehension</p>
<p>Unit 1.2: Modern Office technology for communications: Using technology and internet to obtain information about suppliers, their credibility, latest specification of items, contacting people, quick feedback, social networking, skype, whatsapp, spell check, dissemination of information, send email to staff, paperless office, etc</p>

Term End Assessment

Components	Maximum marks
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Questions on syllabus.....	20
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Activity.....	30
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4. Suggested specification table with hours and marks (Practical) :

Unit No	Topic	Teaching hours per semester
1.	Communication Skills in the work place	04
2.	Organizing seminars, project work	04
3.	Report writing	05
4.	Letter Writing	05
5.	Meeting	05
6.	Tenders	04
7.	Job interviews	05
	Total hours	32

5. Suggested learning resources :

1. Business Correspondence and report writing, by R C Sharma & Krishna Mohan, Tata Mcgraw hill, New Delhi 2002,
2. Principles and practices of Business Communication ,Doctor R. Doctor A., Seth Publishers,14th edition,2006
3. The functional aspects of communication skills, P. Prasad, Sharma K. Rajendra, S. K. Kataria and Sons,2006
4. Raul R. Timm, How to make winning presentations, Sneha printers, Mumbai,
5. Stand and Deliver, how to become a masterful communicator and public speaker,
6. Dale Carnegie Training, CPI Cox & Wyman, UK.

(IT501) INDUSTRIAL TRAINING

1. RATIONALE:

Industrial Training is a newly introduced component, in the curriculum under Revised Semester Pattern system for all 03 year Diploma Programmes. It is a Training programme designed to expose & prepare the students for the Industrial work situation. This exposure and hands on experience, will further enhance the prospects of student fraternity to be better placed on completion of their course.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				Total Marks
					Theory		Practical		
IT501 INDUSTRIAL TRAINING	L	T	P	C	TH	TM	PR/OR	TW	GRADE
	-	-	16	16	-	-	30	70	

Minimum passing %: 40%

Legends:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

Students are required to study and have hands-on experience wherever possible in the following areas (depending on availability):

1. Company Profile
2. Organizational Structure
3. Company Product Range
4. Manufacturing Facilities Available /Services provided
5. Plant / Facility Layout
6. Operations / Production Processes
7. Production Planning and Control
8. Detail study of Latest Equipment/ Technologies Used
9. Stores Functions
10. Material Handling Systems/ Equipments
11. Quality Management Systems / Functions
12. Maintenance and Repair Practices
13. Safety Practices / Safety Equipments
14. Utilities
15. Logistics
16. Sales and Marketing
17. Ethics, Statutory Rules and Regulations followed
18. Product Design and Development
19. Any other area specific to the Industry providing Training

4. TERM WORK & PRACTICALS

Evaluation Scheme					
TW				PR/OR	TOTAL Marks
Attendance Marks*	Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Training Report	Report Assessment & Seminar/Viva	
10	20	20	20	30	100

* 01 mark shall be deducted for every Absence (with or without permission).

Daily Dairy

The daily dairy should-be maintained in a book. It should reflect the day to day activities performed by the student (including task, men and materials involved). It should be counter signed by the Industry Mentor. It will become the basis for writing reports on the complete training.

Training Report

The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately high lightened, including environmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound.

Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

Note :

- a. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.
- b. Industrial Training will generally be organised and conducted in accordance with Industrial Training Manual duly prescribed by the Board.

5. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No	Name of the Unit	Teaching Hours	Marks
1	PR/OR	} 08 Weeks	30
2	TW		70
	Total	08 Weeks	100

Note:

1. For Industrial training Grades will be awarded based on marks scored as follows:
 - 80% and above Marks – Grade 'A'
 - 60% to 79% Marks – Grade 'B'
 - 40% to 59% Marks – Grade 'C'
 - Marks below 40% - Grade 'D'
2. TW and PR/OR shall be separate Heads of passing. Student has to secure minimum Grade 'C' for passing.

SEMESTER VI

(MN601) MINERAL PROCESSING

1 Rationale: Mineral processing has become an essential part of mining industry in recent years. The high-grade ores are depleting and the market specification for ore is highly stringent with respect to gangue minerals. Only method to meet the industrial requirements is by way of mineral processing. This course equips the diploma holder with the ability to supervise mineral beneficiation plants for various types of ore

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN601	L	T	P	C	TH	TM	TW	PR/OR	
Mineral Processing	3	-	2	5	75	25	25	25	150

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENTS	HOURS	MARKS
1	Introduction	8	12
	Mineral beneficiation: Definition, purposes, properties of mineral used, methods, scope and limitation. Mineral dressing: definition, Unit operation in Mineral dressing, properties of mineral used in mineral dressing. Run of mine material & mineral, sampling: definition, types of sample, methods of sample preparation, precaution in sampling and sample testing. Environmental impact due to mineral processing and control measures.		
2	Communiton	10	15
	Definition, purposes, methods of size reduction, Principles, mechanism of fracture, theory of crushing, crushing: definition, methods, crusher – definition, classification, construction, operations, capacity, factors affecting capacity, selection of crusher. Crushing circuits. Grinding -		

	definition, purpose, and mechanism. Tumbling mill - type, grinding media, constructions, operation and capacity. grinding circuits. Breakage rate and factor affecting breakage rate.		
3	Sizing separation	10	15
	Sizing - definition, purpose, method and principles. Laboratory sizing, Screening – definition, Classification, screen surfaces, equipments construction and application Classification: definition, application, Principles, method, Equipment: construction, operation, application, design, performance of classifier and factors affecting it.		
4	Concentration	13	21
	definition, Methods of concentration and their applications, sorting: definition, methods, Hand sorting: definition, application, sorting surfaces, machines sorting - application, mechanics of sorting, sensing system, sorting machines: types, construction, operation, application, Gravity separation: definition, Principles and methods of gravity concentration, equipment construction, operation and application. Heavy media separation (H.M.S): definition, principle, heavy media, equipment: construction, operation and application. Flotation - definition, principles & chemistry; reagents - collector, froather and regulator, Flotation equipments: construction, operation, Electrical and Magnetic Concentration - principles, mechanism, fields of applications, limitations, methods, equipment and performance. Miscellaneous methods of concentration.		
5	Auxiliary operation and plant control	7	12
	Dewatering: definition, Purpose, methods of dewatering. Dewatering equipment construction, operation, application. Plant Practice: Purpose, flow sheet: definition, types of flow sheets. Flow sheet analysis, selection of equipments, selection of plant site, control objective, principles of automation, instrumentation, plant design, rule for plant design, cost estimation, tailing dam: nature of tailing, design, site selection, construction, tailing water management		
	TOTAL	48	75

