JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For

B. TECH MINING ENGINEERING

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
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DEPARTMENT OF MINING ENGINEERING

COURSE STRUCTURE – R19

I Year – I SEMESTER

Sl. No	Course Code	Subjects	L	T	P	Credits
1	BS1101	Mathematics – I	3	0	0	3
2	BS1102	Mathematics – II	3	0	0	3
3	BS1110	Engineering Chemistry	3	0	0	3
4	ES1101	Programming for Problem Solving Using C	3	0	0	3
5	ES1104	Engineering Mechanics	3	0	0	3
6	HS1102	English Lab	0	0	2	1
7	BS1111	Engineering Chemistry Laboratory	0	0	3	1.5
8	ES1102	Programming for Problem Solving Using C Lab	0	0	3	1.5
9	MC1101	Environmental Science	3	0	0	0
Total Credits			**18**	**0**	**8**	**19**

I Year – II SEMESTER

Sl. No	Course Code	Subjects	L	T	P	Credits
1	HS1201	English	3	0	0	3
2	BS1203	Mathematics – III	3	0	0	3
3	BS1208	Engineering Physics	3	0	0	3
4	ES1206	Basic Electrical & Electrical Engineering	3	0	0	3
5	ES1203	Engineering Drawing	1	0	3	2.5
6	HS1203	Communication Skills Lab	0	0	2	1
7	BS1209	Engineering Physics Lab	0	0	3	1.5
8	ES1208	Electrical and Electronics Engineering lab	0	0	3	1.5
9	ES1220	Engineering Workshop & IT Workshop	0	0	2	1.5
10	PR1201	Engineering Exploration Project	0	0	3	1
Total Credits			**13**	**0**	**16**	**21**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year – I Semester

S.No	Category	Subjects	L	T	P	Credits
1	PCC	Development of Mineral Deposits	3	--	--	3
2	ESC	Fluid Mechanics and Hydraulic Machines	3	--	--	3
3	PCC	Mine Surveying-I	3	--	--	3
4	PCC	Mining Geology –I	3	--	--	3
5	BSC	Managerial Economics & Financial Analysis	3	--	--	3
6	ESC	Computer Aided Engineering Drawing Practice	--	--	**3**	**2**
7	PCC	Mine Surveying-I Lab	--	--	3	1.5
8	ESC	Fluid Mechanics and Hydraulic Machines Lab	--	--	3	1.5
		Total Credits				**20**

II Year – II Semester

S.No	Category	Subjects	L	T	P	Credits
1	PCC	Drilling and Blasting	3	--	--	3
2	ESC	Mechanics of Solids	3	--	--	3
3	PCC	Mining Geology –II	3	--	--	3
4	PCC	Mine Surveying – II	3	--	--	3
5	PCC	Surface Mining	3	--	--	3
6	PCC	Mine Environmental Engineering-I	3	--	--	3
7	PCC	Geology Lab	-	--	3	1.5
8	ESC	Mechanics of Solids Lab	-	--	3	1.5
9	MC	Professional Ethics & Human Values	-	3	--	--
		Total Credits				**21**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester

S.No	Category	Subjects	L	T	P	Credits
1	PCC	Underground Coal Mining Technology	3	--	--	3
2	PCC	Mine Environment Engineering – II	3	--	--	3
3	PCC	Rock Mechanics	3	--	--	3
4		**OPEN ELECTIVE-I** 1. Waste Water Management 2. Environmental impact analysis 3. Disaster Management and Mitigations	3	--	--	3
5	PCC	Mining Machinery & Mechanization-I	3	--	--	3
6	BSC	Advanced English Communication Skills Lab	-	--	3	1.5
7	PCC	Mine Surveying - II Lab	-	--	3	1.5
8	PCC	Rock Mechanics Lab	-	--	3	1.5
9	PCC	Corporate Social Responsibility in mining	1			0.5
10	PCC	Mine Field visit(Mandatory)(internship)	-	--	--	1
		Total Credits				**21**

III Year - II Semester

S.No	Category	Subjects	L	T	P	Credits
1	PCC	Mine Ground Control	3	--	--	3
2	PCC	Mineral processing	3	--	--	3
3	PCC	Under Ground Metal Mining Technology	3	--	--	3
4	PCC	Mining Machinery & Mechanization –II	3	--	--	3
5		**OPEN ELECTIVE - II** 1.Industrial Robotics 2.Artificial intelligence 3.Introduction to Data Base Management System	3	--	--	3
6	PCC	Mineral processing Lab	--	--	3	1.5
7	PCC	Mine Environmental Engineering Lab	--	--	3	1.5
8	PCC	Mining Machinery & Mechanization Lab	--	--	3	1.5
9	PCC	Industrial Training(3-4weeks) or Skill development or Research project	--	--	--	0.5
		Total Credits				**20**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year – I Semester

S.No.	Category	Subjects	L	T	P	Credits
1	PCC	Computer Applications in Mining	3	--	--	3
2	PCC	Mine Planning and Design	3	--	--	3
3	PCC	Mine Legislation & General Safety	3	--	--	3
4	PEC-I	**Professional ELECTIVE Course** –I 1. Rocks slope Engineering 2. Mine Subsidence Engineering 3. Mine systems engineering	3	--	--	3
5	MC	IPR & Patents	--	2	--	--
6	PCC	Computer Applications in Mining Lab	--	--	2	1.5
7	PCC	Mine Planning and Design Lab	--	--	2	1.5
8	PCC	Survey Camp (One Week)	--	--	--	2
9	PCC	Mini Project	3	--	--	2
		Total Credits				**19**

IV Year – II Semester

S.No	Category	Subjects	L	T	P	Credits
1	PCC	Mine Economics & Investment	3	--	--	3
2	PCC	Numerical Modeling in Mining	3	--	--	3
3	PEC-II	**Professional ELECTIVE Course II** **1.**Planning of Underground Metal Mining Projects **2.**Long wall mining **3.**Planning of Surface Mining Projects	3	--	--	3
4	PCC	Seminar and Technical Writing	--	--	3	2
5	PCC	Major project	--	--	4	8
		Total Credits				**19**

- *BSC –Basic Science Course*
- *ESC – Engineering Science Course*
- *OEC- I – Open Elective (Offered by Civil branch)*
- *OEC- II – Open Elective (Offered by CSE branch)*
- *PEC - Professional ELECTIVE Course*
- *PCC - Professional Core Course*
- *HS – Humanities Science*
- *MC – Mandatory Course*

Total Course Credits =40+41+ 41+ 38= 160

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	3
Mathematics-I (BS1101) **(Common to all Branch's for I Year B. Tech)**					

Course Objectives:

- This course will illuminate the students in the concepts of calculus.
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- utilize mean value theorems to real life problems (L3)
- solve the differential equations related to various engineering fields (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- Apply double integration techniques in evaluating areas bounded by region (L3)
- students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems (L5)

UNIT I: Sequences, Series and Mean value theorems: **(10 hrs)**

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

UNIT II: Differential equations of first order and first degree: **(10 hrs)**

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form.
Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT III: Linear differential equations of higher order: **(10 hrs)**

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^nV(x) – Method of Variation of parameters.
Applications: LCR circuit, Simple Harmonic motion.

UNIT IV: Partial differentiation: **(10 hrs)**

Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT V: Multiple integrals: **(8 hrs)**

Double and Triple integrals – Change of order of integration – Change of variables.
Applications: Finding Areas and Volumes.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir,** Thomas calculus, 14th Edition, Pearson.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	3
MATHEMATICS - II (BS1102) **(Common to all Branch's for I Year B. Tech)**					

Course Objectives:

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
- evaluate approximating the roots of polynomial and transcendental equations by different algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)

Unit I: Solving systems of linear equations, Eigen values and Eigen vectors: (10 hrs)

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous equations linear equations – Gauss Elimination for solving system of equations – Eigen values and Eigen vectors and their properties.

Unit-II: Cayley-Hamilton theorem and Quadratic forms: (10 hrs)

Cayley-Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.

Singular values of a matrix, singular value decomposition (Ref. Book – 1).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT III: Iterative methods: **(8 hrs)**

Introduction – Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations.

UNIT IV: Interpolation: **(10 hrs)**

Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula – Newton's divide difference formula.

UNIT V: Numerical integration and solution of ordinary differential equations: **(10 hrs)**

Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43^{rd} Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **David Poole,** Linear Algebra- A modern introduction, 4^{th} Edition, Cengage.
2. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
3. **M. K. Jain, S. R. K. Iyengar and R. K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	3
ENGINEERING CHEMISTRY (BS1110)					

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Learning Objectives:

- ***Importance*** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- ***Outline*** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
  Express the increase in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.
  Classify and discuss the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also ***summarized***.
- ***Relate*** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
- ***Explain*** the importance and usage of water as basic material in almost all the industries; ***interpret*** drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

UNIT I: POLYMER TECHNOLOGY

Polymerisation:- Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.

Plastics: Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

Elastomers:- Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics-conducting polymers-biodegradable polymers-biopolymers-biomedical polymers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Outline*** the properties of polymers and various additives added and different methods of forming plastic materials.
- ***Explain*** the preparation, properties and applications of some plastic materials.
- ***Interpret*** the mechanism of conduction in conducting polymers .
- ***Discuss*** natural and synthetic rubbers and their applications.

UNIT II: ELECTROCHEMICAL CELLS AND CORROSION

Single electrode potential-Electrochemical series and uses of series-standard hydrogen electrode, calomel electrode-concentration cell-construction of glass electrode-Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li ion battery, zinc air cells–Fuel cells: H_2-O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

Corrosion:-Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)-Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Explain*** the theory of construction of battery and fuel cells.
- ***Categorize*** the reasons for corrosion and study some methods of corrosion control.

UNIT III: CHEMISTRY OF MATERIALS

Part- A:

Nano materials:- Introduction-sol-gel method-characterization by BET, SEM and TEM methods-applications of graphene-carbon nanotubes and fullerenes:Types, preparation and applications

Thermal analysis techniques: Instrumentation and applications of thermogravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

Part-B:

Refractories: - Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: - Definition, mechanism of lubricants and properties (definition and importance).

Cement: - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Outline*** the awareness of materials like nanomaterials and fullerenes and their uses.
- ***Explain*** the techniques that detect and measure changes of state of reaction.
- ***Illustrate*** the commonly used industrial materials.

UNIT IV: FUELS

Introduction-calorific value-HCV and LCV-problems using Dulong's formula-proximate and ultimate analysis of coal sample-significance of these analyses-problems-Petroleum (refining-cracking)-Synthetic petrol (Fischer Tropsch and Bergius)-petrol knocking-diesel knocking-octane and cetane ratings-anti-knock agents-Introduction to alternative fuels (Bio-diesel, ethanol, methanol, Natural gas, LPG, CNG)-Flue gas analysis by Orsat apparatus-Rocket fuels.

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Differentiate*** petroleum, petrol, synthetic petrol and have knowledge how they are produced.
- ***Study*** alternate fuels.
- ***Analyse*** flue gases.

UNIT V: WATER TECHNOLOGY

Hardness of water-determination of hardness by complexometric method-boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement)-internal treatments-softening of hard water (zeolite processs and related sums, ion exchange process)-treatment of industrial waste water

Portable water and its specifications-steps involved in purification of water-chlorination, break point chlorination-reverse osmosis and electro dialysis.

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Explain*** the impurities present in raw water, problems associated with them and how to avoid them are understood.

Standard Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co. Latest edition
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition

Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co. Latest edition

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	3
PROGRAMMING FOR PROBLEM SOLVING USING C (ES1101)					

COURSE OBJECTIVES:

The objectives of Programming for Problem Solving Using C are

1) To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2) To gain knowledge of the operators, selection, control statements and repetition in C
3) To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
4) To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
5) To assimilate about File I/O and significance of functions

UNIT I

Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

UNIT II

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples

UNIT III

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages

Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code

Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application

UNIT IV

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value

Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application

Processor Commands: Processor Commands

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT V

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions

Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

TEXT BOOKS:

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE
2. The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson

REFERENCES:

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD

COURSE OUTCOMES:

Upon the completion of the course the student will learn

1) To write algorithms and to draw flowcharts for solving problems
2) To convert flowcharts/algorithms to C Programs, compile and debug programs
3) To use different operators, data types and write programs that use two-way/ multi-way selection
4) To select the best loop construct for a given problem
5) To design and implement programs to analyze the different pointer applications
6) To decompose a problem into functions and to develop modular reusable code
7) To apply File I/O operations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	3
ENGINEERING MECHANICS (ES1104)					

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

UNIT – I

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.
Introduction to Engg. Mechanics – Basic Concepts.
Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.
Friction: Introduction, limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

UNIT II
Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
Equilibrium of Systems of Forces: Free Body Diagrams, , Lami's Theorm, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

UNIT – III
Objectives : The students are to be exposed to concepts of centre of gravity. The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures
Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.
Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia:** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – IV
Objectives: The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics- Work Energy method and applications to particle motion- Impulse momentum method.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT – V
Objectives: The students are to be exposed to rigid motion kinematics and kinetics
Rigid body Motion: Kinematics and kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse momentum method.

TEXT BOOK:
1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.

Course outcomes:
1. The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
2. He should be able to determine centroid for lines, areas and center of gravity for volumes and their composites.
3. He should be able to determine area and mass movement of inertia for composite sections
4. He should be able to analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse – momentum.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		0	0	2	1
ENGLISH LAB (HS1102)					

UNIT I:
Vowels, Consonants, Pronunciation, Phonetic Transcription

UNIT II:

Past tense markers, word stress-di-syllabic words, Poly-Syllabic words

UNIT III:

Rhythm & Intonation

UNIT IV:

Contrastive Stress (Homographs)

UNIT V:

Word Stress: Weak and Strong forms
Stress in compound words

References books:

1. Infotech English, Maruthi Publications. (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		0	0	3	1.5
ENGINEERING CHEMISTRY LAB (BS1111)					

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of copper (II) using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of iron (III) by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of the concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of Mg^{+2} present in an antacid.
12. Determination of $CaCO_3$ present in an egg shell.
13. Estimation of Vitamin C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Outcomes: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		0	0	3	1.5
PROGRAMMING FOR PROBLEM SOLVING USING C LAB (ES1102)					

Course Objectives:

1) Apply the principles of C language in problem solving.
2) To design flowcharts, algorithms and knowing how to debug programs.
3) To design & develop of C programs using arrays, strings pointers & functions.
4) To review the file operations, preprocessor commands.

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.

