Centurion University of Technology and Management Odisha

Choice Based Credit System

Structure & Syllabus

CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT

School of Engineering & Technology

2022

Course Structure
Basket – IV
Mining Engineering

Course Code	Course Title	Credits	Course Type T-P-PJ
CUTM1058	Programming in Java	3	2-1-0
CUTM1059	Database Management System	3	2-1-0
CUTM1062	Theories of Failure Analysis using Finite element Analysis	4	2-2-0
CUTM1908	Computer Aided Drafting	3	0-2-1
CUTM1910	Mine Surveying	2	2-0-0
CUTM1105	Geology for Mining Engineers	4	2-2-0
CUTM1107	Mine Environment and Hazards	3	2-1-0
CUTM1116	Mine Ventilation	3	2-1-0
CUTM1111	Drilling and Blasting	3	2-0-1
CUTM1109	Surface Mining	3	2-0-1
CUTM1106	Rock Mechanics	3	2-1-0
CUTM1108	Underground Coal Mining	3	2-0-1
CUTM1110	Underground Metal Mining	3	2-0-1
CUTM1113	Mine Economics	2	2-0-0
CUTM1115	Mineral Dressing	2	2-0-0
CUTM1912	Mine Electrical Technology	3	2-0-1
CUTM1114	Mine Legislation and General Safety I	3	3-0-0
CUTM1911	Mine Legislation and General Safety II	3	3-0-0
CUTM1909	Mine Management	2	2-0-0
CUTM1112	Electronics Devices and System	3	2-0-1
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Syllabus

Programming in Java

Code	Course Title	Credit	T-P-PJ
CUTM1058	Programming in Java	3	2-1-0

Objective

- This course provides an introduction to object oriented programming (OOP) using the Java programming language.
- Its main objective is to teach the basic concepts and techniques which form the object oriented programming paradigm
- Students completing the course should know:
- The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism
- Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
- How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.
- How to test, document and prepare a professional looking package for each business project using javadoc

Course Outcome

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
- Read and make elementary modifications to **Java** programs that solve real-world problems.Validate input in a **Java program**.

Course outline

Module I

Introduction: Basic Concept of Object Oriented Programming: Object & Class, Data Abstraction & Encapsulation, Inheritance, Polymorphism, Dynamic Binding and Message Communication.Evaluation of JAVA: features of JAVA. Java & Internet.

Assignment 1: Explain Basic Concept of Object Oriented Programming ?

MODULE II (5 HRS)

Java Environment: JDK, JRE, JAVA Programming Structure, Implementing a JAVA Program. JVM, Constant Variable and Data type,

Command Line Argument.
Type Casting, Operator and Expression, Operator Precedence & Associatively.
Decision making and Branching,
Looping (While, do while, for).
Assignment 2: Explain JDK JRE and JVM ?
Practice:
1. Program using Command Line Argument
2. Programming with looping & Control structure

MODULE III (5 HRS)
Classes and Object: Defining a class, Creating Object, Constructor, Method Overloading, Static Members, Inheritance, Method Overriding, Final Variable, final methods and Final Class, Garbage Collection & finalize () method.
Assignment 3: Explain Method Overloading Vs Method Overriding ?
Practice:
Programming with class and Object
Programming with Inheritance

MODULE IV (2 HRS)
Abstract Method and Class, Visibility Control. Array, String, Vectors, Wrapper classes.
Assignment 4: Explain Abstract Method and Class ?

MODULE V (5 HRS)
Interfaces: Defining Interfaces, Extending Interfaces, Implementing Interfaces,

Packages: Creating & Accessing Packages.Exception Handling (try, catch, throw, throws, finally**)**
Assignment 5: Explain for Creating & Accessing Packages ?
Practice:
5. Programming with Package
6. Programming with Intefaces
7. Programming with Exception Handling

MODULE VI (3 HRS)
Multithreading: Creating Threads, Thread Life Cycle,
Thread Priorities, Synchronization, Inter Thread Communication

Assignment 6: Explain Thread Life Cycle ?
Practice:
8. Programming with Thread

MODULE VII (5 HRS)

Applet Programming: Applet Life Cycle**,**
Write & Running Applet Program. Managing Input and Output file: Stream classes,

Byte Stream Classes & Character Stream Classes, Reading & Writing Files.
Assignment 7: Explain Applet Life Cycle **?**
Practice:
9. Programming with Applet concept
10. Programming with the concept of File

Text Book:
1. Programming with JAVA by E. Balagurusamy Tata McGraw - Hill Education
2. Core Java for Beginers, Rashmi Kanta Das, 3rd Edition Vikas Publishing House Pvt Ltd.
Reference Book:
1. Java complete Reference, Herbert Schildt
2. Big Java: Horstman, Willey India, 2nd Edition.
3. Java How to Program: H.M. Deitel & Paul J. Deitel, PHI, 8th Edition

Database Management Systems

Code	Course Title	Credit	T-P-PJ
CUTM1059	Database Management Systems	3	2-1-0

Objective

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database Modeling,relational,hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential Peoperties of DBMS concepts such as: database security,integrity, concurrency
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Outcome

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model,relational database design, relational algebra and SQL
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data
- Improve the database design by normalization
- Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing

Course content

Module-1: **DBMS Concepts [5 Hrs]**
Data Abstraction - Data models and data independence. Instances and Schemas. Components of a DBMS and overall structure of a DBMS- Life Cycle of a DBMS application- Database terminology.

Module-2: Data Modeling [5Hrs]
Basic concepts- Types of data models- Conceptual, physical and logical database models- E-R data model and Object-oriented data model. Components of ER Model- ER Modeling symbols. Entity and entity sets- Relations and relationship sets- E-R Diagrams- Reducing E-R Diagrams into tables.

Practice
Assume we have the following application that models soccer teams, the games they play, and the
players in each team. In the design, we want to capture the following:
• We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.
• Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.
• Teams play matches, in each match there is a host team and a guest team. The match takes place
in the stadium of the host team.
• For each match we need to keep track of the following:
• The date on which the game is played
• The final result of the match
• The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.
• During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.
• Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.
Design an ER diagram to capture the above requirements. State any assumptions you have that affects your design (use the back of the page if needed). Make sure cardinalities and primary keys are clear.

Module-3: Relational DBMS Model [5 Hrs]
Basic concepts, Attributes and domains- Intention and extensions of a relation- concept of integrity and referential constraints- Relational Query Languages (Relational algebra and relational calculus (Tuple and domain relational calculus).

Module-4: Relational Database Design [6 Hrs]
Notion of normalized relations- Normalization using Functional Dependency- First Normal form- Second Normal Form- Third Normal form- BCNF.

Practice
Perform NF on the given table

CLICK HERE FOR TABLE

Module-5: SQL [6 Hrs]
Structure of a SQL query- DDL and DML, TCL- SQL queries and sub queries- Tables, views and indexes.

Practice
To study DDL-create and DML-insert commands.

(i) Create tables according to the following definition.

CREATE TABLE DEPOSIT (ACTNO VARCHAR2(5) ,CNAME VARCHAR2(18) , BNAME VARCHAR2(18) , AMOUNT NUMBER(8,2) ,ADATE DATE);
CREATE TABLE BRANCH(BNAME VARCHAR2(18),CITY VARCHAR2(18)); CREATE TABLE CUSTOMERS(CNAME VARCHAR2(19) ,CITY VARCHAR2(18));
CREATE TABLE BORROW(LOANNO VARCHAR2(5), CNAME VARCHAR2(18), BNAME VARCHAR2(18), AMOUNT NUMBER (8,2));
(ii) Insert the data as shown below.

DEPOSIT
CLICK HERE FOR TABLE
BRANCH
CLICK HERE FOR TABLE
CUSTOMERS
CLICK HERE FOR TABLE
BORROW
CLICK HERE FOR TABLE
(1) Describe deposit, branch.
(2) Describe borrow, customers.
(3) List all data from table DEPOSIT.
(4) List all data from table BORROW.
(5) List all data from table CUSTOMERS.
(6) List all data from table BRANCH.
(7) Give account no and amount of depositors.
(8) Give name of depositors having amount greater than 4000.
(9) Give name of customers who opened account after date '1-12-96'.

Module-6:Aggregate functions [4 Hrs]
Set Operations, predicates and joins, Set Membership- Tuple variables- Set comparison- Database modifications using SQL.