4. LIST OF PRACTICALS (Any ten)

1. Study of sampling, and mineral beneficiation techniques for major metallic minerals (visit to mine)
2. Calculation of reduction ratio of a crusher and grinder.
3. Calculation of crusher capacity.
4. Calculation of consumption of power of a jaw crusher
5. Sieve analysis of a given sample and plotting sizing curve
6. Screen performance calculation
7. Vibrating screen size selection.
8. Calculation of spiral classifier pool area.
9. Calculation of size and number of hydro cyclone

10. Calculation of cell size and number of cell for froth flotation
11. Determination of thickening and clarification area
12. Visit to beneficiation plant and Study of flow sheet
13. Study of plant automation and control
14. Field visit report

5. LIST OF TEXT BOOKS

1. B.A. Wills, Mineral Processing Technology. Pergamon Press, Toronto
2. Jain, S.K., Ore Processing A.A. Balkema Publishers
3. A.M. Gaudin, Principle of Mineral Dressing, McGraw Hill, New York

6. LIST OF REFERENCE BOOKS

1. Kelly E. G. and Spoitiswoods D. J., Mineral Processing, Wiley, New York
2. Vijayendra.H.G., Handbook on Mineral Dressing Vikas Publishing House Pvt. Ltd.
3. Norman I. Wiess, SME Mineral Processing Hand book, SME of the American Institute of Mining, Metallurgical and Petroleum Engineers, 1985
4. A.F.Taggart., Handbook of Mineral Dressing, Wiley engineering Hand book series
5. EIA Guidance Manual for Mineral Beneficiation, by Ministry of Environment & Forest, Administrative Staff College Hyderabad.

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(MN602) MINE MANAGEMENT AND ECONOMICS

- Rationale:** Diploma holders are placed on supervisory capacity in mines after completion of diploma. As a supervisor and further manager of mining enterprise these courses are essential for him to be well versed with his role in the industry. On completion of this course the student will be able to apply the management techniques in the mines and also to look after economic aspects

2. TEACHING & EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN602	L	T	P	C	TH	TM	TW	PR/OR	
Mine Management and Economics	4	-	-	4	75	25	-	25	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3 DETAILED COURSE CONTENTS

	CONTENTS	HOURS	MARKS
1	Mine Management & organisation	15	17
	Principles of Scientific Management. Management By Objectives, TQM, Management functions- Planning, organizing, directing, motivating, controlling, coordinating and communicating, staffing, Types of organization- Line, staff, Line & staff; their merits & demerits; Levels of management and organizational chart. Qualities of leadership in mines manager, workers participation in mine management – objectives, means of participation, functions of trade unions, inventory control and materials management. Calculation of mining personnel, their qualification based on on given output as per CMR/MMR		

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2	Man Power Planning & Training	14	16
	Objectives & requirements of man power planning, factors affecting planning, Job analysis & Job evaluation, Job design, recruitment procedures, Selection process, Induction, Promotions system, causes & reduction of labour turnover, Training – Needs, objectives, Different categories: Types of training Executives, workers training – Types of training, training centres & other matters as per MVT Rules 1966, Performance Appraisal – Need, Objectives, Methods, wage system & incentives		
3	Mineral Economics	14	17
	Special features of mineral and mining industry, role of minerals in national economy, statistics of important and strategic minerals of India. Grading and pricing of coal, limestone, bauxite and iron ore, factors effecting value of minerals, National Mineral Policy, Conservation of minerals, Small mines and their socioeconomic significance, Royalty, taxes & duties, imports & exports, Principles of book keeping – Terms used, journal & ledger, system of book keeping, Balance sheet & Profit loss account, Inflation, depreciation – methods, taxation		
4	Mine Valuation & Feasibility Studies	14	16
	Mine Valuation – Purpose, Present value, Annuity, Derivation of Hoskolds formula – Assumptions & limitations, numerical problems; risks in valuation, Amortisation, redemption of capital Time value of money, Types of capitals – Fixed & working capital, Sources of finance – types of shares & debentures, cost of capital, investment appraisal – purpose, methods, merits & demerits, Break even analysis, feasibility studies		
5	Reserve Calculations	7	9
	Classification of reserve, Reserve Analysis, methods of estimation of reserve, data collection, interpretation & presentation, Introduction to geo-statistical method. Calculation of 'Average' width, assay grade. Classification and incorporation of losses. Coefficient of components of mineral extraction, dilution and recovery		
	Total	64	75

LIST OF REFERENCES BOOKS:

1. Mine Management by Ghatak
2. Mine Economics by R. T. Deshmukh
3. Industrial Organisation & Engineering Economics – T R Banga & S C Sharma
4. Mineral Economics – KK Chatterjee
5. SME Mining Engineering – Howard L Hartman

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(MN603) COMPUTATIONS IN MINING & ALLIED ENGINEERING

- 1 Rationale:** Diploma holders need to be well versed with the calculations related to all the mining activities & they should be in a position to interact with all the other branch engineers. This subject involves computations/ calculations across all the activities pertaining to mining & allied operations.