Course Outcomes:

By the end of the Lab, the student

1) Gains Knowledge on various concepts of a C language.
2) Able to draw flowcharts and write algorithms.
3) Able design and development of C problem solving skills.
4) Able to design and develop modular programming skills.
5) Able to trace and debug a program

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - I Semester		L	T	P	C
		3	0	0	0
ENVIRONMENTAL SCIENCE (MC1101)					

Learning Objectives:
The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

UNIT-I:
Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;. Role of information technology in environment and human health.
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 Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II:
Natural Resources: Natural resources and associated problems.
Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-III:
Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT – IV Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.
Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT – V Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. 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 – VI Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.
The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:
1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

Reference:
1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
ENGLISH (HS1201)					

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

Course Objectives

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 1:

Lesson-1: A Drawer full of happiness from "**Infotech English**", Maruthi Publications
Lesson-2: Deliverance by Premchand from "**The Individual Society",** Pearson Publications.
(Non-detailed)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Listening: Listening to short audio texts and identifying the topic. Listening to short audio texts and identifying the context and specific pieces of information to answer a series of questions both in speaking and writing.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.

Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information.

Reading for Writing: Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.
Pronunciation: Vowels, Consonants, Plural markers and their realizations

Unit 2:

Lesson-1: Nehru's letter to his daughter Indira on her birthday from "**Infotech English**", Maruthi Publications

Lesson-2: Bosom Friend by Hira Bansode from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

Grammar: Use of articles and zero article; prepositions.

Pronunciation: Past tense markers, word stress-di-syllabic words

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Unit 3:

Lesson-1: Stephen Hawking-Positivity 'Benchmark' from "**Infotech English**", Maruthi Publications

Lesson-2: Shakespeare's Sister by Virginia Woolf from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

Grammar: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Pronunciation: word stress-poly-syllabic words

Unit 4:

Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography from "**Infotech English**", Maruthi Publications

Lesson-2: Telephone Conversation-Wole Soyinka from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Reading for Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing SOP, writing for media.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

Grammar: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Pronunciation: Contrastive Stress

Unit 5:

Lesson-1: Stay Hungry-Stay foolish from "**Infotech English**", Maruthi Publications

Lesson-2: Still I Rise by Maya Angelou from **"The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving.

Reading: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

Reading for Writing: Writing academic proposals- writing research articles: format and style.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Pronunciation: Stress in compound words

Prescribed text books for theory:

1. "**Infotech English**", Maruthi Publications. (Detailed)
2. **"The Individual Society",** Pearson Publications. (Non-detailed)

Reference books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
MATHEMATICS - III (BS1203) **(Common to all Branch's for I Year B. Tech)**					

Course Objectives:

- To familiarize the techniques in partial differential equations.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Objectives: At the end of the course, the student will be able to

- Interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- Estimate the work done against a field, circulation and flux using vector calculus (L5)
- Apply the Laplace transform for solving differential equations (L3).
- Find or compute the Fourier series of periodic signals (L3)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- Identify solution methods for partial differential equations that model physical processes (L3)

UNIT I: Vector calculus: **(10 hrs)**

Vector Differentiation: Gradient — Directional derivative — Divergence — Curl — Scalar Potential. Vector Integration: Line integral — Work done — Area — Surface and volume integrals — Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

UNIT II:Laplace Transforms: **(10 hrs)**

Laplace transforms of standard functions — Shifting theorems — Transforms of derivatives and integrals —
Unit step function — Dirac's delta function — Inverse Laplace transforms — Convolution theorem (without proof).
Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III:Fourier series and Fourier Transforms: **(10 hrs)**

Fourier Series: Introduction — Periodic functions — Fourier series of periodic function — Dirichlet's conditions — Even and odd functions — Change of interval — Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) — Fourier sine and cosine integrals — Sine and cosine transforms — Properties — inverse transforms — Finite Fourier transforms.

UNIT IV:PDE of first order: **(8 hrs)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions — Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT V: Second order PDE and Applications: (10 hrs)

Second order PDE: Solutions of linear partial differential equations with constant coefficients — RHS term of the type e^{ax+by} ,$\sin(ax+by)$, $\cos(ax+by)$, $x^m y^n$

Applications of PDE: Method of separation of Variables — Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

Text Books:

1. **B.S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10thEdition, Wiley-India.
2. **Dean. G. Duffy**, Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
3. **Peter O' Neil**, Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
ENIGINEERING PHYSICS (BS1208)					

Course Objectives:

Physics curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by JNTUniversity:kakinada that serves as a transit to understand the branch specific advanced topics. The course is designed to:

- Impart concepts of mechanics required to identify forces and moments in mechanical systems by vector representation-extend Newton's second law for inertial and non-inertial frames of reference- study different types of harmonic oscillatory motions.
- Tap the Simple harmonic motion and its adaptability for improved acoustic quality of concert halls- impart concepts of flaw detection techniques using ultrasonics.
- Study the structure- property relationship exhibited by solid materials within the elastic limit.
- Impart knowledge in basic concepts of LASERs along with its Engineering applications- Familiarize types of sensors for various engineering applications
- Explore the knowledge of magnetic and dielectric materials and their utility in appliances.

UNIT-I **(10hrs)**

MECHANICS: Basic laws of vectors and scalars, rotational frames-conservative and non – conservative forces , $F = -\text{grad } V$, Newton's laws in inertial and linear accelerating non-inertial frames of reference, rotating frame of reference with constant angular velocity, Harmonic oscillator ; damped harmonic motion ; Forced oscillations and resonance.

Outcome:

The students will be able to

- Identify forces and moments in mechanical systems using scalar and vector techniques
- extend Newton's second law for inertial and non-inertial frame of reference
- explain simple harmonic motion and damped harmonic motions

UNIT-II **(10hrs)**

ACOUSTICS & ULTRASONICS: Introduction – Reverberation - Reverberation time - Sabine's formula (Derivation using growth and decay method)–absorption coefficient and its determination-factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by Magnetostriction and piezoelectric methods – Detection of ultrasonics - acoustic grating - Non-Destructive Testing- pulse echo system through transmission and reflection modes - Applications.

Outcome:

The students will be able to

- explain how sound is propagated in buildings
- analyze acoustic properties of typically used materials in buildings
- ~~recognize sound level disruptors and their use in architectural acoustics~~
- Use of ultrasonics in flaw detection using NDT technique

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT-III **(9hrs)**

ELASTICITY:, stress, strain, Hooke's law, stress-strain curve, generalized Hooke's law with and without thermal strains for isotropic materials, different types of moduli and their relations, bending of beams – Bending moment of a beam – Depression of cantilever.

Outcome:

The students will be able to

- Understand the elasticity and plasticity concepts
- Study different types of moduli and their relation
- Analyze the concepts of shearing force and moment of inertia

UNIT-IV **(9hrs)**

LASERS & SENSORS: Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium Neon laser – Applications.

SENSORS (qualitative description only): Different types of sensors and applications; Strain and Pressure sensors- Piezoelectric, magnetostrictive sensors, Temperature sensor - bimetallic strip, pyroelectric detectors.

Outcome:

The students will be able to

- **Understand** the basic concepts of LASER light Sources
- Study Different types of laser systems
- Identify different types of sensors and their working principles

UNIT-V **(10hrs)**

MAGNETISM & DIELECTRICS: Introduction – Magnetic dipole moment – Magnetization-Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr Magneton - Classification of magnetic materials (Dia, Para and Ferro) – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – Applications of Ferromagnetic materials.

Introduction - Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative)-Lorentz internal field – Claussius_Mossoti equation- Frequency dependence of polarization - Applications of dielectrics.

Outcome:

The students will be able to

- **explain** the concept of dielectric constant and polarization in dielectric materials.
- **summarize** various types of polarization of dielectrics .
- **interpret** Lorentz field and Claussius_Mosotti relation in dielectrics.
- **classify** the magnetic materials based on susceptibility and their temperature dependence.
- **explain** the applications of dielectric and magnetic materials .
- **Apply** the concept of magnetism to magnetic devices.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Text Books:

1. "Engineering Mechanics" by Manoj K Harbola, Cengage Publications 2nd Eds.
2. "A text book of Engineering Physics" by P G Kshirsagar & M N Avadhanulu, S Chand & Company Ltd.
3. "Engineering Physics" by R K Gaur and S L Gupta, Dhanpat Rai Publications.
4. "Sensor and Transducers" by Ian R Sinclair, Elsevier (Newnes) 3rd Eds.

Reference Books:

1. "Engineering Physics" by M R Srinivasan, New Age International Publishers.
2. "Lectures on Physics" by Richard P Feynman, Pearson Publishers, New Millennium Eds.
3. "Lasers and Non-linear Optics" by B B Laud, New Age International Publishers (3rd Eds.).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
BASIC ELECTRICAL & ELECTRONICS ENGINEERING (ES1206)					

Preamble:
This course covers the topics related to analysis of various electrical circuits, operation of various electrical machines and electronic components to perform well in their respective fields.

Learning Objectives:
- To learn the basic principles of electrical circuital law's and analysis of networks.
- To understand principle of operation and construction details of DC machines.
- To understand principle of operation and construction details of transformers, alternator and 3-Phase induction motor.
- To study operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn operation of PNP and NPN transistors and various amplifiers.

Unit - I
Electrical Circuits
Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits – star-delta and delta-star transformations.-Numerical Problems.

Unit - II
DC Machines
Principle of operation of DC generator – EMF equation – types of DC machines – torque equation characteristics of DC motors – applications – three point starter – speed control methods of DC motor – Swinburne's Test-Brake test on DC shunt motor-Numerical problems.

Unit - III
AC Machines:
Transformers
Principle of operation and construction of single phase transformers – EMF equation – Losses – OC & SC tests – efficiency and regulation-Numerical Problems.
AC Rotating Machines
Principle of operation and construction of alternators – types of alternators Regulation of alternator by synchronous impedance method – principle of operation of synchronous motor – principle of operation of 3-Phase induction motor – slip-torque characteristics – efficiency – applications-Numerical Problems.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Unit IV
Rectifiers & Linear ICs
PN junction diodes – diode applications (half wave and bridge rectifiers). Characteristics of operation amplifiers (OP-AMP) – application of OP-AMPs (inverting, non-inverting, integrator and differentiator)-Numerical Problems.

Unit V
Transistors
PNP and NPN junction transistor, transistor as an amplifier– frequency response of CE amplifier – Basic concepts of feedback amplifier-Numerical problems.

Learning Outcomes:
The student should be able to:
- Analyse various electrical networks.
- Understand operation of DC generators,3-point starter and DC machine testing by Swinburne's Test and Brake test.
- Analyse performance of single-phase transformer and acquire proper knowledge and working of 3-phase alternator and 3-phase induction motors.
- Analyse operation of half wave, full wave bridge rectifiers and OP-AMPs.
- Understanding operations of CE amplifier and basic concept of feedback amplifier.

Text Books:
1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electronic Devices and Circuits by R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference Books:
1. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
3. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
4. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications,2nd edition
5. Industrial Electronics by G.K. Mittal, PHI

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		1	0	3	2.5
ENGINEERING DRAWING (ES1203)					

Course Objective: Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Unit I
Objective: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.
Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.
Curves: Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents & normals for the curves.
Scales: Plain scales, diagonal scales and vernier scales

Unit II
Objective: To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.
Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

Unit III
Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.
Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

Unit IV
Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both the planes.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Unit V

Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer Aided Design, Drawing practice using Auto CAD, Creating 2D&3D drawings of objects using Auto CAD

Note: In the End Examination there will be no question from CAD.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

Course Outcome: The student will learn how to visualize 2D & 3D objects.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		0	0	2	1
COMMUNICATION SKILLS LAB (HS1203)					

UNIT I:
Oral Activity: JAM, Hypothetical Situations, Self/Peer Profile
Common Errors in Pronunciation, Neutralising Accent

UNIT II:
Oral Activity: Telephonic Etiquette, Role Plays
Poster Presentations

UNIT III:
Oral Activity: Oral Presentation skills, Public speaking
Data Interpretation

UNIT IV:
Oral Activity: Group Discussions: Do's and Don'ts- Types, Modalities

UNIT V:
Oral Activity: Interview Skills: Preparatory Techniques, Frequently asked questions, Mock Interviews.
Pronunciation: Connected speech (Pausing, Tempo, Tone, Fluency etc.,)

References:

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
8. Technical Communication- Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
9. Technical Communication- Gajendrea Singh Chauhan, Smita Kashiramka, Cengage Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		0	0	3	1.5
ENGINEERING PHYSICS LAB (BS1209)					

(Any 10 of the following listed 15 experiments)

LIST OF EXPERIMENTS:

1. Determination of Rigidity modulus of a material- Torsional Pendulum.
2. Determination of Young's modulus by method of single cantilever oscillations.
3. Determination of Acceleration due to Gravity and Radius of Gyration - Compound Pendulum.
4. Verification of laws of vibrations in stretched strings – Sonometer.
5. Determination of spring constant of springs using coupled oscillators.
6. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus
7. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
8. Measurement of magnetic susceptibility by Gouy's method.
9. Determination of ultrasonic velocity in liquid (Acoustic Grating)
10. Determination of dielectric constant by charging and discharging method
11. Determination of wavelength of Laser by diffraction grating
12. Determination of particle size using Laser.
13. Determeination of Pressure variation using strain Gauge sensor.
14. Determination of Moment of Inertia of a Fly Wheel.
15. Determination of Velocity of sound –Volume Resoantor.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		0	0	3	1.5
BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (ES1208)					

Learning Objectives:

- To predetermine the efficiency of dc shunt machine using Swinburne's test.
- To predetermine the efficiency and regulation of 1-phase transformer with O.C and S.C tests.
- To obtain performance characteristics of DC shunt motor &3-phase induction motor.
- To find out regulation of an alternator with synchronous impedance method.
- To control speed of dc shunt motor using Armature voltage and Field flux control methods.
- To find out the characteristics of PN junction diode & transistor
- To determine the ripple factor of half wave & full wave rectifiers.

Section A: Electrical Engineering:

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C. shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (predetermination of efficiency and regulation at given power factors).
3. Brake test on 3-phase Induction motor (determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method.
5. Speed control of D.C. Shunt motor by
   a) Armature Voltage control b) Field flux control method
6. Brake test on D.C. Shunt Motor.