Practice
Create the below given table and insert the data accordingly.

Create Table Job (job_id, job_title, min_sal, max_sal)

COLUMN NAME DATA TYPE
job_id Varchar2(15)
job_title Varchar2(30)
min_sal Number(7,2)
max_sal Number(7,2)
Create table Employee (emp_no, emp_name, emp_sal, emp_comm, dept_no)

COLUMN NAME DATA TYPE
emp_no Number(3)
emp_name Varchar2(30)
emp_sal Number(8,2)
emp_comm Number(6,1)
dept_no Number(3)
Create table deposit(a_no,cname,bname,amount,a_date).

COLUMN NAME DATA TYPE
a_no Varchar2(5)
cname Varchar2(15)
bname Varchar2(10)
amount Number(7,2)
a_date Date

Create table borrow(loanno,cname,bname,amount).

COLUMN NAME DATA TYPE
loanno Varchar2(5)
cname Varchar2(15)
bname Varchar2(10)
amount Varchar2(7,2)

Insert following values in the table Employee.

emp_n emp_name emp_sal emp_comm dept _no
101 Smith 800 20
102 Snehal 1600 300 25
103 Adama 1100 0 20
104 Aman 3000 15
105 Anita 5000 50,000 10
106 Sneha 2450 24,500 10
107 Anamika 2975 30
Insert following values in the table job.

CLICK HERE FOR TABLE
Insert following values in the table deposit.
CLICK HERE FOR TABLE
Perform following queries
(1) Retrieve all data from employee, jobs and deposit.
(2) Give details of account no. and deposited rupees of customers having account opened between dates 01-01-06 and 25-07-06.

(3) Display all jobs with minimum salary is greater than 4000.
(4) Display name and salary of employee whose department no is 20. Give alias name to name of employee.
(5) Display employee no,name and department details of those employee whose department lies in(10,20)
To study various options of LIKE predicate
(1) Display all employee whose name start with 'A' and third character is ' 'a'.

(2) Display name, number and salary of those employees whose name is 5 characters long and first three characters are 'Ani'.
(3) Display the non-null values of employees and also employee name second character should be 'n' and string should be 5 character long.

(4) Display the null values of employee and also employee name's third character should be 'a'.
(5) What will be output if you are giving LIKE predicate as '%_%' ESCAPE '\'

To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.
(1) List total deposit from deposit.
(2) List total loan from karolbagh branch
(3) Give maximum loan from branch vrce.
(4) Count total number of customers
(5) Count total number of customer's cities.
(6) Create table supplier from employee with all the columns.
(7) Create table sup1 from employee with first two columns.
(8) Create table sup2 from employee with no data
(9) Insert the data into sup2 from employee whose second character should be 'n' and string should be 5 characters long in employee name field.

(10) Delete all the rows from sup1.
(11) Delete the detail of supplier whose sup_no is 103.
(12) Rename the table sup2.
(13) Destroy table sup1 with all the data.
(14) Update the value dept_no to 10 where second character of emp. name is 'm'.
(15) Update the value of employee name whose employee number is 103.

To study Single-row functions.

(1) Write a query to display the current date. Label the column Date

(2) For each employee, display the employee number, job, salary, and salary increased by 15% and expressed as a whole number. Label the column New Salary
(3) Modify your query no 4.(2) to add a column that subtracts the old salary from the new salary. Label the column Increase
(4) Write a query that displays the employee's names with the first letter capitalized and all other letters lowercase, and the length of the names, for all employees whose name starts with J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.
(5) Write a query that produces the following for each employee:
earns monthly

(6) Display the name, hire date, number of months employed and day of the week on which the employee has started. Order the results by the day of the week starting with Monday.
(7) Display the hiredate of emp in a format that appears as Seventh of June 1994 12:00:00 AM.
(8) Write a query to calculate the annual compensation of all employees (sal+comm.).

Displaying data from Multiple Tables (join)

(1) Give details of customers ANIL.
(2) Give name of customer who are borrowers and depositors and having living city nagpur
(3) Give city as their city name of customers having same living branch.
(4) Write a query to display the last name, department number, and department name for all employees.
(5) Create a unique listing of all jobs that are in department 30. Include the location of the department in the output
(6) Write a query to display the employee name, department number, and department name for all employees who work in NEW YORK.
(7) Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, respectively.
(8) Create a query to display the name and hire date of any employee hired after employee SCOTT.

Module-7: Transaction Management [8 Hrs]
Subqueries,Manupulating Data,Transaction management and Concurrency control
Practice
To apply the concept of Aggregating Data using Group functions.

(1) List total deposit of customer having account date after 1-jan-96.
(2) List total deposit of customers living in city Nagpur.
(3) List maximum deposit of customers living in bombay.
(4) Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number.
(5) Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE.
(6) Create a query that will display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998
(7) Find the average salaries for each department without displaying the respective department numbers.
(8) Write a query to display the total salary being paid to each job title, within each department.
(9) Find the average salaries > 2000 for each department without displaying the respective department numbers.
(10) Display the job and total salary for each job with a total salary amount exceeding 3000, in which excludes president and sorts the list by the total salary.

(11) List the branches having sum of deposit more than 5000 and located in city bombay.

To solve queries using the concept of sub query.

(1) Write a query to display the last name and hire date of any employee in the same department as SCOTT. Exclude SCOTT
(2) Give name of customers who are depositors having same branch city of mr. sunil.
(3) Give deposit details and loan details of customer in same city where pramod is living.
(4) Create a query to display the employee numbers and last names of all employees who earn more than the average salary. Sort the results in ascending order of salary.
(5) Give names of depositors having same living city as mr. anil and having deposit amount greater than 2000
(6) Display the last name and salary of every employee who reports to ford.
(7) Display the department number, name, and job for every employee in the Accounting department.
(8) List the name of branch having highest number of depositors.
(9) Give the name of cities where in which the maximum numbers of branches are located.
(10) Give name of customers living in same city where maximum depositors are located.

Manipulating Data

(1) Give 10% interest to all depositors.
(2) Give 10% interest to all depositors having branch vrce
(3) Give 10% interest to all depositors living in n
agpur and having branch city bombay.
(4) Write a query which changes the department number of all employees with empno 7788's job to employee 7844'current department number.
(5) Transfer 10 Rs from account of anil to sunil if both are having same branch.
(6) Give 100 Rs more to all depositors if they are maximum depositors in their respective branch.
(7) Delete depositors of branches having number of customers between 1 to 3.
(8) Delete deposit of vijay.
(9) Delete borrower of branches having average loan less than 1000.

To apply the concept of security and privileges.

To study Transaction control commands

VIRTUAL LAB

TEXT BOOKS

Database Management Systems: Raghu Ramakrishnan
ORACLE PL/SQL Programming – Scott Urman BPB Publications.

REFERENCES

Database Systems Concepts – Henry F Korth, Abraham Silberschatz.
Database Management Systems – Alexis Leon, Mathews Leon – Leon, Vikas Publications

Theories of Failure Analysis using FEA

Code	Course Title	Credit	T-P-PJ
CUTM1062	Theories of Failure Analysis using FEA	4	2-2-0

Objective

- To educate the students on basic theories behind mechanics of solids.
- To educate the students on Finite Element Analysis concept applicable to Practical conditions.
- To educate the students on Failure Criterion which will be useful for designing Practical problems.
- To educate the students on using 3D Experience Tools for analysis of various mechanical structures and load transmitting elements.

Course Outcome

- Students will have knowledge and practical engineering skills in analysis of mechanical strength of structures and load transmission elements and will be able to design them based on input data.
- Students will be able to deploy 3D Experience Platform to develop design solutions.
- Students will be able to apply the Concept of Meshing and Failure Criteria to Practical Problems which will lead Economical and safe in Design Aspect.

Course outline

Module I Introduction to Finite Element Analysis (FEA) and 3D Experience Platform - (4(T)+5(P)) –(9 Hours)

Introduction to FEA: Need for Studying FEA; Types of Analysis; Discretization of a Structure; Element Shapes, Nodes and Degrees of Freedom; Mesh Refining, Element Aspect Ratio, Use of Symmetry, Principle of Convergence; General Procedure of FEA.