2. TEACHING & EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				
	L	T	P		TH	TM	TW	PR/OR	Total Marks
MN603 Computations in Mining & Allied Engineering	-	-	2	2	-	-	50	50	100

Minimum passing %: 40%

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3 DETAILED COURSE CONTENT

The following activities need to be analysed based on Case studies (Any Ten). On an average 6 Hours have to be allocated to each of the activity

1. Reserve calculations: classification- General & UNFC, Quantification & quality
2. Mine Closure Plan, Rehabilitation & Post Land use
3. Calculation of Production & Material Handling Equipments
4. Determination of Mining Cost – Elements of cost,
5. Study of mine plan layouts, sections & manpower calculations
6. CSR activities performed by various companies- A compulsory visit to Sanquelim Mine
7. Sketch of an opencast mine showing the elements of benches, calculating the overburden & ore quantity
8. Electrical distribution system in mines

9. Study of Mineral Beneficiation plant – Layout, capacity
- 10 Maintenance schedule of shovel & dumper
- 11 Mine water treatment – General treatment methods, construction of tailing dam, its design & capacity calculations
- 12 Critical analysis of Acts, Rules, Regulations, Bye laws & DGMS circulars
- 13 Application of CPM/PERT in Mining
- 14 Mine Sumps- Capacity & Pump calculations

(MN604) MINING PROJECT

- 1 Rationale:- Mining engineer is required to take on the spot decisions at the mine site considering the change in working parameters. Outline knowledge on design of mining operations is required for taking appropriate decisions. The subject shall enable the students to be trained in logical thinking and deriving conclusion for designing parameters of mining processes.

2. TEACHING & EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
	L	T	P	C	TH	TM	TW	PR/OR	
MN604 Mining Project	-	-	6	6	-	-	50	50	100

Minimum passing %: 40%

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. Detailed Contents

The Project work enables the students to identify and develop their talents and skills and also to increase their academic knowledge, practical experience and ability to analyse problems and suggest solutions. The work involves design, fabrications, theoretical and experimental studies, and investigations into specific aspects of live problems in mining and mining related industries.

The project work is a four-credit course with four conduct hour per week. The student would perform in convenient group of not exceeding five members under the guidance of a faculty of the institute. The guide would constantly interact with and monitor the student and assess the progress by periodical review of the laboratory work, computer analysis/field work a manner deemed fit and appropriate. The continuous assessment and semester evaluation would be carried out from time to time.

The students shall finally produce a comprehensive report enshrining the problem statement, background information, literature survey, project work details and conclusions. The report shall be submitted in the specified form.

The fieldwork is expected to be less. However two to three visits to the field related assignment is suggested. The project may be identified during the training programme that the student has undergone in Fifth Semester.

The following steps shall be followed

1. To understand the project given by teacher or selected by the student at the time of training.
2. To scan the library for relevant book, journal, report etc.
3. To decide the approach for seeking the problem
4. To make field visit if required
5. To collect relevant data for calculations.
6. To do the actual calculations
7. To project the final calculations in the form of report charts, drawing, models etc.
8. To prepare a detail report neatly bound
9. To appear for the oral examination

SUGGESTED TOPICS FOR THE PROJECT

1. Suggest a suitable blasting pattern for a specified excavation work. Calculate all the blasting parameters including cost, Manpower, machine requirement & work organisation.
2. Given geological plan of a mineral deposits suggest the best method of opening up a deposit and design the dimension of the entries.
3. Given the characteristic of the ore body suggest a suitable method of extraction of a ore for specific production level.
4. Project the men and machinery requirement for a mine for given rate of production.
5. Suggest the tunnelling operation required for a railway tunnel including requirement of men and machinery.
6. Suggest the suitable method of overburden disposal for any mine based upon given conditions.
7. Project a method of dust control for working opencast mine.
8. Suggest a good ventilation system for an existing mine.
9. Suggest an open cast mine working below water table.

(MN611) MINE SURVEYING

1. **Rationale:** Mine surveying is designed to cater the needs of advance knowledge in mine surveying to modern instruments in surveying is given additional stress to build up further self confidence in performing the job of surveying in mines. On the completion of this course, a diploma holder will be able to carry out surveying works & estimation of reserves that are related to mining

2. TEACHING & EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN611	L	T	P	C	TH	TM	TW	PR/OR	
Mine Surveying	3	1	-	4	75	25	-	-	100

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENT	HOURS	MARKS
1	Introduction	8	9
	Mine surveying - definition, purpose, uniqueness of mine surveying, Role and responsibilities of mine surveyor, appointment and qualification of mine surveyor, Error: definition, classification & types of error, limiting error, acceptable limits of error (by DGMS) , sources of error in mine surveying, prediction and elimination		
2	Modern mine surveying instruments	17	20
	EDM;- definition, component, principle, setting up and measurement, error, application in mining, Gyrotheodolite: definition, principle, application, operation, uses in mining, limitation; Total station: definition, component, types, principle, setting up, observation, data processing, limitation, advantages & disadvantages, application in mining; GPS & DGPS: definition, component, principle, signal, setting up and observation, calculation and position estimation, application in mining, error, methods of improving accuracy, GIS: definition, principle, components , functions, data and data visualisation, application in mining, limitations, advantages & disadvantages, brief introduction of 3D laser scanning, LiDAR, WASS, Remote sensing, robotic total station,		