Section B: Electronics Engineering:

The following experiments are required to be conducted as compulsory experiments:

1. PN junction diode characteristics a) Forward bias b) Reverse bias (Cut in voltage and resistance calculations)
2. Transistor CE characteristics (input and output)
3. Half wave rectifier with and without filters.
4. Full wave rectifier with and without filters.
5. CE amplifiers.
6. OP- amp applications (inverting, non inverting, integrator and differentiator)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Learning Outcomes:

The student should be able to:

- Compute the efficiency of DC shunt machine without actual loading of the machine.
- Estimate the efficiency and regulation at different load conditions and power factors for single phase transformer with OC and SC tests.
- Analyse the performance characteristics and to determine efficiency of DC shunt motor &3-Phase induction motor.
- Pre-determine the regulation of an alternator by synchronous impedance method.
- Control the speed of dc shunt motor using Armature voltage and Field flux control methods.
- Draw the characteristics of PN junction diode & transistor
- Determine the ripple factor of half wave & full wave rectifiers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		0	0	2	1.5
ENGINEERING WORKSHOP & IT WORKSHOP (ES1220)					

Engg Workshop

Course Objective: To impart hands-on practice on basic engineering trades and skills.
Note: At least two exercises to be done from each trade.
Trade:

1.Carpentry	1. T-Lap Joint
	2. Cross Lap Joint
	3. Dovetail Joint
	4. Mortise and Tenon Joint
2.Fitting	1. Vee Fit
	2. Square Fit
	3. Half Round Fit
	4. Dovetail Fit
3.Black Smithy	1. Round rod to Square
	2. S-Hook
	3. Round Rod to Flat Ring
	4. Round Rod to Square headed bolt
4.House Wiring	1. Parallel / Series Connection of three bulbs
	2. Stair Case wiring
	3. Florescent Lamp Fitting
	4. Measurement of Earth Resistance
5.Tin Smithy	1. Taper Tray
	2. Square Box without lid
	3. Open Scoop
	4. Funnel
6.IT Workshop	1.Assembly & Disassembly of Computer

IT Workshop

COURSE OBJECTIVES:

The objective of IT Workshop is to

1. Explain the internal parts of a computer, peripherals, I/O ports, connecting cables
2. Demonstrate basic command line interface commands on Linux
3. Teach the usage of Internet for productivity and self paced lifelong learning
4. Describe about Compression, Multimedia and Antivirus tools
5. Demonstrate Office Tools such as Word processors, Spreadsheets and Presentation tools

Computer Hardware:

Experiment 1: Identification of peripherals of a PC, Laptop, Server and Smart Phones: Prepare a report containing the block diagram along with the configuration of each component and its functionality, Input/ Output devices, I/O ports and interfaces, main memory, cache memory and secondary storage technologies, digital storage basics, networking components and speeds.

Operating Systems:

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Experiment 2: Internet Services:

- Web Browser usage and advanced settings like LAN, proxy, content, privacy, security, cookies, extensions/ plugins
- Antivirus installation, configuring a firewall, blocking pop-ups
- Email creation and usage, Creating a Digital Profile on LinkedIn
- Source control on Github, Hackerrank, Codechef, HackerEarth, etc
- Google hangout/ Skype/ gotomeeting video conferencing
- archive.org for accessing archived resources on the web

Productivity Tools:

Experiment 3: Demonstration and Practice on archival and compression tools

- scanning and image editing tools
- OCR and text extraction
- audio players, recording using Mic, editing, podcast preparation
- video players, recording using webcam/camcorder, editing
- podcast, screencast, vodcast, webcasting

Office Tools:

Experiment 4: Demonstration and Practice on Text Editors like Notepad++, Sublime Text, Atom, Brackets, Visual code, etc

Experiment 5: Demonstration and practice on Microsoft Word, Power Point

Experiment 6: Demonstration and practice on Microsoft Excel.

Experiment 7: Demonstration and practice on LaTeX and produce professional pdf documents.

Experiment 8: Cloud based productivity enhancement and collaboration tools:

- Store, sync, and share files with ease in the cloud using Google Drive
- Document creation and editing text documents in your web browser using Google docs
- Handle task lists, create project plans, analyze data with charts and filters using Google Sheets
- Create pitch decks, project presentations, training modules using Google Slides
- Manage event registrations, create quizzes, analyze responses using Google Forms
- Build public sites, internal project hubs using Google Sites
- Online collaboration through cross-platform support using Jamboard
- Keep track of important events, sharing one's schedule, and create multiple calendars using Google Calendar

TEXT BOOKS:

1. Computer Fundamentals, Anita Goel, Pearson Education, 2017
2. PC Hardware Trouble Shooting Made Easy, TMH

REFERENCES:

1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr.N.B.Vekateswarlu, S.Chand

WEB RESOURCES:

1. https://explorersposts.grc.nasa.gov/post631/2006-2007/computer_basics/ComputerPorts.doc
2. https://explorersposts.grc.nasa.gov/post631/2006-2007/bitsnbyte/Digital_Storage_Basics.doc
3. https://www.thegeekstuff.com/2009/07/linux-ls-command-examples
4. https://www.pcsuggest.com/basic-linux-commands/
5. https://www.vmware.com/pdf/VMwarePlayerManual10.pdf
6. https://geek-university.com/vmware-player/manually-install-a-guest-operating-system/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

7. https://gsuite.google.com/learning-center/products/#!/

COURSE OUTCOMES:

Students should be able to:

1. Assemble and disassemble components of a PC
2. Construct a fully functional virtual machine, Summarize various Linux operating system commands,
3. Secure a computer from cyber threats, Learn and practice programming skill in Github, Hackerrank, Codechef, HackerEarth etc.
4. Recognize characters & extract text from scanned images, Create audio files and podcasts
5. Create video tutorials and publishing, Use office tools for documentation, Build interactive presentations, Build websites, Create quizzes & analyze responses.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

I Year - II Semester		L	T	P	C
		0	0	3	1
ENGINEERING EXPLORATION PROJECT (PR1201)					

COURSE OBJECTIVES:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating illdefined problems.
- Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Task 4: Empathizing

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8:

- Final Report Submission and Presentation

Note: The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

REFERENCES:

1. Tom Kelly, *The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm* (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:

- Human-Centered Design Toolkit (IDEO); https://www.ideo.com/post/design-kit
- Design Thinking Boot Camp Bootleg (Stanford D-School); https://dschool.stanford.edu/resources/the-bootcamp-bootleg
- Collective Action Toolkit (frogdesign); https://www.frogdesign.com/wpcontent/uploads/2016/ 03/CAT_2.0_English.pdf
- Design Thinking for Educators (IDEO); https://designthinkingforeducators.com/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
DEVELOPMENT OF MINERAL DEPOSITS					

Course Objectives: To impart the knowledge of mineral deposits and to make the student learn and understand the ordinary methods of drilling, blasting and special methods of shaft sinking. Also to make the student understand the detonators and drivage of drifts.

UNIT I:
Various types of development openings shape and size, Selection of suitable type for actual situations raises, winzes or passes, ore chutes.

UNIT II:
Location of shaft shape and size, incline and vertical shafts. Surface arrangements for sinking shafts, tools and equipments ordinary methods of sinking drilling, blasting removal of debris and water.

UNIT III:
Ventilation and lighting, temporary and permanent lining, widening and deepening of shafts.

UNIT IV
Special methods of shaft sinking piling, caisson, freezing and cementation method of shaft sinking Modern techniques of shaft sinking. Design of shafts inserts and pit bottoms

UNIT -V:
Classification and properties of explosives, detonators. Detonating cords, and detonating fuse and nonel detonator. Blasting systems, electrical and non electrical methods, delay blasting techniques. Blasting in open pit mines, blasting in underground coal and metal mines. Mechanics of blasting.

UNIT -VI:
Drivage of drifts, organization and cycle of operations, drilling, blasting, blasting patterns, loading, transport, support, drainage, ventilation and lighting. Mechanized drifting, road heading and tunnel boring.

Course Outcomes: Students can design procedure for shaft sinking ;drilling and blasting for various mining operations.

TEXT BOOKS:
1. Surface Mining by Dr. G.B.Mishra,Dhanbad publishers,1978
2. EMT Volume-I by D.J.Deshmukh(9th edition),central techni publication.

REFERENCE BOOKS:
1. SME Hand Book
2. Blasting Manual- Sandhu & Pradhan.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
FLUID MECHANICS AND HYDRAULIC MACHINES					

Course Objective: The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

UNIT I

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric gauge and vacuum pressure – measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT II

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow.circulation and vorticity. Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT III

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis: Similitude and modeling – Dimensionless numbers

UNIT IV

Basics of turbo machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

UNIT V

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT VI

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Course Outcomes: Identify importance of various fluid properties at rest and in transit. understand the concept of boundary layer theory and flow seperation. plot velocity and pressure profiles for any given fluid flow. evaluate the perfomance characteristics of hydraulic turbines and pumps.

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
3. Fluid Mechanics and Hydraulic Machines/ RK Bansal/Laxmi Publications (P) Ltd.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley ,John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements)
5. Fluid Mechanics and Hydraulic Machines by Domkundwar & Domkundwar, Dhanpatrai & Co.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
MINE SURVEYING – I					

Course Objectives: To impart the knowledge of measurements of distances and angles, determination of different levels and level difference and computation of areas, volumes which includes determination of capacity of reservoirs, volumes of barrow pits. The knowledge of modern instruments like Theodolite surveying and tachometric surveying, designing & setup of curves and global positioning systems.

UNIT – I

Introduction & distances and direction: Overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications. Direct and indirect ranging, chaining along sloping ground. Obstacle in chaining, errors and their elimination.

Distance measurement conventions and methods; use of chain and tape, Electronic distance measurements, Meridians, Azimuths and Bearings, declination, computation of angle.

UNIT – II

Leveling and contouring: Concept and Terminology, Temporary and permanent adjustments-method of leveling. Characteristics and Uses of contours- methods of conducting contour surveys and their plotting. Methods of plane table, radiations. Intersection, traversing and resection. 2-point and 3-point problem. Adjustment and common error in plane table survey.

UNIT – III

Computation of areas and volumes: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

UNIT –IV

Theodolite & tacheometric surveying: Theodolite, description, uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite. Trigonometrically leveling, traversing.

Stadia and tangential methods of Tachometry. Distance and Elevation formulae for Staff vertical position.

UNIT – V

Curves: Types of curves, design and setting out – simple and compound curves.

UNIT -VI

Introduction to geodetic surveying, Total Station and Global positioning system, Introduction to Geographic information system (GIS).

Course Outcomes: Students can perform surveying of mine areas with variopous instruments such **as** Theodolite , plane table , total station etc,.

TEXT BOOKS:

1. "Surveying (Vol – 1, 2 & 3), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi
2 .Duggal S K, "Surveying (Vol – 1 & 2), Tata Mc.Graw Hill Publishing Co. Ltd. New Delhi, 2004.

REFERENCE BOOKS:

1.Surveying and levelling by R. Subramanian, Oxford university press, New Delhi
2.Mine surveying and levelling by S.Gatak(vol-i,ii,iii)
3.Surveying by Kanetkar

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
MINING GEOLOGY – I					

Course objectives: Geo means "earth" and logos means "science". Hence geology is the science of the earth or the study of the earth. Geology is a must for mining engineers as they deal with the material of the earth's crust i.e. rocks and minerals. Truly speaking, all the material (rock, mineral , soil etc) are the outcome of one of the processes viz. igneous, sedimentary and metamorphic. In mining the ore, geology plays an important role. It gives a clear picture about the nature of the material, the attitude of the beds, structures caused by deformed forces, etc. Hence, Geology helps in choosing the method of exploitation, finding the solution for the problems associated.

UNIT – I
Definition of Geology – Branches of Geology – Importance of Geology in Mining – Interior of the earth – Weathering, Erosion, Denudation, Geological processes. Ground water – Origin and occurrence – Hydrological cycle - Sources of water in Mines - Classification of rocks based on porosity and permeability – Water table and types of Ground water – Geological controls on ground water movement in mines. Crystallography: Characteristics of Crystals – Laws of Crystallography – Classification and study of crystal systems.

UNIT – II
Mineralogy: Definition of mineral – Classification of minerals – Physical and chemical properties of minerals – Study of Silicate structures individual minerals.

UNIT – III
Mineralogy: Study of individual groups – Quartz – Feldspar – Pyroxenes – Amphiboles – Micas – Aluminum silicates – Garnets – Olivine.

UNIT – IV
Optical Mineralogy : Ordinary light and Polarized light – Reflection, refraction, double refraction – Polarizing and Ore microscopes - Polarizer and analyzer – Thin sections and polished sections – Examination of the minerals under the microscope – Optical properties – Pleochroism, Extinction, Interference colors.

UNIT – V
Petrology : Igneous petrology – Rocks , 3 fold classification – Origin, form, structures, textures and classification of igneous rocks – Bowen's reaction principle – Study of rocks – Granite, syenite, gabbro, pegmatite, dolerite.

UNIT – VI
Sedimentary petrology – Formation, structures, textures and classification of sedimentary rocks – Petro graphic characteristics of conglomerate, breccia, sandstone, shale, limestone – Metamorphic petrology – Formation, structures, textures and classification of metamorphic rocks – Petrography of gneiss, schist, slate, marble, quartzite, charnockite.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

TEXT BOOKS :

1. Engineering and general Geology by Parbin Singh,kataria ,S.k.sons publishers.
2. Principles of Engineering Geology by K.M.Bangar , standard publishers and distributers

REFERENCE BOOKS:

3. A text book of Geology – G.B.Mahapathra

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-I
Introduction to Managerial Economics and demand Analysis:
Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:
Theories of Production and Cost Analyses:
Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:
Introduction to Markets, Theories of the Firm & Pricing Policies:
Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:
Introduction to Accounting & Financing Analysis:
Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

Unit – V:
Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS:

A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCES:

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
4. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - I Semester		L	T	P	C
		0	0	3	2
COMPUTER AIDED ENGINEERING DRAWING PRACTICE					

Course Objective: To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

UNIT-I:
Projections of solids: Projections of Regular Solids inclined to both planes – Auxiliary Views.

UNIT-II:
Sections of solids: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.
Development and interpenetration of solids: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts.

UNIT-III:
Interpenetration of right regular solids: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.
Perspective projections: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).

In part B computer aided drafting is introduced.

UNIT IV:
Introduction to computer aided drafting: Generation of points, lines, curves, polygons, dimensioning. Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling,.

UNIT V:
View points and view ports: view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete , joint , single option.

UNIT VI:
Computer aided solid modeling: Isometric projections, orthographic projections of isometric projections, Modeling of simple solids, Modeling of Machines & Machine Parts.