Material failure Behaviour: Stress–Strain Diagrams for Ductile and Brittle Materials. Equivalent stresses for varying orientations, Principal stresses, maximum shear stress, Mohr's circles.

Practice:

1. Introduction to 3D Experience Platform: About the Apps and their Applications from

Engineering Point of View.

2. Analysis of Steel Bridge – Simulation using 3D Experience Tool.

3. Tensile Test using Simulation 3D Experience Tool.

4. Stress Strain Curve of a Ductile Material (Mild Steel) using Universal Testing Machine

Module II Mesh Generation and Modeling of Truss Structure (1(T)+ 4(P) - (5 Hours) Mesh Generation and Methods of Meshing and Types of Meshing. Procedure for selecting the method of meshing and type of meshing. Importance and application of Stiffness Matrix for different types of elements and the procedure for getting the results.

Practice:

5. 3D Experience Simulia – Modelling and Meshing of Transmission line tower.

Module III Stresses and Deflection Criteria: (5(T)+ 4(P) - (9 Hours) Procedure for Drawing Shear Force and Bending Moment Diagrams, Point of Contra Flexure. **Stresses (No Derivation):** Simple or Pure Bending, Flexure Formula, Section Modulus, Neutral Axis, Determination of Bending Stresses, Shear Stress Distribution for Different Sections. **Deflection :** Equation of Elastic Curve, Direct Integration Method

Practice:

6. 3D Experience Simulia – Modelling and Finite Element Analysis of Framed Structure subjected Earthquake Loads.

Module IV: Theories of Failure: (2(T)+ 4(P) - (6 Hours)

Theories of Failure: Failure Under Biaxial Loading, Rankine's Theory, Guest's or Tresca's Theory, Von Mises Theory, Graphical Representation of Failure, Safety Factors, Prevention of Failure in Design Stage, Diagnosis of Failure In Post-Manufacturing Stage.

Practice:

7. 3D Experience Simulia: Bicycle Frame Structural Analysis

Module V: Torsion: (3(T)+ 4(P) - (7 Hours)

Torsion: Torsion Equation, Design of Shafts, Power Transmitted by Shafts, Composite Shafts, Combined Bending and Torsion, Closed-Coiled Helical Springs, Spring Connected in Series and Parallel.

Dynamic Analysis: Fundamentals of Vibration; Evaluation of Natural Frequencies and Mode

Shapes (Eigen values and Eigenvectors); Non-linear Analysis, Fatigue Analysis. Structures Subjected to Blast Loads.

Practice:

8. Simulation: Static and Dynamic Analysis of Shaft

Module VI Pressure Vessels (1(T) + 2(P) - (3 Hours)

Longitudinal and Hoop Stress in Thin-walled Pressure Vessels Subjected to Internal Pressure.

Practice:

9. Simulation: Crack Analysis of Thin walled Pressure Vessels.

Module VII Fatigue and Fracture: (3(T)+ 4(P) - (7 Hours)

Fatigue: Failure Under Cyclic Loading, Endurance Limit. S-N Curve, Stress Concentration, Goodman and Soderberg Criteria.

Fracture: Types of Failure, Brittle and Ductile Fracture, Basic Modes of Fracture. Griffith's Analysis, Crack Growth and Stress Intensity Factor.

10. Fatigue Analysis of Crankshaft of Two-Wheeler

Text Books:

1. Strength of Materials, S.S. Rattan, Tata Mc-Graw Hill Publication.

2. Advanced Mechanics of Materials, A.P. Boresi and R.J. Schmidt, Willey India

Reference Books:

1. Elements of Fracture mechanics, Prashant Kumar, McGraw Hill Education (India)

2. Engineering Mechanics of Solids, Egor P. Popov, Pearson publication

3. Strength of Materials, R.K.Bansal, Laxmi Publications.

Course outline Prepared by; Sudheer Choudari Date:7.6.2020

Source of reference:

1. NPTEL, Udemy, 3D Experience Tools.

2. Link1 - Edx Course

3. Link2 - Edx Course

4. Practical Introduction and Basics of Finite Element Analysis

Computer Aided Drafting

Code	Course Title	Credit	T-P-PJ
CUTM1908	Computer Aided Drafting	3	0-2-1

Objective

- How to create simple parts, assemblies and drawings.
- How to use different feature-based tools to build, review and modify a model.
- How to create and analyze assemblies and how to produce a drawing with different views.
- Learn how to dimension the drawing and annotate the views.

Course Outcome

- Students will be able to use CATIA for creation of 3D models, Assembly Designs and Drawings

Course outline

Module I: Sketcher - Creating Profiles 2 (hrs)

PLM Objects, Sketch Support, Simple elements, constraining sketches, simple and complex profiles, transforming sketches, saving documents

Practice-1 : Hands on Session on Sketcher Workbench

Module II: Part Design -Creating Basic Features 5 (hrs)

Extruded Features, revolved features, holes, threads, taps, drafts, fillets, chamfers, shelling and stiffeners, relational dimensions,

Practice-2 : Hands on Session on Sketch Based Features & Dress Up Features

Practice-3: Hands on Session on Transformation Features

Module III: Reviewing & Modifying 2 (hrs)

Measuring the model, re using the data, editing features

Practice-4: Hands on Session on Measuring Tools & Editing Features

Module IV: Finalizing Design 5 (hrs)

Adding parameters, reusing features, rendering, weight calculation,

Practice-5: Hands on Session on Parametric Design

Practice-6: Hands on Session on Rendering, Material Addition

Module V: Creating & Managing Products 6 (hrs)

Positioning Components, constraining Components, Analyzing weight distribution, replacing and revising parts

Practice-7: Hands on Session on Assembly Design

Practice-8 : Hands on Session on Digital Mock Up

Module VI: Creating Drawings 4 (hrs)

Creating Drawing, Modifying, dimensioning, Annotations, Finalizing & Printing

Practice-9 : Hands on Session on Drawing Conventions

Practice-10: Hands on Session on Creating Drawings

Module VII: Master Exercise (5 hrs)

Heat Sink , PC Card Slide

Practice-11 : Modeling of Heat Sink

Practice-12: Modeling and Assembly of PC card Slide

Text Books/ Reference Books/ Reference Material

1. Mechanical Design Fundamentals : Dassault Systemes Companion Learning Space Material

Mine Surveying

Code	Course Title	Credit	T-P-PJ
CUTM1910	Mine Surveying	2	2-0-0

Objective

- To Understand correlation and stope survey methods and know and limitations of photogrammetry and modern survey methods.
- To be Familiar with dip and strike problems and surveyor responsibility in underground

Course Outcome

- Perform surveying of mine areas with various instruments.
- Able to correlate the surveying methods.

Course outline

Module I Correlation of surface and underground survey:

State direct correlation by traversing & optical methods. Describe orientation by wires in two shafts. Explain correlation by mines in vertical shafts. State co-planning/ alignment, weissbach triangle weis-quadrilateral methods, precise magnetic correlation.

Module I Setting out curves:

State elements of curves. Define designation of curves, simple, compound & reverse curves. Explain setting out of surface & underground curves by chords & offsets, chords and angle, tangent and offset, plate layers method. Describe various setting out by chain & one theodolite, two theodolites. Define super elevation, transition and vertical curves.

Module III Stope Surveying:

Explain tape triangulation, instrumental survey.

Determine stope face.State preparation of stope planes, plotting the stope station, plotting of stope face to the mine plan. Find out area of extraction by Planimeter and calculation of triangle thereof.

Module IV

Simple problems on Dip, Fault, Strike, Borehole, Drifts**:** Solve various numerical problems related to dip, strike, fault, borehole & drifts.

RECOMMENDED BOOKS

1. Plane & Geodetic Survey – D.Clerk
2. Surveying E. Mason – Vol.I & II
3. Metalliferious Mine Surveying– F.Winniberg
4. U.M.S. Vol.-III & Extra Lesions.
5. Mineral Economics – R.K.Sinha & N.L.Sharma
6. Basics of remote sensing and G.I.S. by Dr. S.Kumar.

Geology for Mining Engineer

Code	Course Title	Credit	T-P-PJ
CUTM1105	Geology for Mining Engineer	4	2-2-0

Objective

- Mineralogy
- Structural geology
- Economic geology
- Exploration geology
- Coal and petroleum geology

Course Outcome

- Identify processes of the rock cycle and the different rock types associated with each step.
- Apply the knowledge gained in the contexts of exploration and mining geology.
- Demonstrate knowledge of the physical and chemical properties of the lithosphere.