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	Unmanned Aerial Vehicle (UAV) surveying, borehole surveying, Aerial surveying		
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3	Opencast survey	14	17
	Purpose of opencast surveying, control point, frame work and development of opencast survey station. Detailed survey of opencast, determination of mine boundary, photometric survey in opencast, Area and volume of regular figure, methods of area calculations, computation of area from field notes, computation of area plotted plan, measurement of stripping, mineral tonnage & mineral stock calculation. Volume of cutting and embankment, volume and weight of coal and mineral, volume of water in pit calculation, box cut volume calculation, bench advance calculation, mine boundary marking, movement of strata prediction,		
4	Underground survey	17	20
	Correlation: Underground mining reference and survey nets, Underground vertical surveying, underground theodolite traversing, surface surveying, correlation: definition, purpose & steps in correlation, methods of correlation, instrument used, precaution, Shaft plumbing, Shaft surveying, Direct traversing in inclined shaft. Control of direction and gradient in drifts, tunnels, raises and winzes; Curve setting: Purpose, type of curve, underground methods of curve setting. Stope Surveying: Purpose, methods, instruments, methods of survey in moderately and steeply inclined ore bodies, flat and vertical ore bodies/seams. Calculating mineral output, percentage of extraction calculation, Dip and strike calculation, fault calculation, cross measure drift calculation, Bore hole calculation, Determination of true thickness from core.		
5	Mine plan and section	8	9
	Types of Mining plans and sections, General requirement, conventional symbols used for preparation of plans and sections. Preparation and preservation of plans and sections, storage of plans, sections and instruments, plans and sections for a new mine, methods of plotting, co ordinate methods of plotting, survey office: location, equipment, enlarging and reduction of plan, surveying software and hardware; CMR-60,61,65		
	TOTAL	64	75

4 TEXT BOOKS

1. William Wesely Staley, Introduction to Mine surveying, Stanford University Press
2. B.C. Punmia, Surveying Vol. III –12th edition, Lakshmi Publications, 1994.
3. T.P.Kanetker and S.V. Kulkarni, Surveying and levelling Vol I and II, Vidyapith Grihan Prakashan, Pune.

5. LIST OF REFERENCE BOOKS

1. Fedrick Wini Berg, Metalliferous Mine Surveying, 2nd edition, Mining Publications, London,
2. Ghatak, Mine Surveying Vol. I, II, III, 5th edition, Coal Field Publishers, 1996.
3. V. Borsheh and Komponiets, Mine Surveying, Mir-Publishers, 1989.

(MN612) EXPLORATION ENGINEERING

- Rationale:** Mineral exploration has become integral part of cost effective mining. For the minerals to be extracted the proper exploration is important. Hence, the course content of this subject has been carefully chosen to make mining students conversant in the practical applications of exploration during mining.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN612	L	T	P	C	TH	TM	TW	PR/OR	
Exploration Engineering	3	1	-	4	75	25	-	-	100

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

	CONTENTS	HOURS	MARKS
1	Mineral exploration	12	19
	Definition, General principle, Types of exploration – reconnaissance & detailed, Methods – Geophysical, Geological, geochemical, remote sensing and other new methods, applications, advantages, disadvantages, stages in exploration process, planning, design, instrumentation, interpretation, evaluation, modeling, representation data and exploration plan		
2	Exploratory drilling	10	16
	definition, purpose, types, methods, drilling components, operations, safety, automotive drilling, site and drill pad preparation, supervision, limitation, advantages, disadvantages, drilling guidelines, selection of drill bits.		

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	Directional core drilling - definition, methods, merits and operation. Core- definition, core size, core collection, core box, core recovery, core lifter, core analysis and reporting		
3	Exploration and major metallic ore and coal	6	10
	Iron, lead , zinc, gold, manganese, coal, alumina, chromite, case studies.		
4	Petroleum exploration	12	19
	definition, types, petroleum geology, purpose, elements, stages, exploration methods, exploration procedures and production. Exploration platforms, production well logging and rig. Data collection, interpretation and presentation, risk and safety. Supervision, environmental issues, Product transportation, The Petroleum (exploration, development and production) Act 2013		
5	Underwater / ocean mineral exploration	8	11
	Definition, minerals found underwater/ ocean in world and in India, importance, purpose, steps, planning, methods , sampling device and methods, sample preparation analytical methods, expenditure. Rule and regulation related to underwater/ ocean exploration and mining		
	Total	48	75

4. LIST OF REFERENCES

1. Elements of Mineral Exploration by I.B.M. Publications.
2. Exploration and Mining Geology by Peters W.C.
3. Introduction to Geophysical Prospecting by Dobrin, M. B.
4. An Introduction to Geophysical exploration by Kearcy P and M. Brooks
5. Mineral Exploration: Principles and Applications;- By S. K. Halda

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(MN613) OCEAN MINING

1. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		Theory Marks		Practical Marks		
MN613	L	T	P	C	TH	TM	TW	PR/OR	
Ocean Mining	3	1	-	4	75	25	-	-	100

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

2. DETAILED COURSE CONTENTS

	CONTENTS	HOURS	MARKS
1	INTRODUCTION	2	4
	Ocean, beach, continental shelf. Exclusive Economic Zone. International Organisations. Pioneer Status granted to India. Laws governing exploration & extraction, CRZ, Mineral reserves found in Indian ocean		
2	BACKGROUND OF OCEAN MINING	4	7
	Types of Marine minerals and deposits:- Petroleum and natural gas. Gas hydrates, Placers- heavy minerals, Phosphorite deposits, Ferromanganese deposits, Hydrothermal deposits. Physiographic settings of the minerals :- Beaches, Continental of Minerals – Strategic, critical, essential.		
3	TYPES OF MINERAL DEPOSITS	12	18
	Genesis, distribution, occurrence and economic importance of Petroleum and natural gas , Gas hydrates:- Formation process and mode of Occurrence Placer- heavy Minerals:- Heavy heavies, Light Heavies, Gem stones; Beach placers, palaeo-beach placers, subsurface placers, palaeo- valley placers; Types of minerals and distributions; Sources areas (provenance); Characteristics of mining. Phosphorite deposits:- Mode of occurrence and formation process of phosphotatisation (microbial action, upwelling, sea-level changes); Types-phosphatic nodules, hardground, granular, pellets, shate-chert assemblages; Distribution - continental shelves, seamounts.		