TEXT BOOKS :
1. Engineering drawing by N.D Bhatt , Charotar publications.
2. Engineering Graphics, K.C. john, PHI Publications

REFERENCES:
1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

7. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9. Engineering Graphics – PI Varghese, Mc Graw Hill
10. Text book of Engineering Drawing with auto-CAD , K.venkata reddy/B.S . publications.
11. Engineering Drawing with Auto CAD/ James D Bethune/Pearson Publications
12. Engineering Graphics with Auto CAD/Kulkarni D.M, Rastogi A.P, Sarkar A.K/PHI Publications

End Semester examination shall be conducted for **Four** hours with the following pattern:

a) Two hours-Conventional drawing
Two hours – Computer Aided Drawing

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

		L	T	P	C
II Year - I Semester		**0**	**0**	**3**	**1.5**
MINE SURVEYING – I LAB					

Course objectives: To Understand different equipment and compare accuracy levels and to study several experiments and conversant with it. To find the importance of latest technology through total station. To be familiar with conventional symbols used in mines. it enables the student to attain good practical knowledge.

List of Experiments

1. Triangulation survey by theodolite
2. Measure horizontal and vertical angles by theodolite
3. Measure horizontal angles by method of repetition and reiteration using theodolite
4. Trigonometric Leveling - Heights and distance problem
5. Signs and conventions used by GSI, MMR, CMR
6. Finding heights and distance using Principles of tachometric surveying
7. Curve setting – different methods by total station
8. Setting out works for buildings & pipe lines.
9. Determine area using total station
10. Traversing using total station
11. contouring using total station
12. Determination of remote height using total station
13. Coordinate measurement by total station and GPS
14. Traversing and recording position of points by GPS
15. Distance, gradient, Difference, height between two inaccessible points using total stations.

Course outcome: Familiar with equipment and capable to do work independently at any time if you get chance

EQUIPMENT TO BE USED:

1. Theodolites, and leveling staffs.
2. Tachometers.
3. Total Station

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - I Semester		L	T	P	C
		0	0	3	1.5
FLUID MECHANICS AND HYDRAULICS MACHINES LAB					

Course Objective: To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.

Course Outcomes: Student will be able to utilize the knowledge in the design of water supply pipe networks and measure the rate of flow in pipes and channels. Students will have confidence in the hydraulic design of turbines and should be able to identify suitable pumps and turbines for different working conditions.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
DRILLING AND BLASTING					

Course Objectives:
To understand the principles and mechanism of different drilling methods, novel drilling techniques. To learn the basic mechanism of rock fragmentation by blasting. To know the various types of explosives and accessories used in blasting. To learn the different methods of blasting adopted in surface and underground coal / non-coal mines including adverse effects of blasting & their control

UNIT I: Principles of Drilling and Drill bits
Principles of drilling: Principles of rock drilling, drillability, factors affecting the drillability, selection of drills.
Drill Bits: Various types of drill bits, study of bit life, factors affecting bit life, Thrust and rotation

UNIT-II: Explosives
Historical development, properties of explosives, low and high explosives, ANFO, slurries, Emulsion explosives, heavy ANFO, permitted explosives, testing of permitted explosives, bulk explosive systems-PMS, SMS, substitutes for explosives and their applications- hydrox, cardox, airdox.

UNIT-III: Firing of Explosives and blasting methods
A: Firing of Explosives: Safety fuse, detonating cord and accessories, detonators, Exploders, Electric firing and non-electric firing, electronic detonators, NONEL blasting.
B: Blasting methods**:** Preparation of charge, stemming and shot firing, choice and economical use of explosives, misfires, blown out shots, incomplete detonation, their causes, prevention and remedies.

UNIT-IV: Handling of Explosives
Surface and underground transport of explosives, storage and handling of explosives, magazines, accidents due to explosives, precautions and safety measures during transportation.

UNIT-V: Mechanics of blasting and effects of blasting
Mechanics of blasting: Factors affecting rock breakage using explosives, theory of shaped charge, detonation pressure, coupling, shock waves impedance, critical diameter.
Effects of blasting: Vibrations due to blasting and damage criteria, fly rocks, dust, fumes, water pollution and controlled blasting.

Course Outcomes:
At the end of the course, students will be able to
1:Understand Principles of drilling and various types of drill bits.
2:Understand different types of Explosives.
3:Apply different methods of Blasting according to the conditions.
4:Deal with the Explosives.
5:Understand Mechanics of blasting and effects of blasting

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

TEXT BOOKS:

1. Blasting in ground excavations and mines, Roy Pijush Pal, Oxford and IBH, 1st ed 1993
2. Drilling technology handbook, C.P. Chugh, Oxford and IBH, 1st ed, 1977 .

REFERENCES:

1. Rock blasting effect and operation, Roy Pijush Pal, A.A. Balkema, 1st ed, 2005
2. Elements of mining technology, Vol-1, D.J. Deshmukh
3. Blasting operations, B.Hemphill Gary, Mc-graw Hill, 1st ed 1981
4. Explosive and blasting practices in mines, S.K.Das, Lovely prakashan, 1st ed, 1993.

E RESOURCES:

1. http://technology.infomine.com/reviews/blasting/welcome.asp?view=full
2. https://miningandblasting.wordpress.com/list-of-technical-papers/
3. Science direct

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
MECHANICS OF SOLIDS					

Course Objectives:
The objective of this subject is to provide the basic concepts of mechanical behaviour of the materials under various loads, provides knowledge on shear force and bending moment diagrams of beams and knowledge about stress distribution across various cross sections of beams.

UNIT I: Simple Stresses & Strains
Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress–strain diagram for ductile and brittle material–Working stress–Factor of safety–Lateral strain, Poisson's ratio & volumetric strain.
Elastic Module & the relationship between them–Bars of varying section–composite bars–Temperature stresses. Strain energy – Resilience–Gradual, sudden, impact and shock loadings

UNIT II: Shear Force and Bending Moment
Definition of beam –Types of beams–Concept of shear force and bending moment–SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, UVL and combination of these loads–Point of contra flexure–Relation between SF and BM and rate of loading at section of a beam

UNIT III: Bending Stresses & Shear Stresses
A: Bending Stresses: Theory of simple bending– Assumptions– Neutral axis – Derivation of bending equation: M/I=f/y=E/R –Determination bending stresses– section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections–Design of simple beam sections.
B: Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections – rectangular, circular, triangular, I, T and angle sections.

UNIT IV: Deflection of Beams &Torsion
Deflection of Beams: Bending into a circular arc–slope, deflection and radius of curvature – Differential equation for the elastic line of a beam– Double integration and Macaulay's methods– Determination of slope and deflection for cantilever and simply supported beams subjected to point loads- UDL – uniformly varying load.
Torsion: Theory of pure torsion – Assumptions – Derivation of torsion equation, polar section modulus – power transmitted by shafts – combined bending and torsion.

UNIT V: Analysis of Pin Jointed Plane Frames & Thin Cylinders
Analysis of Pin- Jointed Plane Frames: Determination of forces in the members of various types of cantilever & simply supported trusses using (i) Method of Joints (ii) Method of Sections.
Thin Cylinders: Thin seamless cylindrical shells–Derivation of formula for longitudinal and circumferential stresses– hoop, longitudinal and volumetric strains– changes in diameter and volume of thin cylinder

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcomes:

1)to understand the theory of elasticity including strain/displacement and Hooke's law relationships.
2) to analyze solid mechanics problems using classical methods and energy methods.
3) to solve torsion problems in bars and thin walled members.
4) to solve for stresses and deflections of beams under unsymmetrical loading.
5) to locate the shear center of thin wall beams.
6) to obtain stresses and deflections of beams on elastic foundations.
7) to obtain solutions to column buckling and plate problems.
8) to apply various failure criteria for general stress states at points.

TEXT BOOKS

1. S.Timshenko **"Strength of Materials",** D. Van Nostr and Company, inc., 3rd edition,1983
2. Ramamrutham **"Strength of materials",** Dhanpat Rai Publishing, 18th edition, 2014

REFERENCES

1. R..K. Rajput, **"**Strength of Materials" S. Chand company Pvt, 5th edition, 2014
2. R K Bansal "Strength of Materials" Lakshmi – publications, 6th edition, 2015
3. Bhavikatti "Strength of materials" Lakshmi publications, 4th edition, 2014.
4. R S Khurmi, "Strength of Materials" S Chand, revised edition, 2013.
5. D. S. Kumar, "Strength of Materials, S K Kataria & Sons, Reprint 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
MINING GEOLOGY-II					

Course Objectives: To impart the knowledge of the forces acting in the earth's crust, deformation caused by them, different economic minerals and emphasizes their distribution in India. students will know the basic principles of stratigraphy and procedure to be adopted in sampling and mineral wealth of India and Andhra Pradesh

UNIT – I

Structural Geology – Stratified rocks and their structures - Attitude of beds – Strike and dip – Thickness of beds – Folds – genesis, classification, identification in field, impact on landscape, mineral deposits and mining – Unconformities – Types, importance and identification – Faults – Definition, mechanism of faulting, classification, impact of faulting on topography, significance of faults in mining – Joints – definition and characteristics, classification, occurrence of joints in igneous, sedimentary and metamorphic rocks – Differences between joints and faults – Overlap – Inlier and outlier, their importance.

UNIT – II

Economic Geology – Ore minerals and gangue minerals – Syngenetic and epigenetic deposits – Processes of ore formation – Magmatic concentration, Sublimation, Contact metasomatism, Hydrothermal processes, Sedimentation, Evaporation, Residual and mechanical concentration, Oxidation and supergene enrichment, Metamorphism

UNIT – III

Origin, occurrence, distribution and uses of minerals of coal, Iron, lime stone, Lead, Zinc, Copper Manganese, Chromite, , Beach sands, Rock Phosphate, Clay and Graphite.

UNIT – IV

Stratigraphy – Definition principles of Stratigraphic correlation – Geological time scale - Indian stratigraphic scale physiographic divisions Economic minerals occurring in different systems, metallogenic epochs and provinces - Fossils – Conditions, mode of preservation and uses.

UNIT – V

Estimation of Ore reserves– Definition, classification and importance – Sampling – Definition, types, preservation of core samples and importance. Mineral wealth of India – Mineral wealth of Andhra Pradesh – Industrial uses of different minerals.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT – VI

Introduction to different methods of prospecting for mineral deposits – geological, geophysical, geochemical, geobotanical, aerial photography and remote sensing.

Course Outcomes: Students can understand the distribution of various minerals in India and abroad.Knowledge gained in stratigraphy,and structural geology will help in better evaluation of geo-mining conditions for design of appropriate excavation process

TEXT BOOKS:

1. Principles of Engineering Geology – Parbin Singh kataria , s.k and sons publishers
2. Principles of Engineering Geology – K.M.Bangar

REFERENCE BOOKS:

3. A text book of Geology – G.B.Mahapathra
4. Mining geology- Arogya Swamy

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year II Semester		L	T	P	C
		3	0	0	3
MINE SURVEYING –II					

Course Objectives: 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

UNIT I:
Correlation survey: Principles, Classification, Methods, Shaft Plumbing, Assumed Bearing, Weisback Triangle, Co-planning, Weis-back quadrilateral, Problems on correlation survey etc. and degree of accuracy. Orientation of underground net through adits, inclines and shafts. Depth of shaft. Magnetic and gyroscopic orientation

UNIT II:
Opencast, stope & subsidence survey: Opencast: Principles, methods and survey network, Calculation of areas and volumes, mid ordinate and average ordinate, trapezoidal method, Simpson method, contour method.
Subsidence survey: Principles, method and degree of accuracy, underground traversing, setting out gradients in tunnels and adits
Stope surveying**:** Definition, purpose, methods: Tape triangulation, Ray, steeply dipping ore bodies, moderately dipping ore bodies, degree of accuracy.

UNIT – III
Curve setting: Types of curves, simple and compound curves by linear and angular methods on surface and in the underground. Requirements and functions of a super elevation and transition curve.

UNIT IV
Modern survey: Special Mine surveys-survey of installations of Mine, EDM & ITS Application, GPS, total station, survey for connecting national grid. Field Astronomical terms and definitions. Determination of the meridian Longitude and latitude of a place.

UNIT V:
Photogrammetry: General principles, Elements of photogrametry; orientation of photographs, finding heights and distances of ground points from photographs. Gyrotheodolite survey. Elements of Photogrammetry, field astonomy: Principles & Definitions, Determination of true Meridian, Latitude & Longitude & Time

UNIT VI:
Problems in mine surveying. Dip & fault problems. Mine plans & sections, Types of plans, preparation and preservation of plans and sections. Regulations pertaining to mine plans and sections and mine surveying. duties and responsibilities of surveyors care and precaution in storage statutory responsibilities.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course outcomes:
Ready to do curve setting in surface and underground, able to do latest surveying by total station.

TEXT BOOKS:
1. Dr.B.C.Punimia "Surveying" Vol II & III
2. Kanetakar & Kulkarni "Surveying and Leveling" Vol – II

REFERENCES:
1 JJ.Holland K.Wardell "Coal mines series editor E.Mason", Vol – II
2 Statham "Coal Mining Practice" Vol- IV
3 Basak "Surveying & Levelling"
4 Ghatak "Mine Surveying and Levelling"

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year II Semester		L	T	P	C
		3	0	0	3
SURFACE MINING					

Course Objectives: To impart the knowledge of Opencast Mining, Ground Water control, use of drilling machines,Smooth Blasting and Pre- splitting, Mining methods and selection of high angle conveyor and In-Pit Crusher Conveyor System

UNIT-I:
Introduction: General consideration for the applicability of opencast mining, limits of open cast mining and its advantages and disadvantages. Method of opening box cut, selection of site for box cut.

UNIT-II:
Open Pit Layout and Design: Planning the layout and open pit mine with special reference to large mechanized mines. Optimum dimensions of open pit mines. Removal of over burden and disposal, open cast bench- number, height, width and slope angle of the bench. Factors affecting the stability of the slope. Various types of slope failures, problems on slope failures. Ground water control.

UNIT-III:
Drilling and Blasting: Drillability, mechanics of drilling, major types of drilling machines, basics of mechanics of blasting, principles of fragmentation.

UNIT- IV
Design of blasting: with special reference to heavy blasting, air blasting, ground vibrations, fly rocks novel methods of drilling, smooth blasting and pre-splitting.

UNIT-V:
Surface Mining Methods: Casting, strip, quarrying and Placer Mining, and Modern Methods Excavation and loading: Shovels, Dragline, Front-end loader, Stackers, Graders. Non-Cyclic Surface Mining: Bucket Wheel Excavators and Continuous surface miners.