Course outline

MODULE I

Mineralogy

Minerals: Physical and chemical properties; Crystal, crystal classes and systems; Classification of minerals

PRACTICE:

Identification of rock forming minerals in hand specimens(Part-I)

Identification of rock forming minerals in hand specimens(Part-II)

Igneous Rocks:

Magma and lava, extrusive and intrusive forms, textures; Classification of igneous rocks.

PRACTICE:

Megascopic identification of igneous rocks-granite,pegmatite,basalt,gabbro,diorite

Sedimentary rocks:

Sedimentation processes; Classification of sedimentary rocks

PRACTICE:

Megascopic identification of sedimentary rocks-
sandstone,limestone,conglomerate,breccia,bituminous coal

Metamorphic rocks:

Processes of metamorphism, textures and structures of metamorphic rocks

PRACTICE:

Megascopic identification of metamorphic rocks-
marble,gneiss,schist,quarzite,anthracite coal.

Concepts of paleontology:
Fossils, their mode of preservation and significance as indices of age and climate; Concept of index fossils.
Principles of stratigraphy:
Broad stratigraphic subdivisions and associated rock types of important ore provinces, coal belts and oil fields of India.
MODULE II
Structural geology
Unconformities, folds, faults and joints - their nomenclature, classification and recognition. Effects of folds and fractures on strata/orebodies and their importance in mining operations. Forms of igneous intrusions - dyke, sill and batholith.
PRACTICE:
Determination of Dip and Strike of bed using Bruton or Clino Compass
MODULE III
Introduction and scope of economic geology
Ore and gangue; Processes of ore formation; Major Indian mineral deposits (Iron, Manganese, Copper, Lead, Zinc) distribution and mode of occurrence.
Mineral Exploration
Concepts and methods viz. surface and subsurface; Exploration strategy and design; Stages of exploration; Resources and reserves.
MODULE IV
Coal and Petroleum Geology
Rank, characteristics and important constituents of coal; Classification and origin of coal; Chief characteristics of Indian coals; Geology of the principal coalfields of India.
Concept of organic constituents of petroleum origin, migration, accumulation, concept of traps and important petroliferous basins of India.
REFERENCES:
Structural Geology -M.P.Billings
Economic Geology – U. Prasad
Exploration Geology – Exploration and mining geology – W.C.Peters
Coal and petroleum geology – elements of petroleum geology – R.C.Shelly and S.A.Sonnenberg
Rutley's elements of mineralogy
Petrology – Tyrrell
Textbook of paleontology – M.S. Chatwal

Mines Environment and Hazards

Code	Course Title	Credit	T-P-PJ
CUTM1107	Mines Environment and Hazards	3	2-1-0

Objectives

- Students will be able to understand the environmental factors that concerns with the mines.
- Students will have an understanding on mine Gasses
- during the mines hazards, airborne respirable dust and illumination survey.
- Evaluation System
- As per the University Norms.

Course Outcomes

- Mine fires
- Mine explosions
- Inundation
- Rescue and recovery
- Airborne respirable dust
- Ventilation

Course outline

Module I Mine air (6 hrs)

Atmospheric air composition, mine air composition and comparison, Mine gases-origin, occurrence, physiological effects, detection, monitoring and control. Methane layering, degasification of coal seams, production, assessment, physiological effects and control.

Practice:
Determination of CO, CH4, H2S, SO2, O2, CO2, Nitrous fumes by corresponding detectors.
Detection of methane by different types of methano meters & flame safety lamp.

Module II: Mine climate (6hrs)

Sources of heat in mines, effects of heat and humidity in mines, testing methods and devices: psychometry, kata thermometer, control methods or improving of cooling power of mine air: Air conditioning basic vapor cycle, representative layout.

Module III Mine Explosions (6 hrs)

Explosions: Types, mechanism, ignition temperature, lag on ignition, Causes and preventive measures of underground explosions (Fire damp and coal dust explosions) causes and preventive measures. Stone dusting, stone dust and water barriers, investigation after explosion.

Module -IV: Spontaneous Heating (6hrs)

Spontaneous heating: Mechanism, factors governing spontaneous heating, stages of spontaneous heating, symptoms of spontaneous heating in underground mines, detection and prevention of Spontaneous heating, interpretation of mine air samples, Graham's index, and problems on Graham's index. Incubation period

Practice:

Detection of different gases by Gas – Chromatograph.

Module V: Mine Inundation (6hrs)

Causes of inundation by surface and underground water by opencast and underground mines, Design and construction of Boundary barriers, Panel barriers, and Water dams.

Module VI: Airborne respirable dust (6hrs)

Generation, dispersion, measurement, and control; physiological effects of dust, dust-related diseases.

Assignment

Study on respirable Airborne disease in Miners and recommendations from Statutory bodies.

Module VII: Rescue & Recovery

Rescue & Recovery and its Scope. Rescue organization, Rescue stations, Rescue teams Selection Initial & refresher training. Rescue apparatus self-contained portable breathing apparatus, Gasmasks, Smoke helmets, Self Rescuers, Reviving apparatus with actual rescue operations

Projects:

Study and uses of self rescuer Gas mask, smoke helmet. 8. Study and use of reviving apparatus**.**

Text Books:

Elements of Mining Technology Vol 2, Deshmukh DJ, Denett& Company.

Mine Environmental Engineering, Volume I Mritunjoy Sengupta, CRC Press

Reference Books

Environmental Engineering in Mines R. D. Lama, Cambridge University Press.
Mine Environmental Engineering H Rabia, British Library.
Short notes on Mine explosions from NIOSH
https://www.cdc.gov/niosh/mining/features/coalmineexplosion.html

/https:/www.sciencedirect.com/science/article/pii/B9780081004579000213%20%20%20pgno%20352

Reference Books:

1. Lodish, Harvey etal., " Molecular Cell Biology," 6th Edition. W.H.Freeman, 2008

2. Alberts, Bruce, "Molecular Biology of Cell", 5th Edition, Garland Science, 2008.

3. Satyanarayana, U. "Biotechnology" Books & Allied (P) Ltd., 2005.

4. Friefelder, David. "Molecular Biology." Narosa Publications, 199

Mine Ventilation

Code	Course Title	Credit	T-P-PJ
CUTM1116	Mine Ventilation	3	2-1-0

Objective

- Understand the different approaches to design a perfect blast design in surface and underground mines depending upon different geotechnical properties of rock and explosives
- Select a suitable method of working for exploitation of ore body economically and safely.
- Grasp process of mine production
- Gain knowledge about the various technical and economical and safety issues to be considered in mine designing.

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Course Outcome

- Prepare and design a blasting pattern depending upon various geotechnical conditions of rock.
- Select suitable blasting methods depending upon the economical and safe conditions.
- Explain various technical parameters related with mine designing.
- Follow the safe and economic working procedure for mining.

Course Outline

Module I: (5 Hrs) Ventilation:

Necessity of ventilation, different ventilation systems, principles on different basis and its related calculations, factors effecting selection ventilation system, mechanism of airflow through mine openings, Laws of air flow, resistance of airways, equivalent orifice, Distribution of air flow and control devices. Natural ventilation calculation of NVP, thermodynamic aspects, artificial aids to natural ventilation

Module II: (4 Hrs)

Mechanical ventilation: different types of mine fans installation, operation details, applicability, limitations, efficiencies and characteristic, factors for effecting selection of mine fan, testing and output control of fans, operation of mine fans (Series and parallel). Fan laws, drives, Evasee, diffusers, booster fans, auxiliary ventilation. Reversal of air currents and controlled recirculation.

Module III Ventilation planning and design:

ventilation survey both quantity and pressure and related calculations. Mine ventilation design criteria and factors, Accessional, declensional, homotropal, anti – tropal ventilation plan. Central and boundary ventilation systems – layouts and comparisons. Standard of ventilation including permissible air velocities

Module IV: Ventilation survey:

Importance of ventilation survey, types: - qualitative surveying, pressure survey and quantity survey.

Simple problems.

Module V : **Elements of Ventilation Planning**:

Objective, steps in ventilation planning, desirable features of a ventilation system, types of ventilation system, quantity requirement, analysis of ventilation cost.