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	<p>Ferromanganese deposits:- Polymetallic nodule and crusts – Hydrogenetic, diagenetic, Hydrothermal; Distribution in world oceans; Distribution in Indian Ocean; Deposits in Indian ‘Pioneer area’ Morphological & distribution characteristic. Seamount crusts and nodules – criteria for cobalt enrichment; Characteristic for Mining.</p> <p>Hydrothermal deposits:- Areas of hydrothermal activity – Mid – ocean ridges Island arcs Back arc and fore arc areas: Intrapalate volcanic centres. Types of occurrence Metalliferous muds; Encrustations; Massive types; chimneys; coatings on rocks. Minerals – sulphide, sulphate, silicates, oxide, hydroxide, carbonates. Other marine deposits:- Calcareous sand limestones, corals etc.</p>		
4	EXPLORATION TECHNIQUES	10	15
	<p>Geological:- bathymetry surveys (single & multibeam sounding), Sampling (corers grabs, dredges), Photography (TV, photo), Submersibles and remotely operated vehicles; Geophysical:- magnetic, gravity, seismic; Remote sensing; Geochemical and biogeochemical; Geotechnical; Drilling; Navigation and position fixing.</p>		
5	MINING METHOD	10	15
	<p>Principles of mining methods. Components and subsystems :- Floating (support) platform; Bottom crawler mechanism; Lift mechanism; Transportation to shore; Power generation; Controls and data transmission. Different types of mining. Systems:- Opencast Mining; Dredging – Clamshell, bucket ladder, hopper. Hydraulic; Continuous line bucket; Air- lift; Hydraulic lift, Autonomous vehicles</p>		
6	ECONOMICS CONSIDERATIONS OF OCEAN MINING	6	9
	<p>Land versus marine deposits; Global mineral demands; Global metal prices; Potential of marine minerals; Techno- economics feasibility</p>		
7	IMPACTS OF OCEAN MINING	4	7
	<p>Social impacts; Economic impacts; Environmental impacts; Legal considerations</p>		
	Total	48	75

3. LIST OF REFERENCE BOOKS

1. Ocean Floor Mining by J.S. Pearson, Noyes data Corporation (1975) pp . 201.
2. Marine Mining of the continental shelf by M. Baram. W. Lee D. Rice pp. 301.
3. Marine mineral exploration by H. Kunzendorf, Elsevier Pub. Pp. 300
4. Mining the oceans by T.K.S. Murthy, PID – CSIR, pp 98.

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(MN614) MINE PLANNING & DESIGN

1 Rationale: Mining diploma holders are generally engaged either for assisting in mine planning or for execution of the works as per planning done. For this he should be able to understand the basic criteria, input and processes involved in Mine Planning & Design. This course aims at developing the knowledge and competency in assessment of data encompassed in the plans and design.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN614	L	T	P	C	TH	TM	TW	PR/OR	
Mine Planning & Design	3	1	-	4	75	25	-	-	100

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENTS	HOURS	MARKS
1	DEVELOPMENT PLANNING	11	17
	Planning: Definition, objectives, Types of planning, frequency of planning, factors considered, planning teams, Assessing mineralisation characteristics of the deposits, Fixing of mine boundaries. Divisions of based area into blocks., Selection of site for initial mine cut, location of surface structures, selection of site for overburden dumps and ore stocks, ore access. Drainage and pumping arrangement. Design of bench parameters, Determining ultimate pit limits. Pit expansion process, calculation of overall pit slopes, stripping ratio calculations.		
2	PRODUCTION PLANNING	11	17
	Objectives of production planning, principles of planning, estimation of mine life, Taylor's mine life rule, cash flow calculations. Material destination, plant size, technical documentation required, cut off grade,		

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	grade tonnage curve, open-pit optimisation techniques for mine geometry and output, production scheduling, marketing study, application of PERT & CPM in Mine Planning/Production Planning.		
3	HAUL ROAD DESIGN	6	10
	Various haul road layouts — number and location, geometry of haul road, construction material used in haul road and layers of haul road, design of spiral road and design of switch back road, Layout for railway, conveyor & aerial ropeway		
4	EQUIPMENT PLANNING	12	19
	Selection and planning (includes size) of equipment for various mining conditions - drilling equipment, excavating machines (wheel loaders, shovels, draglines and bucket wheel excavators) & transporting equipments (dumpers & belt conveyors). Designing mine layouts with necessary equipments based on annual production and site factors. Equipment information: Various techniques in maintenance management, expert system and management information system.		
5	PROJECT IMPLEMENTATION & MONITORING	8	12
	Pre-project activities, feasibility report and detailed project report, sources of funds. import of technology, selection of contracts, ore reserve analysis, man power planning, environment impact assessment and preparation of environment management plan		
	TOTAL	48	75

4. LIST OF REFERENCES

1. Mine Planning – S P Mathur
2. Principles of Mine Planning – Jayantha Bhattachrya
3. Surface Mining – G B Mishra
4. Opencast Mining – S K Das
5. SME Mining Engineering Handbook – Howard L Hartman

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(MN615) MINE SYSTEMS ENGINEERING

1. TEACHING & EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN615	L	T	P	C	TH	TM	TW	PR/OR	
Mine Systems Engineering	3	1	-	4	75	25	-	-	100