UNIT-VI:
Transport Equipments: Dumpers, Aerial ropeways-monocable and bicable types and their constructional details. Shovel – dumper combination, high angle conveyor and in-pit crusher. Selection of equipments.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcomes: Detailed knowledge on various unit operations sich as drilling,blasting, transportation equipment helps the students in preparation of layouts for surface mines for required production of minerals

TEXT BOOKS:

1. Surface Mining Technology by S. K. Das, Lovely Prakashan, Dhanbad, 1994.
2. Surface Mining by G. B. Mishra, Dhanbad Publishers, 1978.

REFERENCE BOOKS:

1. Elements of Mining Technology, Vol. – I, D. J. Deshmukh, 6th Edition, Central Techno Publications, Nagpur, 1998.
2. Opencast Mining – R. T. Deshmukh, M. Publications, Nagpur, 1996.
3. Latest Development of Heavy Earth Moving Machinery Amithosh De, Annapurna Publishers, Dhanbad, 1995.
4. Rock Slope Engineering, Hoek and Bray, the Institution of Mining and Metallurgy, 1981.
5. Introductory Mining Engineering, Hartman, John Wiley and Sons, 1987.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
MINE ENVIRONMENTAL ENGINEERING-I					

Course objectives: To Understand atmosphere and mine atmosphere conditions, heat and humidity levels in mines and controlling method. To know the necessity of ventilation in mines and quantity and quality levels. To know about ventilation standards planning and layout.

UNIT - I

Mine air**:** 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. Sampling and testing of different gases using different detectors including multi-gas detector.

UNIT - II

Mine climate: 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.

UNIT - III

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

UNIT - IV

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.

UNIT – V

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

UNIT – VI

Ventilation layout for coal mining and metal mining. Calculation of air quantity and total mine head required for ventilating a mine. Introduction to Network analysis, Hardy – Cross method, Ventilation survey. Case study

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KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcomes: Familiar with mine ventilation systems, quantity and quality requirements, decide ventilation system and method and develop mine ventilation plan and layout for any given mine.

TEXT BOOKS:

1. Elements of Mining Technology - Vol II- D. J. Deshmukh, 9th Edition, Central Techno Publication
2. Mine Environment and Ventilation – G. B. Mishra, Oxford University Press, 1994.

REFERENCE BOOKS:

1. Mine ventilation and air conditioning – Howard L. Hartman. Wiley International, 1976.
2. Environmental Engineering in Mines – Vutukuri & Lama, Cambridge University Press, Cambridge,
3. Legislation in Indian mines a critical appraisal Vol. I and Vol. II – Prasad and Rakesh. Vivek Publications, Varanasi 1999.
4. Mine Ventilation Vol. – II, S. Ghatak, Coalfield Publishers, 1993.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - II Semester		L	T	P	C
		0	0	3	1.5
GEOLOGY LAB					

Objectives: To impart exposure on properties of minerals, faults and economic minerals

List of Experiments

1. Study of Physical properties minerals.
2. Demonstration of Crystal models
3. Demonstration of Optical properties of minerals
4. Study of important Igneous, sedimentary and metamorphic rocks.
5. Recognition of folds, faults, unconformities from maps.
6. Simple problems on strike and dip.

Course Outcomes: To Identify Mega-scopic minerals Mega-scopic rocks ,their properties and their site parameters such as contour, slope and aspect for topography and to know the occurrence of materials using the strike & dip problems.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - II Semester		L	T	P	C
		0	0	3	1.5
MECHANICS OF SOLIDS LAB					

Course Objectives: Student will be able to learn and understand the various basic concept and principles of properties of
materials like young's modulus and rigidity modulus.

LIST OF EXPERIMENTS:
1. Compression test by using UTM
2. Tensile test by using UTM
3. Bending test on simply supported beam
4. Bending test on cantilever beam
5. Torsion test
6. Hardness test usingBrinnel hardness tester
7. Hardness test using Rockwell hardness tester
8. Test on springs a) compression spring b) tension spring
9. Impact test using Izod
10. Impact test using Charpy
11. Fatigue test
12. Hoop stress andstrain relationship for the Thin Cylinder

Course Outcomes:
At the end of the course, students will be able to
1. Find out the hardness of different engineering materials.
2. Find out the Young's modulus of materials using deflection of beams
3. Determine the toughness of materials using Charpy and Izod test.
4. Understand the working principle of heavy machines like UTM, Hardness testers
5. Find out the Rigidity modulus of shafts using torsion test.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

II Year - II Semester		L	T	P	C
		0	3	0	0
PROFESSIONAL ETHICS AND HUMAN VALUES					

Course Objectives: To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality.Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties.

UNIT I: Human Values:
Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.
Principles for Harmony:
Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT II: Engineering Ethics and Social Experimentation:
History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments — Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

UNIT III: Engineers' Responsibilities towards Safety and Risk:
Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/sImmediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT IV: Engineers' Duties and Rights:
Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes- Industrial Espionage-Price Fixing-Whistle Blowing.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT V: Global Issues:
Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics - Intellectual Property Rights.

- Related Cases Shall be dealt where ever necessary.

Course Outcomes: It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

TEXT BOOKS:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill – 2003.

REFERENCE BOOKS:

3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.
4. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar- PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill - 2013

Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publication

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
UNDERGROUND COAL MINING TECHNOLOGY					

Course Objectives: To understand coal growth in India and all over the world and different terminology used in coal mining including modern methods. the student will have the new innovative thoughts through computer application.

UNIT - I

Introduction: Present situation and future growth of coal mining industry in India and world, different coal mining industries in India, factors effecting selection of mode of entry and different types of mode entry: incline, shaft, inclined shaft, coal mine development and its scenario, different terminology used in coal mine development, different coal mining methods, factors influencing choice of coal mining methods. Software application in coal mines for development and depillaring operations.

UNIT - II

Boad and Pillar Mining: applicability, limitations, advantages and disadvantages of Bord and pillar mining method, development and depillaring sequence operations in Bord and Pillar mining, and its related calculations, local fall, main fall, air blast. Dangers associated with B& P method and precautions. Case study with layout.

UNIT – III

Longwall Mining: Applicability, limitations, merits and demerits, different longwall mining methods, factors influencing selection of longwall method, method of development and depillaring and its related calculations. Thin seam and thick seam mining with longwall mining method, Case study with layout.

UNIT - IV

Thick Seam and deep seam Mining: Problems associated with thick and deep seam Mining, selection of mining method, caving and stowing methods, limitations and applicability: different slicing methods-(inclined Slicing, Horizontal Slicing, Diagonal Slicing, Transversely Inclined Slicing),and Caving methods (Sublevel Caving) Working Steep and Moderately Thick Seams: Blasting Gallery Method , room and pillar method , The Velenje Method, Descending Shield Method of Mining.

UNIT – V

Modern coal mining methods: applicability, limitations, merits and demerits of Inseam Mining and Horizon Mining, Hydraulic Mining, plough methods, chirimiri caving method, shield mining, method of extraction by coal gasification and contiguous seam. Working underneath surface features, extraction of multi seams, problems and issues: Coal Bed Methane. Goaf Control: strip packing or

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

solid stowing, Hydraulic Stowing etc. Procurement of stowing materials and its transportation, theoretical aspects and case studies.

UNIT – VI

Future Innovations: blind long hole pre-shattering methods, scientific mining approach, application of mining software for mine development and extraction and production planning and design of workings, Size and grade control by CSP and CWP,.. case study.

Course Outcomes: understand students about all coal mining methods and their limitations, handling and working in difficult working conditions in the field.

TEXT BOOKS:

1. Principles and Practices of Modern Coal Mining – R. D. Singh, New Age International, 1997.
2. Modern Coal Mining Technology – S. K. Das, 2nd edition, Lovely Prakashan Publishers, 1994.

REFERENCE BOOKS:

1. Underground Coal Mining Methods – J. G. Singh, Braj Kalpa Publishers, Varnasi, 2000.
2. Coal Mining – I.C.F. Statham, Vol. I, II, III and Vol. III. The Caxton Publishing Company Ltd. Inc. 1958.
3. Elements of Minning technology- D.J Deshmukh Vol.1
4. Modern Coal mining Technology: Samir kumar Das
5. Underground winning of coal:T.N Singh

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
MINE ENVIRONMENTAL ENGINEERING-II					

Course Objectives: Understand process of spontaneous heating, fires, explosion, inundation and adverse effects, rescue and recovery operation and standards of lighting arrangement.

UNIT – I:
Mine Fires: Classification, surface and underground fires, Prevention and control of underground fires, fire fighting and its organization, study of atmosphere behind sealed off areas, re-opening sealed off areas.

UNIT-II:
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

UNIT – III:
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. Dust production in mines and its control. Health hazards. Sampling and assessment of airborne dust.

UNIT – IV:
Inundations: Causes of mine inundations from surface and underground sources. Dams: Types, design, construction of water dams. Dewatering water logged workings, Precautionary and protective measures on surface and in underground when approaching old water logged areas and dewatering of water logged areas/workings, safety boring apparatus.

UNIT-V:
Mine Illumination/Mine Lighting: Technical terms in lighting and photometry, underground lighting, electric safety lamp, different types of portable lamps, methods of illumination in underground mines-Fixed system, mobile system. standards of mine lighting in opencast and underground mines, Illumination survey lamina and luminance calculations.

UNIT – VI:
Mine Rescue: Mine rescue and equipment, Short distance apparatus. Self-contained oxygen – breathing apparatus, Self rescuers, gas masks,rescue stations, rescue organization, reviving apparatus. Rescue and recovery work in connection with fire, explosions, and inundations. Basic principles of risk management.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course outcomes: prevent occurrence of disaster, familiar with rescue and recovery operation from fire, explosion inundation disasters

TEXT BOOKS:

1. *Elements Of Mining Technology Vol 2, Dj Deshmukh, Denett & Co publisher,2014*
2. *Mine Environment and Ventilation, G. B. Misra, Oxford University Press, 1986*

REFERENCE BOOKS:

1. M ine fire and spontaneous heating, S. P. Banarjee
2. Mine Ventilation – Penman
3. Ramulu M.A "Mine fires, explosions, rescue, recovery and inundations"
4. Fires in coal Mines L.C Kaku

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
ROCK MECHANICS					

Course Objectives: To study about application of Rock Mechanics in mining and allied engineering. To study Physico-Mechanical properties of rocks, non-destructive testing methods, time dependent properties of rock. To study the theories of failure and approaches used for open pit and underground designs.

UNIT-I:
Introduction: Definition of some important terms used in rock mechanics, application of rock mechanics in mining, introduction to stress analysis, stresses in two and three dimensions, Mohr's circle.

UNIT -II:
Physical properties of rocks and rock indices: Physical properties of rocks — density, porosity, moisture content, permeability, water absorption various indices of rocks like swell index, slake durability index, impact strength index, protodynakov index, etc., thermal conductivity, hardness, durability, rock mass classification.

UNIT -III:
Mechanical properties of rocks :
A:Preparation of test specimens, laboratory determination of mechanical properties of rocks - compressive strength, tensile strength, flexural strength, shear and triaxial strength,
B: Modulus of elasticity, Poisson's ratio, Mohr's envelope, effect of various parameters on the strength of rocks, in-situ strength, post failure behavior of rocks.

UNIT -IV:
Non-destructive testing methods and time dependent properties of rocks: Dynamic wave velocities, dynamic elastic constants, their determination in the laboratory, application in mining, time dependent properties of rocks, creep, mechanism of creep of rocks — different stages, rheological models.

UNIT -V:
Theories of failure of rocks &Design of underground workings: Different theories of failure of rocks, modes of failure - Griffith, Coulumb-Navier, Mohr's, Hoek-Brown, empirical criteria, etc. and their field of applications. Stress distribution in underground workings

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

TEXT BOOKS:

1. Vutukuri, V.S., and Lama, R.D., Handbook on Mechanical Properties of Rocks, Vol. I, II, III and IV, Transtech Publication, Berlin, 1974/78.
2. Peng, S.S., Ground Control, Wiley Interscience, New York, 1987.

REFERENCE BOOKS:

1. Obert, L. and Duvall, W.I., Rock Mechanics and Design of Structure in Rock John Wiley andSons Inc., New York, 1967.
2. Brady, B.H.G. and Brown, S.T., Rock Mechanics, Wiley Interscience, 1985.
3. Hoek, E., and Brown, S.T., Underground Excavations in Rocks, Institute of Mining

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
OPEN ELECTIVE- I **WATER WASTE MANAGEMENT**					

Course Objectives:

- Outline planning and the design of waste water collection ,conveyance and treatment systems for a community/town/city
- Provide knowledge of characterization of waste water generated in a community
- Impart understanding of treatment of sewage and the need for its treatment
- Summarize the appurtenance in sewage systems and their necessity
- Teach planning and design of septic tank and imhoff tank and the disposal of the effluent from these low cost treatment systems
- Effluent disposal method and realize the importance of regulations in the disposal of effluents in rivers

UNIT-I:
Introduction to Sanitation-Systems of sanitation- relative merits and demerits - collection and conveyance of waste water - classification of sewerage systems-Estimation of sewage flow and storm water drainage- fluctuations-types of sewers- Hydraulics of sewers and storm drains-design of sewers- appurtenances in sewerage- cleaning and ventilation of sewers

UNIT-II:
Pumping of wastewater: Pumping stations-location- components- types of pumps and their suitability with regard to wastewaters.
House Plumbing: Systems of plumbing-sanitary fittings and other accessories-one pipe and two pipe systems-Design of building drainage

UNIT-III:
Sewage characteristics-Sampling and analysis of waste water-Physical, chemical and Biological examination-measurement of BOD & COD- BOD equations
Treatment of sewage: Primary treatment- Screens-grit chambers- grease traps- floatation-sedimentation-design of preliminary and primary treatment units.

UNIT-IV:
Secondary treatment: Aerobic and anaerobic treatment process -comparison.
Suspended growth process: Activated sludge process, principles, design and operational problems, modifications of Activated sludge processes, Oxidation ponds, Aerated Lagoons.
Attached Growth process: Trickling Filters-mechanism of impurities removal-classification-design - operation and maintenance problems. RBCs. Fluidized bed reactors

UNIT-V:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Miscellaneous Treatment Methods: Nitrification and Denitrification- Removal of phosphates- UASB-Membrane reactors- Integrated fixed film reactors. Anaerobic Processes: Septic Tanks, Imhoff tanks-working principles and Design-disposal of septic tank effluent-FAB Reactors

UNIT-VI:

Bio-solids (sludge) management: Characteristics- handling and treatment of sludge-thickening-anaerobic digestion of sludge

Disposal of sewage: Methods of disposal- disposal into water bodies- Oxygen sag Curve- Disposal into sea-disposal on land- sewage sickness

Course Outcomes:

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

- Plan and design the sewerage systems
- Characterization of sewage
- Select the appropriate appurtenances in the sewerage systems
- Select the suitable treatment flow for sewage treatment
- Identify the critical point of pollution in a river for a specific amount of pollutant disposal into the river

TEXT BOOKS:

1. Waste water Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw- Hill edition.
2. Elements of Environmental Engineering by K.N. Duggal, S.Chand & Company Ltd. New Delhi, 2012.