Text Books:

1.Techno Publication, Nagpur, 1998.

2. Mine Environment and Ventilation – G.B. Mishra, Oxford University Press, 1994.

Reference BOOKS:

Mine ventilation and air conditioning – Howard L. Hartman. Wiley International, 1976.

Environmental Engineering in Mines – Vutukuri & Lama, Cambridge University Press, Cambridge, 1992. Legislation in Indian mines a critical appraisal Vol. I and Vol. II – Prasad and Rakesh. Vivek Publications, Varanasi 1999.

Mine Ventilation Vol. – II, S. Ghatak, Coalfield Publishers, 1993.

Numerical Problems on Mine Ventilation, L.C. Kaku, Lovely Prakashan, Dhanbad

Drilling and Blasting

Code	Course Title	Credit	T-P-PJ
CUTM1111	Drilling and Blasting	3	2-0-1

Objective

- Understand the different approaches to design a perfect blast design in surface and underground mines depending upon different geotechnical properties of rock and explosives
- Select a suitable method of working for exploitation of ore body economically and safely.
- Grasp process of mine production
- Gain knowledge about the various technical and economical and safety issues to be considered in mine designing.

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Course Outcome

- Prepare and design a blasting pattern depending upon various geotechnical conditions of rock.
- Select suitable blasting methods depending upon the economical and safe conditions.
- Explain various technical parameters related with mine designing.
- Follow the safe and economic working procedure for mining.

Course Outline

Module I: (5 Hrs)

Explosives and Initiating Systems:

Types of explosives, their composition and properties, classification; Selection of explosives; Manufacture, transport, storage and handling of explosives; Testing of explosives

PROJECT:

1.1 selection of explosive

1.2. storage and handling of explosives

Types of initiating systems:

Electrical Detonators, Detonating Fuse, Detonating Relays, NONEL, Electronic Detonators, Blasting accessories, exploders.

PROJECT:

1.3 Electronic detonator.

Module II: (4 Hrs)

Drilling:

Blasthole drills types, classification, applicability and limitations; Mechanics of drilling, performance parameters, drilling cost, compressed air requirement for hole cleaning; Selection of drilling systems, drilling errors, organization of drilling.

PROJECT:

1. Selection of drilling systems

2.Estimation of performance of a drill machine

Blasting:

Mechanics of rock fragmentation; Livingstone theory of crater formation; Factors affecting blasting, Blast design estimation of burden and spacing, estimation of charge requirement; Initiation patterns; Secondary blasting pop and plaster shooting; Problems associated with blasting, Ground vibration and air over pressure, Control blasting and Blast instrumentation
PROJECT:
1.control blasting
2. Blast instrumentation

Module III: Drilling & Blasting in Underground Mines(6 Hrs)
Coal mines:
Drilling systems and their applicability, blasting off solid, different blasting cuts, ring hole blasting, calculation of specific charge, specific drilling and detonator factor, initiation patterns.
PROJECT:
Drilling systems and their applicability for u/g coal mine.
Metal mines:
Drilling systems and their applicability, blast design for horizontal drivages, different blasting cuts, long hole blasting, vertical crater retreat blasting.
PROJECT:
Drilling systems and their applicability for u/g metal mine
Module IV: Exploration Drilling:(6 Hrs)
Boring for exploration; Various types of exploratory drills and their applicability Auger, Cable tool, Odex, Core Drills; Core recovery: single and double tube core barrels, wire line core barrel; Storage of cores; Interpretation of borehole data.

Module V: Drilling & Blasting in Surface Mines:
Drilling: Blasthole drills types, classification, applicability and limitations; Mechanics of drilling, performance parameters, drilling cost, compressed air requirement for hole cleaning; Selection of drilling systems, drilling errors, organization of drilling.
PROJECT:
1. Selection of drilling systems
2.Estimation of performance of a drill machine

Text Books:

1. Explosive and blasting practices in mines By Dr. Sameer Das
2. Elements of mining technology By D.J.Deshmukh

Reference Books

Metalliferous mining methods By Y.P. Chacharkar.

Surface Mining

Code	Course Title	Credit	T-P-PJ
CUTM1109	Surface Mining	3	2-0-1

Objective

- The objective of this subject is to impart the fundamentals of modern digital & analog communication systems. Provide a detailed description of the proposed surface mining method and related equipment and support infrastructure.
- Design and evaluate materials handling and transport options.
- Conduct productivity analysis for the selected mining system.
- Identify and evaluate core risks in each mining method.
- Appraise mining systems with respect to safe, efficient, economic and environmentally and socially responsible operations.
- Demonstrate awareness of major technological trends.

Course Outcome

- Understand about the difference of surface mining and underground mining.
- Acquire the knowledge about machinery required for surface mining.
- Study the environmental problems due to surface mining and their remedial measures.
- Gain the knowledge about recent developments in the deployment of heavy earth moving machinery in the surface mines.

Course Outline

MODULE I

Introduction

Basic concepts, applicability, advantages and disadvantages, Surface mining terminology, Stripping ratio and Breakeven stripping ratio, its importance, Surface mining unit operations, Surface mining systems vis-à-vis equipment systems – classification, applicability, advantages and disadvantages, Role of surface mining in total mineral production.

PROJECT:

Role of surface mining in total mineral production

MODULE II

Opening of Deposits

Box cut – objective, types, parameters, methods; Factors affecting selection of box cut site,

Production benches – formation, parameters and factors affecting their selection.

MODULE III

Mine Machinery(Ripper)

Types, classification, applicability and limitations; Method and cycle of operation, Estimation of output; Concept of rippability,

PROJECT:

Estimation of output of ripper

Mine Machinery (Dozer)

Pusher dozer and push-pull operation, Applicability and limitations; Types and classification; Types of blade and corresponding merits and demerits; Method and cycle of operation

Mine Machinery (Shovel and Dumper)

Applicability and limitations of electric shovel, hydraulic excavators and dumpers, Cycle time and productivity calculation for shovel and dumper; Estimation for equipment (shovel, dumper and other heavy earth moving machines) required for a given mine production, Method of work for subsurface bedded and massive deposits and for hilly massive deposits by shovel – dumper combination,

PROJECT:

Productivity calculation of shovel and dumper

Estimation for equipment required for a given mine production

Mine Machinery (Dragline)

Applicability and limitations, different modes of operation; Side cast diagram and calculation of reach; Cycle time and productivity calculation,

PROJECT:

Productivity calculation of Dragline

Mine Machinery (Bucket wheel excavator)

Operations, applicability and cycle time and productivity calculation

PROJECT:

Productivity calculation of Bucket wheel excavator.

Mine Machinery (Surface Miner)

Surface miner: Applicability and limitations, method and cycle operation,

Mine Machinery (Front end-loaders)

Front end-loaders: Applicability and limitations; Method and cycle of operation.

Material transportation

Conveyor belt: applicability and limitations, Arial rope ways: applicability and limitations, Stacker and spreader: applicability and limitations, Reclaimer: applicability and limitations.

MODULE IV

Dimensional Stone Mining

Types, occurrences and uses; Methods vis-à-vis equipment for extraction of primary blocks in granite and marble quarries.

PROJECT:

Methods vis-à-vis equipment for extraction of primary blocks in granite and marble quarries.

Slope Stability

Types of mine slope – high wall and waste dumps; Common modes of slope failure; Factors influencing stability of slopes, Waste dumps - types and formation methods; Slope protection. pit-slope and dump designs and management and monitoring of pit-slope & dump slopes. dump-slopes

PROJECT:

Slope protection

MODULE V

Environmental Impacts

Relevant provisions of coal mines and metalliferous mines regulation; Environmental problems due to surface mining and their remedial measures. Recent developments in the deployment of heavy earth moving machineries in the surface mines.

PROJECT:

Environmental problems due to surface mining and their remedial measures

Recent developments in the deployment of heavy earth moving machineries in the surface mines.

REFERENCES

Surface mining technology by Sameer Ku.Das

Elements of mining technology by D.J.Deshmukh

Surface mining technology by T.N.Singh

SME Mining Engineering Handbook / edited by Peter Darling, 2011. Society for Mining,

Metallurgy, and Exploration (U.S.) ISBN978-0-87335-264-2.