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

2. DETAILED COURSE CONTENT

	CONTENTS	HOURS	MARKS
1	Introduction to systems engineering	6	9
	Concept of system, sub-system and system environment; Classification of systems; Systems analysis; Creative aspects of planning and design; Factors influencing creativity, techniques and alternative ideas/solutions		
2	Linear Programming	12	18
	Linear Programming models; Assumption of linear programming, Graphical and Simple method of solving Linear Programming Problems; Basic and Basic feasible solution, optimal solution, interpretation of SIMPLEX table. Primal and Dual Problem. Application of Linear Programming for solution of mining related problems of production planning, scheduling and blending		
3	Transportation and Assignment Problem	10	16
	Transportation models, Variations on Classical Transportation models, Solution. Algorithm for Transportation problem. Assignment model, Variations on Classical Assignment model; solution algorithm for Assignment problems. Application to mining problems		
4	Project Management with PERT & CPM:	12	20
	Assumption of PERT and CPM; Methods of drawing network; Redundancy		

	and identification of redundant jobs; Critical path calculation, Criticality index; Statistics related to PERT; Probability of completing a project by a due date, Lowest cost schedule: Case studies.		
5	Network Models & Inventory Management	8	12
	Network Models: Introduction and concept; shortest route and minimal spanial tree problems, application to mining problems, Simulation: Introduction and concept; Inventory management: Introduction, components and nature of inventory problems, Classical E.O.Q model; EOQ model with quantity discount;		
	Total	48	75

3. LIST OF REFERENCES

1. Sharma J.K. Mathematical Models in Operations Research. Tata Mcgraw-Hill, New Delhi, 1989.
2. Cummins . Mining Engineers Handbook, Vol. II SME, AIME, New York

(MN621) MINE ENVIRONMENT POLLUTION AND CONTROL

- Rationale:** Due to the increased demand for raw materials, the mining activity is required to progressively increase. However mining is associated with various environmental impacts which hinders in progress. The need is more stress on sustainable development. The diploma holder in mining engineering should be able to execute the mining activities with environmental consciousness. He should be competent to measure and mitigate pollution.

2. TEACHING & EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN621	L	T	P	C	TH	TM	TW	PR/OR	
Mine Environment Pollution & Control	2	-	2	4	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENTS	HOURS	MARKS
1	AIR POLLUTION & NOISE POLLUTION	6	15
	<p>Air pollution;-definition, air pollutant, air pollutant in mining, Causes of air pollution in mines, effects of air pollution, Measurement of air quality & related instrumentation (like HVS, etc. monitoring procedure ,control measures, permissible limits, air quality management, air quality index, occupational hazards due to air pollutants. Salient features of the Air Act — 1987.</p> <p>Noise pollution;-definition, , properties of noise (i.e. loudness & frequency), Sources of noise in mines, effects of noise, monitoring of noise and instrumentation, noise sampling, standards of noise, control of noise, noise management, occupational hazards related to noise, noise level survey, Salient features of The Noise Pollution (Regulation and Control) (Amendment) Rules, 2010.</p>		

2	WATER POLLUTION & CONTROL	6	15
	Definition, water pollutant in mining, types of water pollution from mining, Causes of water pollution in mines. Impact of water pollution from mining, Methods of water quality monitoring and related instrumentation. Water quality index, mine water treatment methods, Water management in mines. use of mine water, Introduction to acid mine drainage. General standard for discharge of effluent Main provisions of The Water Cess Act – 1980, The water (prevention and control of pollution) Act 1974		
3	SOLID WASTE MANAGEMENT IN MINES AND GROUND VIBRATION	4	9
	Definition of solid waste, characteristics of mine solid waste, sources of solid waste in mines, effects of mine solid waste, solid waste management's in mines, use of mine solid waste Ground vibration;- definition, Parameters influencing propagation and intensity of ground vibrations ,causes, prediction ,effects, standards, control methods, monitoring of ground vibrations (Blast induced ground and due to moment of HEMM).		
4	ENVIRONMENTAL PLANNING ,EMS & EIA	8	18
	Environmental planning;- definition, aim and objective, need, elements, procedures, Guiding Principles for Environmental Planning . Tools for Environmental Planning environmental planning team, types of permits & approvals required for mining projects, Environmental management plan, mine closer plan.. Environmental Impact Assessment, definition, aim and objective, need, process, EIA methodology, stages, financial aspects, levels of assessment, Elements of EIA documents. Generic Structure of EIA Report, Benefits of EIA, EIA guidance for Mining of Minerals Environmental Auditing:- Definition, reasons for conducting environmental auditing, scope, types of audits, procedure, outcomes of environmental audits. Benefits of audit, EMS: Definition, need, elements, planning, implementation and operation, ISO 14001;-definition, structure, key requirements, elements ,certification process,		
5	ENVIRONMENTAL ACT,RULE REGULATION	8	18
	Brief of Environment Clearance & Mining Projects, Requirements and Procedure for seeking Environmental Clearance of Projects, the procedure for obtaining environmental clearance in the case of mining projects;information for environmental site clearance of mineral exploration project. procedure for obtaining forest clearance under forest conservation act , Forest Clearance process of mining project, Diversion of forest land and Compensatory Afforestation, main provisions of Environment (protection)Act 1986, ,Hazardous Wastes (Management and Handling) Rules, 1989,The Forest (Conservation) Act, 1980, ,The		

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	Wildlife Protection Act, 1972,		
		TOTAL	32
			75

4. LIST OF PRACTICALS: (Atleast 8)

1. Determination of PH for a given water sample.
2. Determination of Solids for a given water sample.
3. Determination of Turbidity for given water sample.
4. Determination of Oil and Grease for given water sample.
5. Determination of DO for given water sample.
6. Determination of BOD for given water sample.
7. Determination of COD for given water sample.
8. Determination of Heavy Metal for given water sample.
9. Determination of Hardness for given water sample.
10. Measurement of SPM in air.
11. Measurement of Noise at site.
12. Measurement of Ground vibration at site
13. Study of solid waste management in mines.
14. Study of Mine water and Processing water treatment system.
15. Study of land reclamation / Post mining land use
16. EIA study.