REFERENCE BOOKS:

1. Environmental Engineering-II: Sewage disposal and Air pollution Engineering , by Garg, S.K.,: Khanna publishers
2. Sewage treatment and disposal by Dr.P.N.Modi & Sethi.
3. Environmental Engineering, by Ruth F. Weiner and Robin Matthews- 4th Edition Elsevier, 2003
4. Environmental Engineering by D. Srinivasan, PHI Learning private Limited , New Delhi,2011.
5. Environmental Engineering by Howard S.Peavy , Donald R. Rowe, Teorge George Tchobanoglus- Mc-Graw-Hill Book Company, New Delhi, 1985
6. Wastewater Treatment for pollution control and Reuuse, by soli.J Areivala, sham R Asolekar, Mc-GrawHill, New Delhi; 3rd Edition
7. Industrial water & wastewater management by KVSG MuraliKrishna

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
OPEN ELECTIVE- I **ENVIRONMENTAL IMPACT ANALYSIS**					

Course Objectives: This course introduces influencing factors of environmental.

UNIT I:

Sustainable development: Ecology, Sustainable activity and Control Measures, Land environment, Land degradation due to mining; Physical and biological reclamation.

Ecology: Introduction to ecology, ecosystem structures and functions. Sustainable development,environmental carrying capacity - concepts & principles; Base line studies, pre-mining status of environment.

UNIT II:

Water pollution: Study of surface sources of water. Global hydrological cycle; Self purification mechanism, sources of water pollution, important parameters–pH, turbidity, oil & grease, nitrates, DO, BOD, COD; Eutrophication, deoxygenation, Study of water table. Acid mine drainage and heavy metal pollution–preventive and control measures.

UNIT III:

Air, Noise and Vibration pollution:

A: Air pollution due to dust: Atmospheric composition and meteorology; Sources of air pollution – Pollution due to Drilling and Blasting, HEMM, Air pollution due to mine gases, mine fires, mine explosions, point and non-point pollutions; Emission factors; Control measures – extraction, suppression and consolidation of dust.

B: Noise and vibration: Basic concepts, sources, monitoring and control measures. Vibration Reduction techniques.Waste disposal, Fuels, oils and Hazardous materials produced due to mining and dealing them.

UNIT IV:

Environmental administration: The basis for Environmental laws. Laws related to mining environment; National procedure for accreditation of laboratories and consulting organizations, Different functional area experts, Environmental co-ordinators. Impact assessment. Impact management. Environmental clearance of projects procedure for mines and projects.

UNIT V:

Human Angle to the Mine Environment: Public participation in project approvals. Project effected persons, Socio Economic Study. Corporate Social Responsibility: Concepts and principles.140

Mine closure: Concepts and principles. Audit of Mine Closure activities. A case study.

TEXT BOOKS:

1. Environmental impact assessment: a guide to best professional practices 2011 by charles H. Eccleston
2. Water pollusion , Agarwal S. K, New Age International (P) Limited, 2009

REFERENCE BOOKS:

1. Fundamentals of air pollution by daniel vallero
2. Fundamentals of noise and vibration by frank fahy, john walke

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
OPEN ELECTIVE- I **DISASTER MANAGEMENT AND MITIGATIONS**					

Course Objectives: To learn the principles of systematically designing and using large scale Database Management Systems for various applications.

UNIT-I: An Overview of Database Management, Introduction- What is Database System, What is Database-Why Database- Data Independence- Relation Systems and Others- Summary, Database system architecture, Introduction- The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator-The Database Management Systems- Client/Server Architecture.

UNIT-II: The E/R Models, The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and Er Diagrams-Entities Attributes, and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the Er Models, The Relational Model Integrity Constraints Over Relations- Key Constraints –Foreign Key Constraints-General Constraints, Relational Algebra and Calculus, Relational Algebra- Selection and Projection- Set Operation, Renaming – Joins- Division- More Examples of Queries, Relational Calculus, Tuple Relational Calculus- Domain Relational Calculus.

UNIT-III: Queries, Constraints, Triggers: The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

UNIT-IV: Schema Refinement (Normalization) : Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).

UNIT-V: Transaction Management and Concurrency Control: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods : lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery.

UNIT-VI: Overview of Storages and Indexing, Data on External Storage- File Organization and Indexing – Clustered Indexing – Primary and Secondary Indexes, Index Data Structures, Hash-Based Indexing – Tree-Based Indexing, Comparison of File Organization

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcomes: Describe a relational database and object-oriented database. • Create, maintain and manipulate a relational database using SQL • Describe ER model and normalization for database design. • Examine issues in data storage and query processing and can formulate appropriate solutions. • Understand the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage. • Design and build database system for a given real world problem

TEXT BOOKS:

1. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy(2009),Universities press.
2. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.
2. 'Disaster Management' edited by H K Gupta (2003),Universities

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
MINING MACHINERY AND MECHANIZATION-I					

Course Objectives:

To understand the electrical layouts and power distribution in mine, rope haulage layouts, technical details and applications. To study the various modes of transport means and electrical circuits, the types of pumps, installations and design calculations. And to know the various statutory aspects like CMR, MMR and the relevant DGMS circulars related to this course.

UNIT I

Introduction: Different types of motive power used in mines – their fields of application, relative merits and demerits; transmission and distribution of compressed air in mines, compressed air drills. Elements of the transport system, classification and techno-economic indices. Wire ropes – classification, construction, fields of application, rope capping and splicing; deterioration of rope in use and its prevention; testing of ropes, selection and maintenance, rope calculations.

UNIT II

Rope Haulage: Rail Track and tubs– gauge; layout, curves, turnouts and cross-over, track maintenance, main features of rolling stock like tubs, mine cars man riding cars and tipplers;Types of rope haulages – merits, demerits and fields of application, constructional features, safety appliances and rope haulage calculations.

UNIT III

Other Transport Systems-I: Locomotives – diesel, trolley-wire, battery locomotives, constructional features and safety devices and comparison of different types; underground and surface battery charging stations and safety measures, locomotive calculations;

UNIT IV

Other Transport Systems-I: shuttle cars, underground trucks, load-haul- dumpers, SDL vehicles, aerial rope ways, gravity transport, principles of hydraulic& pneumatic transportation and their fields of application, electric layouts, man-riding systems.

UNIT V

Pumping & Conveying: Different types of drives, installation and maintenance of pumps and pipes in shafts and roadways, electrical layouts, various sources of water in mines, design of sumps.

Face haulage and conveyors – Various types of conveyors, Scraper chain conveyors, AFCs, belt conveyors, cable belt conveyor, shaking and vibrating conveyors, armoured flexible conveyors, high angle conveying, electrical layouts. Numerical problems in conveyors

UNIT VI

Mine Electrical Engineering: Distribution of electric power in mines, types of mine cables and their fields of applications, mining switch gears and their installation in hazardous atmosphere, flame proof enclosures, intrinsically safe circuits, (examples) safety aspects and signalling. Mine telephone system and latest development in mine communications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcomes: The students will have basic knowledge on motive power used in mines, pumping, rope haulage and face haulage & conveying transport systems. They also will know about mine electrical engineering in all statutory aspects.

TEXT BOOKS:

1. Cherkassky, B.M., Pumps, Fans, Compressors, MIR Publishers, 1980.
2. Walker, S.C., Mine Winding and Transport, Elsevier, 1988.

REFERENCE BOOKS:

1. Karelin N.T., Mine Transport, Orient Longmans, N. Delhi.
2. Mason, E., Coal Mining Series, Mining Machinery, Virtue and Company Ltd., London.
3. Statham, I.C.F., Coal Mining, Vol. I, II, III and IV, Caxton Eastern Agencies, Calcutta.
4. Deshmukh D.J., Elements of Mining Technology, Vol. III EMDEE Publishers, Nagpur,1989.
5. Universal Mining School - Lecture notes, cardiff, U.K

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		0	0	3	1.5
ADVANCED ENGLISH COMMUNICATION SKILLS LAB					

1. Introduction

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context. The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

i) Gather ideas and information, to organize ideas relevantly and coherently.

ii) Engage in debates.

iii) Participate in group discussions.

iv) Face interviews.

v) Write project/research reports/technical reports.

vi) Make oral presentations.

vii) Write formal letters.

viii) Transfer information from non-verbal to verbal texts and vice versa.

ix) To take part in social and professional communication.

2. Course Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

i) To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.

ii) Further, they would be required to communicate their ideas relevantly and coherently in writing.

3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

i) Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.

ii) Vocabulary building – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.

iii) Group Discussion – dynamics of group discussion , intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

iv) Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

v) Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.

vi) Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.

vii) Technical Report writing – Types of formats and styles, subject matter – organization, clarity, coherence and style, planning, data-collection, tools, analysis.

4. Minimum Requirement:

The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with LAN with minimum 60 multimedia systems with the following specifications:

iii) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB

iv) Headphones of High quality

5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

Suggested Software:

i) Clarity Pronunciation Power – part II

ii) Oxford Advanced Learner's Compass, 7th Edition

iii) DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.

iv) Lingua TOEFL CBT Insider, by Dreamtech

v) TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

The following software from 'train2success.com'

i) Preparing for being Interviewed,
ii) Positive Thinking,
iii) Interviewing Skills,
iv) Telephone Skills,
v) Time Management
vi) Team Building,
vii) Decision making

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge6. Books Recommended:

1. Effective Technical Communication, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd.
2. A Course in English communication by Madhavi Apte, Prentice-Hall of India, 2007.
3. Communication Skills by Leena Sen, Prentice-Hall of India, 2005.
4. Academic Writing- A Practical guide for students by Stephen Bailey, Rontledge Falmer, London & New York, 2004.
5. English Language Communication : A Reader cum Lab Manual Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
6. Body Language- Your Success Mantra by Dr. Shalini Verma, S. Chand, 2006.
7. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice, New Age International (P) Ltd.,Publishers, New Delhi.
8. Books on TOEFL/GRE/GMAT/CAT by Barron's/cup
9. IELTS series with CDs by Cambridge University Press.
10. Technical Report Writing Today by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers, 2005.
11. Basic Communication Skills for Technology by Andra J. Rutherford, 2nd Edition, Pearson Education, 2007.
12. Communication Skills for Engineers by Sunita Mishra & C. Muralikrishna, Pearson Education, 2007.
13. Objective English by Edgar Thorpe & Showick Thorpe, 2nd edition, Pearson Education, 2007.
14. Cambridge Preparation for the TOEFL Test by Jolene Gear & Robert Gear, 4th Edition.
15. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

Advanced Communication Skills Lab Practicals:

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		0	0	3	1.5
MINE SURVEYING II LAB					

Course Objectives:
To familiarize with the various surveying instruments and methods.

List of experiments:
1. Correlation by two shafts by total station.
2. Correlation by single shaft by total station.
3. Correlation by single shaft weiss quadrilateral by total station.
4. Curve ranging offsets from long chord
5. Curve ranging Ranking methods
6. Curve Tachometric methods
7. Curve ranging total station method.
8. Reading mine plans
9. Determination of K and C in Tachometric Survey
10. Finding Horizontal &Vertical distance by Tachometer
11. Study of opencast map.
12. Study of underground map.

Course Outcomes:
At the end of the course, students will be able to
1:Conduct the correlation by two shaft co-planar method.
2:Conduct the correlation by shaft weisbatch methods and shaft Weiss quadrilateral methods.
3:Set a curve by ranging offsets from long chord and ranging ranking method.
4:Set a curve by Tachometric and ranging Tachometric methods.
5: Conduct the weisbatch method

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		0	0	3	1.5
ROCK MECHANICS LAB					

Course Objectives:
To study the various of methods to determine the properties of rocks. To study the operation of various instruments and equipment.

List of experiments:
1. Determination of RQD of rocks.
2. Determination of Protodyaknov index of a given rock sample
147
3. Determination of point load index strength of a given rock sample
4. Determination of porosity of rocks.
5. Determination of hardness of rocks
6. Determination of uniaxial compressive strength of a given rock sample
7. Determination of tensile strength of a given rock sample using Brazilian method
8. Determination of shear strength of rocks
9. Determination of modulus of elasticity of given rock sample using strain gauge.
10. Determination of triaxial strength of rock and drawing of Mohr's envelope
11. Study of different types of supports used in mines
12. Study of design of mine pillars.

Course Outcomes:
At the end of the course, students will be able to
1:Determine the properties of rocks
2:Knowledge of various instruments and equipment.
3:Design the supports for mine openings.
4:Design mine pillars.
5: Knowledge of various equipments.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - I Semester		L	T	P	C
		1	0	0	0.5
Corporate Social Responsibility in mining					

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
MINE GROUND CONTROL					

Objectives:
To Identify and understand the factors contributing to strata control problems in mines, Analyze &design requirement of support system in different workings of mine, To Apply different instruments for evaluation of strata condition and organization of strata control in mines

UNIT-I:
Pit slope stability & subsidence: Approach to slope stability, slope parameters, different types of slope failures, factors affecting slope stability, introduction to methods of failure, analysis, determination of factor of safety,. Introduction to different rock slope stabilization techniques.
Theories of subsidence, factors affecting subsidence, subsidence surveys, subsidence prediction techniques, subsidence control – surface and underground measures, pseudo- mining damage.

UNIT -II:
Pillar design and rock burst :Strength of pillars, barrier and shaft pillar design – load estimation, factor of safety, various formulae, rock burst and bumps — phenomena, causes, prediction, monitoring and control, gas outbursts

UNIT -III:
Underground supports:
A:Various methods of roof examination, objectives and limitations of supports, ground forces and in situ stresses, pressure arch theory, evolution of supports, conventional supports — timber and steel supports, arches, yielding supports.
B: Rock and cable bolting, shotcreting, roof stitching, support of shaft bottoms, galleries, junctions and places of roof falls, freshly exposed roof supports, design of supports, long wall powered supports. Design of systematic support rules for B & P and long wall - development, depillaring, etc.