Kennedy, B. A., Editor, 1990. Surface Mining, 2nd edition, Society for Mining, Metallurgy, and Exploration, Littleton, Colorado. ISBN 0–87335–102–9

Rock Mechanics

Code	Course Title	Credit	T-P-PJ
CUTM1106	Rock Mechanics	3	2-1-0

Objective

- Develop an understanding of the engineering properties of rocks, geological and engineering rock classifications
- Understand rock failure theories
- Learn about in-situ stresses in rock
- Know about the fundamental concepts and principles of rock mechanics.

Course Outcome

- Learn the characteristics and the mechanical properties (strength and failure criteria) of rock mass, rock matrix and discontinuities
- Learn methods for in situ investigation and laboratory testing of rock matrix and discontinuities.
- Use rock mass classification systems (RMR, Q, GSI)
- Conduct rock slope stability analysis.
- Analyse the stress distribution (isotropic, anisotropic) in situ and around an opening in rock (competent rock, jointed rock mass, blocky rock)

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Course outline

Module I

Definition, history, source of information and field of application of rock mechanics. Concept of stress and strain in rock Analysis of stress, strain and constitutive relations in isotropic an anisotropic rocks.

PROJECT:

Analysis of rock types

Module II Physico-mechanical properties of rock(8 HOURS):

Physical Properties: Density, unit weight and specific gravity, Moisture, content, degree of saturation, Porosity, Void ratio, Permeability, Velocity of elastic waves,Electrical resistivity, Thermal properties, Durability

PROJECT:

Determination of rock density and unit weigh Mechanical Properties:

Uniaxial compressive strength, Tensile strength, Point load strength, Triaxial strength, Direct shear Strength

Rock strength and failure mode

PROJECT:

Estimation of unconfined compressive and tensile strength

MODULE II

Dynamic properties of rock and rock mass (3 HOURS): Propagation of elastic wave in rock media;

Determination of dynamic strength and elastic constants of rock.

PROJECT:

Determination of dynamic strength and elastic constants of rock.

Time dependent properties of rocky (4 HOURS) Creep deformation and strength behaviour; Creep test

and rheological models. Strength and Deformability of Rock Mass: In situ shear tests; Evaluation of shear strength; In situ bearing strength test; In situ deformability tests-Plate Loading Test, Plate Jacking Test and Borehole Jack Tests

MODULE III

Failure criteria for rock and rockmass (4 HOURS):

Theories of rock failure; Coulomb, Mohr and Griffith criteria; Empirical criteria.

PROJECT:

Data analysis and rock properties

Rock mass classification(5 HOURS)

Introduction,TERZAGHI'S rock mass classification, Rock quality designation (RQD),Classification based on UCS, Geomechanics classification, Tunnelling qualityindex (Q), Rock structure rating (RSR), The geological strength index (GSI), Rock mass classification in support design

PROJECT:

Determination of rock mass ratings

MODULE IV

Pre-mining state of stress(1 HOUR):

Sources, methods of determination including over coring, hydro-fracturing methods and other methods.

Stresses around underground openings(4 HOURS)

Introduction, Stress around the underground openings

PROJECT:

Determination of stresses around circular openings

Rock slope stability(5 HOURS)

Introduction- failure modes,plain failure,wedge failure,circular failure,toppling failure

Rock slope stabilization

PROJECT:

slope stability analysis

REFERENCES

Fundamentals and applications of rock mechanics By Debashis Deb

Elements of mining technology By D.J.Deshmukh

Underground Coal mining

Code	Course Title	Credit	T-P-PJ
CUTM1108	Underground Coal mining	3	2-0-1

Course Objective

- Concept on underground coal mining
- Bord and Pillar Mining
- Pillar extraction
- Longwall mining
- Roof support
- Thick seam mining

Course Outcome

- Students will be able to understand the concept of underground coal mining and all other operations that are concerned with the underground coal mining.

Course Contents

Module I

Bord and Pillar Mining:

Choice of methods of mining coal seams; factors affecting choice of mining methods.

General principles of Bord and Pillar (B&P) development, different schemes of development and associated merits/demerits; Design of B&P workings, statutory provisions related to B&P workings, Semi-mechanized and mechanized schemes of B&P development; Mechanized face loading. Conditions suitable for mechanical loaders and continuous miners.

Module II

Pillar Extraction:

Preparatory arrangement for depillaring operation, statutory provisions on depillaring; principles of designing pillar extraction, factors affecting choice of pillar extraction; partial and full extraction; depillaring with caving and stowing; mechanization in depillaring operation. Local and main fall, indications of roof weighting, measures to bring down roof at regular interval; air blast and measures to minimize its effects; precautions during depillaring operation against fire and inundation; multi-section

and contiguous workings. Extraction of pillars in seams prone to bumps.

Module III

Longwall Mining:

Factors affecting longwall mining, longwall face layouts, advancing and retreating faces, single versus double unit longwall faces, orientation of longwall faces; single versus multiple heading gate roads, factors affecting length and width of longwall panel. Extraction of Longwall panel,

working with shearer and plough, support system of longwall face and gate roads, monolithic packing in longwall advancing gate roads; case studies of longwall faces in India.

Module IV

Thick seam mining:

Board and pillar and long wall mining in multi section, multi slice method, incline slicing, horizontal slicing and cross slicing in ascending and descending order, under winning method, sub level caving, integral caving – horizontal slicing with caving / stowing – blasting gallery. Method – sub level caving with mechanizes long wall. horizon mining – merit – demerit – application & limitation. Modern method – applicable condition of plough, method of working by plough, unidirectional ploughing method, bi – directional ploughing method over passing hydraulic mining merit & demerit applicable condition of underground gasification of coal merit, demerit of gasification of coal, method of extraction of gasification & contiguous seam.

Module V

Roof Supports:

Timber props and cogs; friction/hydraulic props and chocks; other steel supports; types of roof bolts; function, applicability and advantage of roof bolting and cable bolting; powered supports; systematic support rules; supporting scheme of development gallery, B&P and L/W faces, depillaring district; withdrawal of support. Conditions requiring stowing in mines; types of stowing; suitable materials for hydraulic stowing; stowing plant and stowing range; hydraulic gradient and hydraulic profile.

Text book

Element of mining: D.J Deshmukh vol 1 , bennet & co. Nagpur
Winning and working coal: R.T Deshmukh & D.J Deshmuk vol 1& 2
Long wall mining: Smair Kumar Das, lovelyprakashan Dhanbad
Modern coal mining technology: lovely prakashan dhanbad, smairkumar das
Principles & practices of coal mining: R.D. Singh, New Age Intl. Pvt.Ltd, New Delhi

Underground Metal mining

Code	Course Title	Credit	T-P-PJ
CUTM1110	Underground Metal mining	3	2-0-1

Objective

To make the students have understanding on:

- Concept on underground metal mining
- Concept on development
- Stoping
- Mine support

Course Outcome

- Students will be able to understand the concept of underground metal mining and all other operations that are concerned with the underground metal mining.

Course Contents

Module I

Introduction:

Present status of Indian metal mining industry; Scope and limitations of underground mining.

Module II

Development:

Choice of level interval and back/block length; Shape, size, position, excavation and equipping of shaft station/plat, grizzly, ore/waste bin, main ore pass system, underground crushing and loading stations, underground chambers, sump and other subsidiary excavations; Arrangements for dumping into main ore pass; Underground crushing, loading and hoisting.

Cross cuts and drifts, their shape, size and position, review of excavation process, ground breaking, mucking, ventilation and support, track extension and car switching, Use of modern drilling and loading equipment in drifting, raises and winzes, their shape, size and position, excavation process, ground breaking, mucking, ventilation and support; Modern methods of raising – Alimak and Jora-lift raising, longhole method including vertical crater retreat method of raising; raise boring, systems and their details, modern methods of winzing, secondary breaking at grizzley, conventional and mechanized methods, waste handling systems in underground workings.

Module III

Stopping:

Selection of stoping methods; Classification of stoping methods; Stoping of narrow ore bodies by underhand, overhand, breast, longhole and raise mining methods; Resuing; Mining of parallel veins; Room & pillar, sublevel, large diameter blast hole/DTH, cascade, shrinkage and vertical crater retreat methods, their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting; Haulage and dumping; Supported methods – horizontal overhand and underhand cutand-fill methods, square-set method and its variations, details of stope layouts, ground breaking, supporting, mucking, ventilation, haulage and dumping.