5. LIST OF REFERENCE BOOKS:

1. Ecology & Environment by Or. P. D. Sharma.
2. Best Practice Environment by Environment Protection Agency Management in Mines.
3. Open pit mine planning & Design by W. Hustrulid.
4. Mining Environment & Forests by R. K. Suri.
5. Mining Environment by Dr. B. B. Dhar.
6. The Environment (Protection) Act - 1986.
7. The Air Act - 1981; The Wildlife Act - 1972.
8. The Forest Act - 1980; The Forests Rules - 1981.
9. Environmental Effects of Mining by Earle A. Ripley.
10. Disposal of Solid Waste in Indian Mines, IBM/IC/02 of 1994.

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(MN622) ADVANCED MINING

- Rationale:** There are lot of improvements in the methods of mining as well as the deployment of technologies. This subject gives the latest developments which are gaining ground and shall make them prepared with the principles for future.

2. TEACHING & EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN622	L	T	P	C	TH	TM	TW	PR/OR	
Advanced Mining	2	-	2	4	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENT

	CONTENTS	HOURS	MARKS
1.	Mechanical Extractions:- Definition, methods, Open Cast Mining:- Definition Suitability conditions Development cyclic operations, Advantages, Disadvantages, Quarry: - Definition, Sequence of development cyclic operations Auxiliary operations, advantages and disadvantages. Auger Mining:- Description, suitability, Sequence of development, characteristic, advantages and disadvantages Highwall Mining: Introduction, Applicability and Method	6	14
2	Aqueous Extraction Methods:- definitions, classifications, Hydraulicking :- definitions suitability conditions, Sequence of development, advantages and disadvantages, Dredging: - definitions, types of dredging, sequence of development, advantages and disadvantages. Solution Mining: - definition, borehole extraction, Borehole Extraction, cycle of operation, advantages and disadvantages. Leaching Methods:- definition, sequence of development, conditions, characteristics , advantages and disadvantages,	6	14
3	Rapid Excavation: Introduction, mechanical Rock, Rapid excavation,	8	19

	<p>systems- Horizontal and sub horizontal mine development, Automation and Robotics: - Purpose, methods, advantages and disadvantages Horizon mining: Definition, suitability condition, methods & layouts Hydraulic Mining of Coal: Conditions suitable for hydraulic Mining of Coal, Hydraulic Mining Operation, Hydraulic breaking of coal, hydraulic transport and hydro hoisting; Layout of workings for hydraulic mining of moderately thick seams. Mining of thin seams: Problems in Mining thin seams; Equipment and methods for thin seam extraction.</p>		
4	<p>Underground Coal Gasification: Conditions suitable for Underground Coal Gasification; Basic processes and technology of underground coal gasification, Methods using underground excavations – vertical and directional drilling boreholes from surface. Linkages and innovations Advantage and disadvantage of UCG: Scope of application of UCG in Indian conditions.</p> <p>Methane Drainage: Concept, Problems of methane, Methane drainage technology during mining, Methane drainage technology- vertical boreholes, Gob ventilation boreholes, Directional drilling,</p>	6	14
5	<p>Marine Mining</p>	6	14
	<p>Marine Mining Environment – Natural system, Mineral resources, artificial system, environmental hazards & constraints</p> <p>Principles of mining methods. Components and subsystems :- Floating (support) platform; Bottom crawler mechanism; Lift mechanism; Transportation to shore; Power generation; Controls and data transmission. Different types of mining. Systems:- Opencast Mining; Dredging – Clamshell, bucket ladder, hopper. Hydraulic; Continuous line bucket; Air- lift; Hydraulic lift, Autonomous vehicles, Case studies</p>		
	Total	32	75

4. LIST OF PRACTICALS (Any 6)

1. Determination of Dredger production
2. Calculation of face advance by TBM/ Road Header
3. Production calculations of Continuous Miner
4. Study of Mine layout of Horizon Mining
5. Study of Layout of Hydraulic Mining
6. Study of linkages in Underground gasification
7. Study of Environmental Impact due to marine mining
8. Sketching of marine mining methods

5. LIST OF REFERENCES

1. Introductory Mining Engineering – Howard L Hartman & Jan M Mutmanský
2. Wining and working, volume-ii, -R.T.deshmukh & D.J.Deshmukh
3. SME Mining Engineering – Howard L Hartman
4. R.D. Singh, Principles and Practices of Modern Coal Mining, New Age International, 1997.
5. S.K. Das, Modern Coal Mining Technology, Lovely Prakashan Publishers, 1994,
6. J.G.Singh, Underground Coal Mining Methods, Braj Kalpa Publishers, Varnasi, 2000

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(MN623) MINE DISASTERS RESCUE & RECOVERY

- Rationale;** The environmental hazards are first required to be understood for taking corrective action. This course aims at providing knowledge of be various environmental hazards, its assessment and preventive measures. It provides the skills for keeping the environment hazard-free. At the end of this course the student will be able to identify the type of mine disaster and take prompt measures for the safety of mine workers.

2. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
					Theory Marks		Practical Marks		
MN623	L	T	P	C	TH	TM	TW	PR/OR	
Mine Disasters Rescue & Recovery	2	-	2	4	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

3. DETAILED COURSE CONTENTS

	CONTENTS	HOURS	MARKS
1	MINE FIRES	6	14
	Surface fires and underground fires, their causes, common combustible materials and sources of ignition in mines. Spontaneous heating: - Theories of spontaneous heating, factors affecting stages in spontaneous heating, crossing point temperature. Crossing point apparatus, crossing point temperature, detection of spontaneous heating, Graham's index elementary knowledge of gas chromatography, prevention of spontaneous heating. Classes of fire extinguishers. Methods of fire fighting prevention of mine fires, localisation, and ventilation control in fire fighting; CMR REG. 116 (A), 117,118, 118 (A), 119 , 122, 128		
2	FIRE DAMP EXPLOSION	3	7
	Introduction to mine explosion, gassyness of mine, mechanism of fire		