UNIT -IV:
Instrumentation : Convergence indicators, load cells, strain gauges, flat jacks, LVDT, dial gauges, pressure cells and recorder, anchorage testing equipment, laboratory and in situ measurements, hydraulic fracturing rock mechanics instrumentation for B & P and long wall workings

UNIT -V:
Stowing / filling: Selection and preparation of stowing materials, principal methods of stowing, collection, fields of application and limitations, preparation and transport of materials, surface, underground and face arrangements, design of stowing plants.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

TEXT BOOKS:

1. Strata Control in Mineral Engineering, T. Bieniawski Ziti, John Wiley & Sons, 1987
2. Underground winning of Coal, T.N. Singh, Oxford and IBH New Delhi,1992

REFERENCE BOOKS:

1. Engineering Rock Mass Classifications, Bieniawski Z.T. 1989, Wiley, New York
2. Longwall mining, Peng S S and Chiang HS, Wiley, New York, 708p.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
MINERAL PROCESSING					

Course Objectives: This course introduces Objectives of mineral processing, characteristics of minerals and coal, crushing methods, separation methods, methods of concentration, fields of application and limitations.

UNIT-I
Introduction **:** Scope, objectives and limitations of mineral processing, liberation and beneficiation.
Combinations: Theory and practices of crushing and grinding; different types of crushing and grinding equipment's – their applications and limitations.

UNIT -II
Size Separation : Laboratory size analysis and interpretation; settling of solids in fluids; industrial screens, mechanical classifiers and hydro cyclones.
Gravity Concentration Methods: Jigging, Heavy media separation, flowing film concentrators–theory, applications and limitations.

UNIT -III:
Froth Floatation:
A: Physico-chemical principles, reagents.
B**:** Machines, floatation of sulphides, oxides and coal.

UNIT -IV:
Applications and Limitations of concentrating technique: Applications and limitations of magnetic concentration, high tension concentration**,** Ore sorters
Dewatering: Thickeners, filters, thermal drying.

UNIT -V:
Flow Sheets: Simplified flow sheets for coal, zinc, iron, and manganese ores.
Magnetic methods of concentration Principles, Fields of Application and Limitation.

TEXT BOOKS:
1. Mineral Processing – S.K. Jain, CBS Publishers & Distributors,2018
2. Mineral Processing – Barry AWills, Elsevier,2006
REFERENCE BOOKS:
1. Mineral beneficiation a concise basic course by D.V. Subba rao
2. Introduction to Mineral Processing – V. Malleswar Rao, Indian Academy of Geoscience

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
UNDERGROUND METAL MINING TECHNOLOGY					

Course objectives: Understand peculiarities and limitations of metal mining, familiar with different stoping methods, design and planning of stoping methods.

UNIT – I:
Introduction to Metal Mining: Peculiarities of Metallic ferrous deposit. Scope and limitations of underground mining, Opening up of underground deposits, choice of entry shaft and combination and their applicability, limitations.

UNIT – II:
Mine Developments: Methods of developments, Factors effecting choice of level interval, Cross cuts, Drive, shape and size of drive, winzes, Raises, block size, shaft station, ore bin, ore pass and their position in relation to ore body and general scheme of its development.Division of mining area into working units and level pattern, dimensions of panels and blocks.

UNIT –III:
Stoping: Classification of stoping methods, applicability, limitations, merits and demerits, Factors affecting choice of stopping methods like depth, dip, Width grade / value of deposit, physio mechanical characteristics of the ore and wall rocks. Stope design and production planning in various methods of stoping. Production and cycle time estimates. Stope and development support, mining cycles, shift times, estimating equipment's requirements

UNIT –IV:
Stoping Methods: Stoping without supports: Open stopping, overhand, underhand, breast stoping. Stoping with Supports: shrinkage stopping cut and fill stopping, square set stopping. Caving methods: Top Slicing, sublevel caving and block caving.

UNIT – V:
Special Stoping methods: Sublevel stoping, long-hole stoping, blast hole stoping, raise stoping, V.C.R Stoping, in-situ leaching, bio-mineral engineering, hydraulic mining, blast hole stoping, underground bench blasting, Extraction of remnant pillars, shaft pillars and contiguous reefs, their supporting system and special precautions during extraction.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT – VI:
Deep mining: concept of deep mining, special problems of deep mining, , salt potash and sulphur mining and their special problems, stoping practices in rock burst prone mines.Under sea mining, novel mining methods, application of tunnel and shaft boring machines and their applications.

Course outcome: Stope design and planning is essential in various stoping methods for effective production.

TEXT BOOKS:
1. Introductory Mining Engineering, Harman, John Wiley and sons,2002
2. Elements Of Mining Technology Vol 2, Dj Deshmukh, Denett & Co publisher,2014

REFERENCE BOOKS:
1. Deep Mining-jack Spalding, mining publications;
2. Peele:"Mineral engineers hand book"Vol.I&II
3. U/G Mining Method-Hustrulid, society for mining, metallurgy & Exploration
4. Wood-roof S.C:"Methods of working coal and metal mines",Vol.III
5. Shevyaov:"Mining and mineral deposits". 5. Popov:"Working of mineral deposits".

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
MINING MACHINERY AND MECHANIZATION-II					

Course Objectives:
To understand the functioning of winding engines and other winding accessories. To study surface and pit bottom layouts, various coal face machinery. To study the design and construction details of excavating & transporting equipment's used in surface mines. To know the various statutory aspects like CMR, MMR and the relevant DGMS circulars related to this course.

UNIT – I:
Winding engines**:** Winding systems, drum winders, drives, mechanical braking of winders, safety devices in winding, overwind and over speed protection, Koepe and multi-rope friction winding, electrical layouts. Duty cycles of drum winders of different drum cross-sections. Special problems of deep shaft winding.

UNIT – II:
Winding accessories and layouts: Head gear and their design, head sheave, cages and skips, suspension gear, shaft fittings and appliances – guides, keps, etc., signalling systems, winding calculations relating to rope size & numbers, capacity & power requirement for cages, skips, drum and Koepe winding systems. Surface and Pit-bottom layouts - Mine car circuits at the surface and pit bottom, creepers, skip winding – loading and discharge arrangements. Case studies, railway sidings and layouts.

UNIT – III:
Coal face machinery:
A: Construction, salient mechanical and electrical features and operations of coal drills and their control panels, different types of mechanical loaders, coal ploughs, and continuous miners.
B**:** Development road headers in face mechanization, longwall mining equipment, electrical and hydraulic layouts; condition monitoring of mining machinery for underground and opencast mines and ore handling plants, modern concepts in underground mine mechanization.

UNIT – IV:
Excavation and loading machinery in surface mines: Classification. Hydraulic system diagram. Under carriage. Design and Constructional details of Front end loaders, Hydraulic excavators and Electric Rope shovel, Backhoe, Dragline, and Bucket Wheel Excavator. Bucket Chain Excavator and Surface Miners.

UNIT – V:
Other machinery in surface mines**:** Classification of transport equipments; Construction and technical specifications of Dumpers of different types including multi-axial dumpers,, Tractors, trailers, dump trucks, Rippers (types), Motor Graders, Bull Dozers, Rock breakers, Road Compactors, Water Tankers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

TEXT BOOKS:

1. Elements of Mining Technology Vol. I & II, Deshmukh D.J., Denett & Company,2014
2. Pumps Focus Compressors Walkar, winding & Transport, Cherkasky B.M.

REFERENCE BOOKS:

1. Mine Mechanisation and Automation, Alemgren G, U.Kumar.
2. Coal Mining Series, Ernest Mason, London, 1952.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
(OPEN ELECTIVE-II) **INDUSTRIAL ROBOTICS**					

Course Objectives:

1. To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.
2. The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
3. Mathematical approach to explain how the robotic arm motion can be described.
4. The students will understand the functioning of sensors and actuators.

UNIT-I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

UNIT – II

Components of the industrial robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – III

Motion analysis: Homogeneous transformations as applicable to rotation and translation – problems.
Manipulator kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT – IV

Differential transformation and manipulators, Jacobians – problems
Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT V

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT VI

Robot actuators and feed back components:
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.
Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.
Robot applications in manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Identify various robot configuration and components,
2. Select appropriate actuators and sensors for a robot based on specific application
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains

Perform trajectory planning for a manipulator by avoiding obstacles

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu, 2008
2. Robotics and Control / Mittal R K & Nagrath I J / TMH,2003

REFERENCE BOOKS:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.
4. Introduction to Robotics / John J Craig / Pearson Edu.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
(OPEN ELECTIVE-II) **ARTIFICIAL INTELLIGENCE**					

Objectives: To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language. • To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs. • To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning

UNIT-I:

Introduction to artificial intelligence: Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI

UNIT-II:

Problem solving: state-space search and control strategies :Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterativedeepening a*, constraint satisfaction Problem reduction and game playing: Introduction, problem reduction, game playing, alphabeta pruning, two-player perfect information games

UNIT-III:

Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic

UNIT-IV:

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web

UNIT-V:

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools

UNIT-VI:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

Course outcomes: Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem. • Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc). • Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming). • Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

TEXT BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,2011

2. Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA,2016

REFERENCE BOOKS:

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5thed, PEA

2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer

3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

4. Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rded, TMH

5. Introduction to Artificial Intelligence, Patterson, PHI

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
(OPEN ELECTIVE-II)					
INTRODUCTION TO DATA BASE MANAGEMENT SYSTEM					

Cousre Objectives: To learn the principles of systematically designing and using large scale Database Management Systems for various applications.

UNIT-I:
An Overview of Database Management, Introduction- What is Database System, What is Database- Why Database- Data Independence- Relation Systems and Others- Summary, Database system architecture, Introduction- The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator-The Database Management Systems- Client/Server Architecture.

UNIT-II:
The E/R Models, The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and Er Diagrams-Entities Attributes, and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the Er Models, The Relational Model Integrity Constraints Over Relations- Key Constraints –Foreign Key Constraints-General Constraints, Relational Algebra and Calculus, Relational Algebra- Selection and Projection- Set Operation, Renaming – Joins- Division- More Examples of Queries, Relational Calculus, Tuple Relational Calculus- Domain Relational Calculus.

UNIT-III:
Queries, Constraints, Triggers: The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

UNIT-IV:
Schema Refinement (Normalization) : Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF). III Year – I Semester

UNIT-V:
Transaction Management and Concurrency Control: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods : lock granularity, lock types, two

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery.

UNIT-VI: Overview of Storages and Indexing, Data on External Storage- File Organization and Indexing – Clustered Indexing – Primary and Secondary Indexes, Index Data Structures, Hash-Based Indexing – Tree-Based Indexing, Comparison of File Organization

Course Outcomes : Describe a relational database and object-oriented database. • Create, maintain and manipulate a relational database using SQL • Describe ER model and normalization for database design. • Examine issues in data storage and query processing and can formulate appropriate solutions. • Understand the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage. • Design and build database system for a given real world problem

TEXT BOOKS:

1. Introduction to Database Systems, CJ Date, Pearson education, 2004
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition, 2000

REFERENCES BOOKS:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		0	0	3	1.5
MINERAL PROCESSING LAB					

Course objectives: To study various mineral processing technique to enrich minerals.

List of experiments:
1. Different sample division techniques like coning and quartering, riffle sampling techniques, etc.
2. Determination of crushing characteristics of a given mineral sample using jaw crusher
3. Determination of the grinding characteristics of a given mineral sample using ball mill.
4. Sieve analysis of a given sample and to calculate (a) percentage sample retained on screens (b) to plot sizing curves.
5. Concentration of a given mineral sample using mineral jig.
6. Concentration of a given mineral using Wifely table.
7. Concentration of a given mineral using froth flotation cell
8. Study of wash ability characteristic of a coal sample using float and sink test.
9. Study of sedimentation characteristics of a given sample.
10. Estimation moisture content by Drying of mineral sample.
11. Determining the average size of samples
12. Collection of sample by riffle sample technique.

Course Outcomes:
At the end of the course, students will be able to
1. Know different sample division techniques.
2. Determine the grinding and crushing characteristics of a given mineral sample.
3. Know the wash ability characteristic of a coal sample.
4. Determine the moisture content by Drying of mineral sample.
5. Determine the average size of samples.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		0	0	3	1.5
MINE ENVIRONMENTAL ENGINEERING LAB					

Course objective:

To be familiar with detection of different gases using deferent methods detectors and multi gas detector, to find flammable index of coal dust and understand the rescue and recovery operations using different rescue apparatus

List of experiments:

1. Determination of CO, CH4, H2S, SO2, O2, CO2, Nitrous fumes by corresponding detectors.
2. Study and application of infrared gas analiser.
3. Detection of different gases by Gas – Chromatograph
4. Detection of methane by different types of methano meters & flame safety lamp.
5. Determination index of flammability of coal dust.
6. Study and uses of proto – IV, Proto – V. Dragger – BG – 174 self contained breathing apparatus
7. Study and uses of self rescuer Gas mask, smoke helmet.
8. Study and use of reviving apparatus
9. Study of Born-Side safety boning apparatus.

Course outcomes: The student will familiar with rescue and recovery operation from different disasters in mine

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

III Year - II Semester		L	T	P	C
		0	0	3	1.5
MINING MACHINERY AND MECHANIZATION LAB					

Course Objectives:: To study the various machineries, ropes, conveyors and different types of loading machines.

1. Study of jack Hammer, lubricator and air leg.
2. Study of construction of different types of wire ropes.
3. Study of safety hooks used in winding.
4. Study of different types of haulage systems and attachment of tubs to the rope.
5. Study of tensioning arrangement in endless haulage and different types of haulage clips.
6. Study of haulage track, curves, diamond crossing.
7. Study of construction of mine tubs and cars along with their couplings.
8. Study of safety devices provided of haulage roads
9. Study of submersible pumps.
10. Study of Electrical and hydraulic layouts for longwall faces
11. Study of aerial rope ways.
12. Study of various types of head gear-fleet angle, Study of shaft fittings-signal systems, guides, safety dogs and protective roofing, study of guides– methods of support and tensioning arrangements.

Course Outcomes:

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

1: Understand the safety and efficiency of various haulage layouts and devices
2: Understand the safety and efficiency of various Winding arrangements and devices
3: Understand the safety and efficiency of various Pit top layouts and devices
4: Understand the safety and efficiency of various Pit bottom layouts and devices
5: Understand the safety and efficiency of various machineries used at coal faces.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		3	0	0	3
COMPUTER APPLICATIONS IN MINING					

Course Objectives: To introduce the concepts on computer basics and its applications on mining industry. It covers the the application of geo-statistical methods in sampling, reserve estimation, computation of grade-tonnage curves, production scheduling simulation and modeling of mine structures using simulation language.