Module IV

Mine supports:

Timber support: Post, drift-set of various types, square-set, crib-set, cog, stull and chock/chock mat supports; fore poling/piling; load bearing capacity of timber supports; bulkheads, steel support: steel set, rigid and yielding types, tubbing, wire mesh, steel lining, screw jacks and ratchet jacks; improvised steel props, friction props, hydraulic props; link bars and chocks, powered supports.

Cement support: Poured monolithic and reinforced concrete lining; monolithic pump packing, concrete blocks, concrete slabs, geniting and shotcreting. Rock support: Pillars of ore and waste, pack walls, masonry, walls and arches, building materials and construction, fill support : materials of backfill and their procurement; theoretical aspects of slurry transportation; preparation, transport and placement of hydraulic backfill with and without cement; Paste fills; rock and concrete fills; surface arrangement for storage and mixing; pneumatic and mechanical methods of backfilling.

Reinforcement systems:

Materials and techniques; rock bolts and dowels – different types and uses; mechanics of bolting; point anchored rockbolts – Slot and wedge type, expansion shell type, grouted point anchor type.

Text Books/References

1. Howard, L.Hartman. Introductory Mining Engineering, Pub: John Willey & Sons.
2. Cummins & Givens. SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. New-York.
3. Ramlu et al, Computer in mineral industry. Pub: Oxford & IBH, New-Delhi.
4. W.A. Hustrulid. Underground mining methods handbook, Pub: Society of mining engineers of the American Institute of Mining Metallurgical and Petroleum Engineers, Inc. New-York.

Mine Economics

Code	Course Title	Credit	T-P-PJ
CUTM1113	Mine Economics	2	2-0-0

Objective

- Exposure to National Mineral policy, pricing Exports and imports.
- Fundamental principles of Mine economics
- Estimation of reserves, classification of reserves, tenor, grade etc.
- Mine Valuation, factors affecting mine evaluation.

Course Outcome

- Knowledge on National Mineral Policy and economic modeling.
- Importance and relevance of Sampling in mineral Industry.
- Estimation of mine reserves and mine life cycle.
- Analyse the mine valuation and process.

Course outline

Module I: (6hrs)
Introduction: Role of mining and mineral industry in national economy, special features of mineral industry, essential and strategic minerals of India and their economic significance.

Module: II
National Mineral Policy: Appraisal of Mineral Resources, Pricing policy, Exports and Imports, taxation and subsidies, conservation of Minerals.

Module: III
Time Value of Money: Value at constant point, discontinued cash flow analysis, discount factors (risk and uncertainty), inflation.

Module IV
Capital and Operating Cost:
Machine Life and Operating Cost first principal cost modeling.
Module V
Cost Effective Mining Scheme :
Systematic planning process and economic data at each phase of Mining cycle.

Text Books :
Mine and Mineral Economics -Subash C.Ray, Indra N Sinha.

Mineral Dressing

Code	Course Title	Credit	T-P-PJ
CUTM1115	Mineral Dressing	2	2-0-0

Objective

- Exposure to various aspects of beneficiation of ores and industrial minerals for value addition.
- To introduce mineral processing characteristics of minerals.
- To introduce Concentrations, Physico-chemical principles.
- To introduce Flowsheets for the beneficiation of various minerals.

Course Outcome

- Exposed to the practices of beneficiation ores and coal.
- Gain value up-gradation for main product and for the byproduct.
- Various techniques of Mineral processing

Course outline

MODULE I Introduction

Scope, objectives, and limitations of mineral processing, liberation, and beneficiation characteristics of minerals and coal. Comminution: Theory and practices of crushing and grinding.

MODULE II Liberation

Liberation- importance, and determination of liberation size, Crushing fundamentals, construction, and operational features of primary and secondary crushers, Jaw, Gyratory, cone, and roll crushers. Grinding- theory and practice, Ball & Rod Mills construction, and operation.

Project:

Study on mineral processing, liberation, and beneficiation in India Scenario.

Study on Operational features of different grinding practices**.**

MODULE III Grinding

Theory of grinding, critical speed, types of grinding mills, such as ball mills, rod mill, autogenous mills, close circuit and open circuit grinding.

MODULE IV Metallurgical Accounting

Sampling, Definition, objectives, different types of sampling methods. Hand sampling, mechanical and electrical sampling.

MOUDLE V Size Separation

Industrial screens, mechanical classifiers and hydro cyclones, mineral concentration technologies including magnetic and electrostatic separation, gravity separation, and flotation..

References

Introduction to Mineral Processing – V. Malleswar Rao

Mineral Processing – B A Wills

Ore Deposits of India – Their distribution and processing. Rao, T C and Gokhale, KVG.

Mine Electrical Technology

Code	Course Title	Credit	T-P-PJ
CUTM1912	Mine Electrical Technology	3	2-0-1

Objective

- Indian Electricity rules applicable to Mining.
- Electrical equipment being used in mines like cable, Transformers.
- Mine Communication, and Protective System
- Required Mine miscellaneous topics.

Course Outcome

- Gain Electrical knowledge required in mining operations.
- Can cope up the equipment and system established in mining operations?
- Understand Mine Communication system, Safety Apparatus and other special topics.

Course outline

MODULE I Introduction (6 hrs.)

Scope and importance of electrical engineering in mining, Role of electrical engineer in mining. Indian Electricity Rules Applicable to Mining.

MODULE II Electrical cables for Mining use (6 hrs.)

Classify cables for mining use. Constructional features of high tension and low-tension cables armored & trailing cables. State size of cables & their use. State procedures of cable laying at surface, underground roadway & in shafts. Describe cable joint box mining type.

Practice:

Identify the different part of given cable and find fault on the cable.

MODULE III Protective Systems (6 hrs.)

Fuses: Fuses, Rewireable Fuses and HRC Fuse, Circuit Breakers: Minimum Oil Circuit Breaker, Vacuum Circuit Breaker, SF6 circuit breaker. Essential qualities of good protective system. Relays: Types of Relays, Latching relay, frequency relay, overload relay.

Practice:
Study of Relays: Buccoz relay and Overcurrent relay.

MODULE IV Typical Power equipment in mines (**6 hrs**)

Power distribution in mines, Surface and Underground power distribution in mines, Main Lighting equipment, Surface auxiliaries, Fundamentals of Transformers (without numerical)

MOUDLE V Mine Communication (6 hrs)

Principles of underground signaling systems, Wire system communication, Wireless communication system -RFID, Trapped Miner communication, Shaft Communication system. Use of Megger check the continuity of windings, body to winding, body to earth of an 3-Phase induction Motor.

Module VI Miscellaneous topics (6 hrs)

Electrical Braking system, Intrinsic safe apparatus and Flame Proof apparatus. Electrical drives, advantages of electric drives.

Text Books

Basic Electrical Technology by BL Therija

Electrical Engineering in Mines by Nil K Dutta

References

Mine Power Systems Vol 1 Lloyd A. Morley

Mine Legislation and General Safety I

Code	Course Title	Credit	T-P-PJ
CUTM1114	Mine Legislation and general safety I	3	3-0-0

Objective

- Describe various aspects of Mines Act 1952.
- Describe various aspects of Mines Rule 1955.
- Describe various aspects of Coal Mines Regulations 1957.
- Describe various aspects of mine safety.

Course Outcome

- Students will be able to apprehend on Mine Acts and rules which could be helpful in their professional work.
- Students will be able to gain knowledge on Coal mine regulations and rescue rules.
- Gain knowledge on MMR 1961.
- Gain information on various aspects of mine safety.

Course Contents

Module I:

Mines Act 1952:

Meaning of the terms, Mine Act, Regulations, Rules, Bye-laws, standing order and situations under which act does not apply. Provisions of Mines Act in respect of Drinking water health and hygicive conservancy, Medical Appliances, Hour and limitations of Employment – Leave with wages.

Module II:

Mines Rules 1955:

Mine Rules related to drinking water, lavatories, urinals with on surface and in underground first aid, - Ambulance, Hours, and limitations of Employment - leave with wages with wages and over time.