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	damp explosion, limits of flammability, causes of fire damp explosion, control of F-D emission, measures for prevention and localisation.		
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3	COAL DUST EXPLOSION	5	13
	Mechanism of coal dust explosion, explosibility of coal dust, Godbert – Greenwald apparatus, factors affecting development of coal dust explosions, coke crust and soot deposits, causes of coal dust explosions, sources of coal dust, measures to control formation and dissemination of coal dust, measures against ignition, measures against explosion, propagation; characteristics of stone dust, stone dusting plan, stone dust barriers, water barriers, quick barrier, triggered barrier. Maintenance & care of stone dust barrier, explosion stoppings & salt zones. Localisation of coal dust explosion.		
4	INUNDATION	4	9
	Causes of Inundation, Measures against Inundation- surface & underground measures, water dams, Bulk head doors. Water logged areas pattern of bore holes, Dewatering, precautions while approaching water logged areas, safety boring apertures, CMR REG- 126, 127,129		
5	MINE LIGHTING	3	7
	Technical terms in mine lighting, measurement of illumination, Mine regulations on standard of lighting, underground electric lights. Miners cap Lamp unit, Detail study on Lead-acid battery, cap lamp room. CMR REG: -151,152,153,154,156,148.		
6	MINE RESCUE	4	9
	Introduction to human respiratory system, various types of rescue apparatus, detail study of proto apparatus procedure of its use, care and maintenance. Gas mask, self-rescuer, Reviving appt. Rescue Organisation - rescue station, rescue organisation at mines, staff and equipment in rescue station, rescue & recovery work. Fresh-air base, elementary knowledge on use of infra red images in rescue work. CMR REG: - 120, 125. Regulation on rescue station, rescue room, duties & responsibilities of superintendent, organisation & equipment in mine, conduct of rescue work.		
7	REOPENING SEALED OFF AREAS	3	7
	Sampling of air behind stopping, interpretation analysis of gas samples, cowards diagram preparatory measures for reopening, Methods of reopening.		

8	DUST AND NOISE PROBLEMS IN MINES	4	9
	Dust hazard in mines, Pneumokonosis, silicosis, asbestosis, Manganese poisoning etc. Pysiological properties of dust, Dust sampling methods and instruments — Gravimetric dust samplers, konimeter, Midget impinger, Thermal precipitation and suppression of dust. CMR - 123, 123(A), 123(B)		
	TOTAL	32	75

4. LIST OF PRACTICALS: (Any Ten)

1. Study and handling of different types of fire extinguishers.
2. Sketching different types of fire stoppings.
3. Sketching stone dust barriers and water barriers.
4. Demonstration on burnside safety boring apparatus.
5. Sketching waterdams and bulk head door.
6. Studying layout of a cap lamp room.
7. Opening and studying lead acid lamp.
8. Study of gas mask
9. Study of proto apparatus.
10. Study of layout of a rescue station.
11. A short course on first aid.
12. Visit to local fire station to acquaint with fire fighting facilities.

5. LIST OF REFERENCE BOOKS:

1. Mine Disasters & Rescue by M.A. Ramalu
2. Elements of Mining Tech. by D. J. Deshmukh
3. Mine Fires by L.C. Kaku
4. Mine Ventilation by G. B. Mishra
5. Mine Fires by S. C. Benerjee.
6. U.M.S. Series.
7. The Coal Mine Regulation — 1957 by L. C. Kaku

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(MN624) COMPUTER APPLICATIONS IN MINING

1. TEACHING AND EXAMINATION SCHEME

Course code & Course Title	Periods/ week (in Hours)			Total Credits	Examination Scheme				Total Marks
	L	T	P		Theory Marks		Practical Marks		
MN624	L	T	P	C	TH	TM	TW	PR/OR	
Computer Applications In Mining	2	-	2	4	75	25	25	-	125

Minimum passing %: Theory 40%

Duration of Theory Paper: 3 Hours

Legends:

L- Lecture; T- Tutorial; P- Practical; C-Credit; TH- End semester Theory; TM- Test Marks; PR/OR – End semester Practical/ Oral Examinations; TW- Term Work

2. DETAILED COURSE CONTENTS

	CONTENTS	HOURS	MARKS
1	INTRODUCTION TO COMPUTERS	5	12
	Introduction to microprocessors — overview of input, output and memory devices —interfacing concepts. Evolution of operating systems functions, characteristics.		
2	SOFTWARE	9	21
	Applications of structured and object oriented programming languages to mining problems. Development of algorithms and flowcharts for mine design problems like pillar design, blast design, subsidence etc., Softwares used in Mining		
3	DATABASE MANAGEMENT SYSTEMS	7	16
	Introduction to basic database concepts, operational data, data independence, database architecture, distributed database, relational approach, mining applications		
4	PROBLEM SOLVING — APPLICATION IN MINING	7	17
	Ventilation Network analysis. On-line and off-line monitoring and control. MINOS, FIDOS, CAD in mining-opencast and underground mines like Krigging, orebody modelling, pit optimisation, mine scheduling, TDS etc Management Information systems. Digitisation of		

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	mine maps.		
5	MODERN TRENDS	4	9
	Computer graphics, Multimedia, Artificial Intelligence, Neural Networks, Robotics, and Virtual Reality.		
	TOTAL	32	75

3. LIST OF PRACTICALS:

1. Flow-charts and symbols for mining applications.
2. Computer aided design of Mine Pillars
3. Subsidence Modelling
4. Pit slope Blasting
5. Mine Ventilation network Analysis
6. Database systems and analysis
7. Digitisation of mine plans
8. Orebody modelling.
9. Digital Terrain modelling and wireframe modelling.
10. Mine Modelling.
11. Pit Optimisation.

4. LIST OF REFERENCES BOOKS:

1. Computer Application in Mineral Industry by Fytas K & R. K. Singhal
2. Computers in Mineral Industry by Ramani.
3. Application of Computers and Operation Research in the Mineral Industry by Elbrond