Module III:

Coal Mines and Metalliferous Mines Regulations:

Important definitions, regulations related to notice of accidents duties of managers, Asst/under Managers, Overman, foreman and surveyor, Mine plans and sections. Means of Access and egress ladder and Ladder ways under M.M.R. Transport of men and material by Haulage mine working precautions against dangers from gas and water Mine ventilation, mine lighting and safety equipment and types of fences (Miscellaneous)

Module IV:

Safety Aspects in Mines:

Accidents classification and analysis-safe condition- unsafe condition- mine safety- safety objectives- major factors to be considered for safety - safety week- pit safety committee safety organization and safety policy.

Mine Legislation and General Safety II

Code	Course Title	Credit	T-P-PJ
CUTM1911	Mine Legislation and general safety II	3	3-0-0

Objective

- To give comprehensive knowledge on Mine Rescue RULES.
- To give knowledge on Mines VT rules 1966and CEAR.
- To give concepts and discussions on risk assessment and safety management plan.

Course Outcome

- Students able to understand various provisions of Metalliferous Mines Rescue rule, VT rules 1966.
- Students gain knowledge on Risk assessment and safety management plan.

Course Contents

Module I
The Mines Rescue Rules, 1985;
Module II
Mines Vocational Training Rules, 1966,
Module III
Central Electricity Authority Regulations, 2010
Module IV
Mineral Concession Rules, 1960, and Mineral conservation and Development Rules.
Module V
Risk Assessment & Safety Management Plan

Text books
Mine Act - 52 by B. K. Kejriwal 2. DGMS Circulars.

References

Mines Act, Mine regulations, Mine rules Govt. of India Publication

Legislation in Indian Mines - Critical Appraisal by Prasad & Rakesh.

Mine Management

Code	Course Title	Credit	T-P-PJ
CUTM1909	Mine Management	3	3-0-0

Objectives

- Demonstrate an awareness of management theory and processes.
- Recognise the factors that motivate people's behaviour in the mine working environment.
- Apply the principal performance measures used in mine management.

Course Outcomes

- Students gain knowledge about personal management, industrial relation and legislation and management information system.

Module I

Brief History of Management:

Evolution of Management, traditional management, Scientific management, Contribution of pioneers to scientific management, Functions of management, Principles of Management. Mine management: Duties and responsibilities of mines manager.

Personal Management:

Functions of personnel management, recruitment and selection of employees. Education and training: mines vocational training center. Communication: formal and informal communication, barriers in communication and techniques to overcome barriers and improve communication.

Industrial Psychology and Human Relation:

Definition, scope of industrial psychology, aims of industrial psychology. Group Dynamics. Motivation: definition, characteristics of motivation, kinds of motivation, factors affecting motivation, motivational techniques.

Module II

Industrial Relations and Legislation:

Introduction, basic requirement of industrial –relation programme. Trade unions: definition, functions of trade uniosn. Industrial disputes: causes, settlement of industrial disputes, handling of workers' grievances. Workers participation in management, work of ILO. Necessity of labour legislation, principles of labour legislation. Important provisions of factories act, payment of wages act, Workmen's Compensation act, Employee state insurance Act.

Work Study:

Definition, productivity and work study, postion of work study department in the organization, work study man, work study and the workers, work study and the management. Motion Study: Definition, aims of motion study, procedure for motion study.

Time Study:

Definition, uses of time study, procedure, performance rating number of cycles to be timed, allowances, uses of time study data for wage incentives. Standard Data: Advantages, Basic Motion Time Study.

Electronic Devices and Systems

Code	Course Title	Credit	T-P-PJ
CUTM1112	Electronic Devices and Systems	3	2-0-1

Management Information System (MIS):

Introduction, Need for Information System, Characteristics of Good MIS, Sources of Information, application of MIS, design of MIS, development, Implementation of MIS.

TEXT BOOKS:

Mine Management, Legislation and General Safety, S. Ghatak, Coal Field Publishers, Asansol, 1999

Roy,P., Blasting in Underground excavations and mines, CMR Dhanbad, 1993.

Objective

- The course is designed to be a broad introduction to electronic systems for students from diverse engineering disciplines. Completing the course will provide the necessary foundation to understand the role, capabilities and constraints of electronics in contemporary engineering systems.
- This course develops a basic understanding of the fundamentals and principles of analog and digital circuits and electronic devices. This understanding is a critical step towards being able to design new electronic circuits or use them appropriately as part of a larger engineering system.

Course Outcome

- Understand operation of semiconductor devices.
- Understand the current voltage characteristics of semiconductor devices.
- Design and analyze of electronic circuits.
- Evaluate frequency response to understand behavior of Electronics circuits
- Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.
- To apply concepts for the design of Regulators and Amplifiers.
- To verify the theoretical concepts through laboratory and simulation experiments.
- To implement mini projects based on concept of electronics circuit concepts.

Course Contents

Module I: Semiconductor Diodes, Diode Applications (5 Hrs)
Semiconductor Physics, Semiconductor Diode and analysis, Zener Diodes, Light-Emitting Diodes, realization of logic gates using diodes, rectifier circuits.
Practice:

1.1 V-I Characteristics of PN Junction diode and ZENER diode. (Both hardware and MULTISIM)

1.2 Implementation of Full-Wave rectifier. (Both hardware and MULTISIM).

1.3 Implementation of AND/OR gates. (Both hardware and MULTISIM)

Module II: Bipolar Junction Transistors, Field-Effect Transistors (4 Hrs)

Transistor Construction and characteristics, Construction and Characteristics of JFETs, MOSFET

Practice:

2.1 Input - Output Characteristics of CB/CE/CC configuration BJT. (Both hardware and MULTISIM)

2.2 Output and transfer Characteristics of FET. (Both hardware and MULTISIM)

Module III: DC Biasing—BJTs. BJT AC Analysis, FET Biasing , FET Amplifiers , BJT and JFET Frequency Response (6 Hrs)

Load-Line Analysis, Operating Point, biasing techniques, AC analysis of BJT and FET, General Frequency Considerations, Low-Frequency Analysis of BJT, FET

Practice:

3.1 Frequency response of self-biased BJT amplifier. (Both hardware and MULTISIM)

3.2 Frequency response of CS FET amplifier. (Both hardware and MULTISIM)

Module IV: Operational Amplifiers, Op-Amp Applications, Linear-Digital ICs (6 Hrs)

Practical Op-Amp Circuits and various parameter analyses, various applications, Timer and PLL ICs

Practice:

4.1 Design and implement of Adder, Subtractor using IC 741. (Both hardware and MULTISIM)

4.2 Design and implement of Integrator and Differentiator using IC 741. (Both hardware and MULTISIM)

4.3 Design and implement of Any oscillator using IC 741. (Both hardware and MULTISIM

Module V: Power Amplifiers, Feedback and Oscillator Circuits (5 Hrs)

Various classes of power amplifier and their characteristics, design of various oscillators and its applications

Practice:

5.1 Design and implement of Class-C power amplifier (Both hardware and MULTISIM)

5.2 Design and implement of RC Phase shift oscillator (Both hardware and MULTISIM)

5.3 Design and implement of UJT relaxation oscillator (Both hardware and MULTISIM)

Module VI: Power Supplies (Voltage Regulators) (4 Hrs)

Various filters, Voltage regulator, Design and different IC voltage regulators.

Practice:

6.1 Regulation characteristics of transistor voltage regulator.(Both hardware and MULTISIM).

6.2 Regulation characteristics of IC7805/7912 voltage regulators.(Both hardware and MULTISIM).

Module VII: Other Two-Terminal Devices, *pnpn* and Other Devices (4 Hrs)

Varactor diode, photodiode, solar cell, tunnel diode, LCD, thermisters, SCR construction, applications, UJT

Text Books:

1. Electronic Devices and Circuit Theory, Eleventh Edition: Robert L. Boylestad. Louis Nashelsky
2. Electronic Principles and Applications , Ninth Edition: Charles A. Schuler

Reference Books

1. Electronic Devices and Circuits : GSN Raju
2. Electronic Devices: Systems and Applications: Robert Diffenderfer.

Link for Text Book

1: www.rtna.ac.th/departments/elect/Data/EE306/Electronic%20Devices%20and%20Circuit%20Theory.pdf

Link for Text Book

2: http://dl.booktolearn.com/ebooks2/engineering/electrical/9780073373836_Electronics_Principles_and_Applications_9th_7d8d.pdf