UNIT-I

Introduction to structure terminology and peripherals, algorithms, flow charts, programs, dedicated systems. application in mining.

UNIT-II

Exploration, rocket topographic models, bore hole compositing, ore reserve calculation, interpolation, geostatical models, open pit design, ultimate pit design, introductory process control, underground mine design.

UNIT-III

Production scheduling: Operational simulation: Introduction, simulation overview, objective, understand the role of modeling. Understanding the basic concept in simulation, example of simulation in mining aspects, simulation of machine repair problem.

UNIT-IV

concept of variability and prediction, example with dumping time problem, fitting distribution with chi-square test, random number generation, properties of random number, pseudorandom number, random variants generation.

UNIT -V

methods of random variants generation, inverse transform method, acceptance rejection method, composition method, empirical method and rectangular approximation

UNIT-VI

simulation languages, GPPS and SLAM, logical flow diagram of different milling activities, coding with GPSS and SLAM of different mining problems. Computer control, remote control, automatic, applications and limitations of control

Course Outcomes:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Basic knowledge of computer applications is essential in the mineral industry as most of the software were already commercially available to meet different application areas of mining (opencast, underground methods). These software proven to be very effective and hence basic knowledge of computer and exposure to developments of computational skills to handle mining software is essential to be accepted by the industry. Application areas include rock engineering, mine design, slope stability, mining geo-statistics, financial analysis, valuation, risk analysis, feasibility etc.

TEXT BOOKS:

1. T.C.Bartee, digital computer fundamental, Mc Graw Hill, 4th edition 1984.

2. P.Malvino and D.P.leach digital principals and applications Mc Graw Hill 5th edition 1994.

REFERENCE BOOKS:

1.R.V. Ramani, application of computer methods in the mineral industry,published by society of mining engineers of AMIE,newyork city ,U.S.A, 1977.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		3	0	0	3
MINE PLANNING AND DESIGN					

Course Objectives: To study the planning aspects of production, scheduling and monitoring of openpit and underground mining for extraction of coal and other mineral deposits.

UNIT – I

Technical factors in mine planning, methodology of mine planning, short range & long range,mine modelling, mine simulation systems approach to mine planning based on mine subsystemand their elements, mine plan generation.

UNIT – II

Open Pit Mining**:** Selection of initial mine cuts, location of surface structures, division of mining area into blocks, mine design, bench drainage, geometry, haul roads, slope stability; open pit limit sand optimisation, calendar plan, production planning, production scheduling, economic productivity indices.

UNIT – III

Underground Mining: Location of mine entries, mine and auxiliary, optimisation of mine parameters, design of shaft pillars and protective pillars, planning of production capacity, layout of development drives /raises / winzes etc, length of faces, size of panels, etc, planning of support systems, ventilation, lay out of drainage system, planning production schedule and monitoring, selection of depillaring / stoping method, manpower management, economic/ productivity indices, technoeconomic analysis, mine reclamation design.

UNIT – IV

Equipment Planning: Latest technological developments in increase in both types and capacities of equipment used in mining operations. Planning and selection of equipment for different mining conditions. Equipment design for optimum drilling and blasting operations. Equipment information – performance, monitoring and expert systems. Innovative mining systems.

UNIT – V

Project Implementation and Monitoring **:** Pre-project activities – feasibility report, environment clearance, detailed project, report,sources of funds, import of technology, selection of contracts and contract administration,time management, cost control material management system, project quality assurance,social responsibility, government orders and guidelines. Environmental impact assessmentand preparation of environmental management plan. Mine closure plan.

Course Outcomes: Students will be able to plan open cast and undergrtound mines for given conditions of production ,selection of machinery etc., with reference to geo mining parameters.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

TEXT BOOKS:

1. Jayanth Bhattacharya, Principles of Mine Planning-Allied Publishers, Delhi 2003.
2. Hustrulid, W. and Kuchta, M., (eds)., Fundamentals of Open pit Mine Planning and Design, Elsevier, 1995.

REFERENCE BOOKS:

3. Ehrenburger, V and Fajkos, A., Mining Modelling, Elsevier, 1995.
4. Bawden, W.F., and Archibald., J.F., Innovative Mine Design for the 21st Century Elsevier,1993.
5. Passamehtoglu, A.G., Karpuz, C., Eskikaya, S. and Hizal, T., (Eds), Mine Planning and Equipment Selection, Elsevier, 1994.
6. Pazdziora, J., Design of Underground Hard Coal Mines, Elsevier, 1988.
7. Swilski, and Richards, Underground Hard Coal Mines, Elsevier, 1986. Singh, B. and Pal Roy, P., Blasting in Underground excavations and mines, CMR Dhanbad, 1993.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		3	0	0	3
MINE LEGISLATION & GENERAL SAFETY					

Course Objectives: It is very important to all mining engineering students because, it provides an insight to various laws, rules and Acts related to Mines Safety and mining legislation. A separate paper on the above subject is one of the requirements for the DGMS certification for qualifying in the exam of Mines Manager.

UNIT – I
General principles of mining laws, mines & Minerals (Regulation & Development), Act.

UNIT – II
Mineral concession rules, principle provision of mine act. Rules & regulation framed there under (CMR - 1957, MMR - 1961)

UNIT – III
Indian Electricity rule, Mine rescue rule, industrial dispute Act.

UNIT – IV
V-T rules, Pit Head Bath Rules, DGMS circular.

UNIT – V
Coal mines regulations and metalliferous mines regulations

UNIT - VI
Introduction to rescue rules, vocational training rules, maternity benefit act and rules. Causes & Classification of Accidents, accidents statistics, Accidents investigation & Reports.

Course Outcomes:
The student will be benefitted with this course paper as it covers all the mining legislation and statutory Ruls, Acts and amendments made from time to time. This paper is one of the qualifying papers for DGMS exams.

TEXT BOOKS:
1. Mine Act - 52 by B. K. Kejriwal
2. DGMS Circulars

REFERENCE BOOKS:
3. Mines Act, Mine regulations, Mine rules Govt. of India Publication
4. Legislation In Indian Mines - Critical Appraisal by Prasad & Rakesh

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		3	0	0	3
(PROFESSIONAL ELECTIVE COURSE- I) **ROCK SLOPE ENGINEERING**					

Course Objectives: To introduce the basic mechanics of rock slope failures To learn the types of rock failure and its influencing parameters

UNIT I Basic mechanics of rock slope failure:
Rock slope economics; continuum mechanics approach to slope stability; slope parameters; effect of water pressure; factor of safety of slopes; slope height vs slope angle; design of slopes.

UNIT II Geological and rock strength properties:
Geological parameters affecting slope stability; graphical representation of geological data; plotting and analysis of field measurements; physico-mechanical properties affecting slope stability, shearing on incline plane, determination of shear strength of rock and rock discontinuities; Ground water flow in rock masses; field measurement of permeability; measurement of water pressure.

UNIT III Plane failure:
Plane failure analysis; graphical analysis of stability; influence of ground water on stability; influence of tension crack; analysis of failure on a rough plane; rock reinforcement of slopes;

UNIT IV Wedge failure:
Analysis of wedge failure; wedge analysis including cohesion and water pressure; Wedge stability charts for friction only; case studies. Numerical problems.

UNIT V Circular and toppling failure:
Conditions for circular failure; derivation of circular failure analysis; effect of ground water; circular failure charts; Bishop's and Janbu's methods of failure analysis; case studies. Types of toppling failure; secondary toppling modes; analysis of toppling failure; limit equilibrium analysis of toppling failures; Influence of slope curvature on stability; slope depressurisation; protection of slopes; control of rock falls; measurement and monitoring and interpretation of slope displacements. Numerical problems.

UNIT VI Rock slope failure monitoring and slope stabilization:
Types of slope movement, Surface and Sub-surface monitoring methods inclusing instrumentation and techniques & Guidelines for monitoring programs. Causes of rock falls; Rock slope stabilization programs – stabilization by rock reinforcement & rock removal; protection measures against rock falls.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcome:
The students will know the fundamental mechanics of rock slope failure, types of failure and its influencing parameters

TEXT BOOKS:

1. Hoek, E and Bray, J.W., Rock Slope Engineering, Institution of Mining and Metallurgy, 1991.
2. Goodman, R.E., Rock Mechanics, John Wiley and Sons, 1989.
3. Singh, R.N. and Ghose, A.K., Engineered Rock Structures in Mining and Civil Construction, A.A. Balkema, Netherlands, 2006.

REFERENCE BOOKS:

1. Duncan C. Wylie and Chris Mah, Rock Slope Engineering, 4th Edition, 4th Edition, CRC Press, 456p, 2004.
2. John Read and Peter Stacey, Guidelines for Open Pit Slope Design, 1st Edition, CRC Press, 510p, 2009.
3. William A. Hustrulid (Ed), Michael K. McCarter (Ed) and Dirk J. A. Van Zyl (Ed), Slope stability in Surface Mining, Society for Mining, Metallurgy, and Exploration, 442p, 2001.
4. John Jaeger, N. G. Cook and Robert Zimmerman, Fundamentals of Rock Mechanics, 4th Edition, Wiley-Blackwell; 4 edition, 488p, 2007.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		3	0	0	3
(PROFESSIONAL ELECTIVE COURSE- I) MINE SUBSIDENCE ENGINEERING					

Course Objectives: The mine subsidence is a common phenomena in any underground coal mining operations. The subsidence prediction, causes and analysis and preventive measures to be taken form an important role in coal mining operations. The subsidence impact on surface structures, governing laws to subsidence control, instrumentation and monitoring techniques and to minimize such effects need to be emphasized.

UNIT-I
Introduction: strata movement at the mining horizon, convergence in mine working, factors influencing convergence in mine working. subsidence mechanism; Zones of movement in the ovelying beds, veritical and horizontal movements, subsidence trough, angle of draw, angle of break sub-surface subsidence.

UNIT-II
subsidence prediction: different methods of surface subsidence prediction - graphical, analytical, profile function, empirical and theoretical models.

UNIT-III
Time influence and impact on structures: Influence of item on subsidence, example from long wall and bord and pillar working.

UNIT -IV
Mining damage to building, industrial installations, railway lines, pipes cannels, etc.,

UNIT-V
calculation of ground movement over time. types of stress on structures stress-strain behavior of soils. Different standards suggested for mining and ground in respect of subsidence.

UNIT-VI
Time influence and impact on structures: influence of item on subsidence, examplr from long wall and board and pillar working.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

Course Outcomes:
The subsidence of mined out areas. The mechanism of failure of strata after creating the voids and filling the mine voids with different materials need to be addressed to monitor the ground movement.

TEXT BOOKS:
1. Kratzsch, H.Mining susnsidence Engineering, Sringer vertag publications, Berlin,1983

2. Whittakerm B.N. and Raddish, D.J.Subsudebce, occurrence, prediction and contol Elsvier publication amsterdam, 1989.

REFERENCE BOOKS:
1. Mining subsidence engineering, by Kratzsch, published by Nedra of Moscow,1978
2. Brauner, G.Subsidence due to underground Mining, Part I & II and III U.S. Department of Interior, Bureau of Mines, 1973

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		3	0	0	3
(PROFESSIONAL ELECTIVE COURSE- I) **MINE SYSTEMS ENGINEERING**					

Course Objectives:
The objective of this subject is to provide knowledge of solving the models for their optimal solutions.

UNIT -I: Introduction
Introduction to optimization techniques, Introduction to linear programming, problem formulations, graphical solutions, unboundedness, infusibility, unique solution, multiple solutions. Mining examples

UNIT -II:
Simplex method with different combinations of constraints, Big M method, Duality of linear programming, importance of dual problems, interpretations of solutions of primal from dual

UNIT -III: Transportation Problem
A: Formulation–Optimal solution, unbalanced transportation problem–Degeneracy, variants in assignment problems, mining examples.
B: Assignment problem – Formulation – Optimal solution - Mining examples

UNIT -IV: Inventory and Waiting line
Importance of Inventory, Introduction to inventory, basic assumptions in EOQ model, EOQ (Economic Order Quantity). Introduction to waiting line theory, basic assumptions in waiting line, determination of waiting time in quee, waiting time in system, Single channel quee systems – arrivals Poisson distributed, service time exponential distribution

UNIT-V:
Introduction to CPM, Importance of CPM, Determination of Early start times, Early finish times, Latest finish times, Critical path, Project duration, Crashing of a network, Importance of PERT, Probability of project completion time, Assumptions in PERT

Course Outcomes: students can optimize the production through implementation of various models such as CPM, PERT etc., for extraction of minerals.

TEXT BOOKS:
1. Introduction to O.R /Taha/PHI Publishers
2. Operations Research / S.D.Sharma/Kedarnath Publisher
REFERENCE BOOKS:
1. Operations Research /A.M.Natarajan, P.Balasubramani,A. Tamilarasi/Pearson Education.
2. Operations Research: Methods & Problems / Maurice Saseini, ArhurYaspan& Lawrence Friedman/ Literary Licensing
3. Operations Research / R.Pannerselvam,PHI Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		0	2	0	0
IPR & PATENTS					

Course Objectives: To know the importance of Intellectual property rights, which plays a vital role in advanced Technical and Scientific disciplines. Imparting IPR protections and regulations for further advancement, so that the students can familiarize with the latest developments.

Unit I Introduction to Intellectual Property Rights (IPR):
Concept of Property - Introduction to IPR – International Instruments and IPR - WIPO - TRIPS – WTO -Laws Relating to IPR - IPR Tool Kit - Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents - Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR - Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

Unit II Copyrights and Neighboring Rights:
Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law - Semiconductor Chip Protection Act.

UNIT III Patents:
Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Patent Registration and Granting of Patent - Exclusive Rights – Limitations - Ownership and Transfer — Revocation of Patent – Patent Appellate Board - Infringement of Patent – Compulsory Licensing — Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations.

UNIT IV Trademarks:
Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Deceptive Similarities - Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies – Passing Off Action.

UNIT V Trade Secrets:
Introduction to Trade Secrets – General Principles - Laws Relating to Trade Secrets - Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreements – Breach of Contract –Law of Unfair Competition – Trade Secret Litigation – Applying State Law.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

UNIT VI Cyber Law and Cyber Crime:
Introduction to Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions - E-commerce - Data Security – Authentication and Confidentiality - Privacy - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention and Punishment – Liability of Network Providers. Relevant Cases Shall be dealt where ever necessary.

Course Outcomes: IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents. Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements.

TEXTBOOKS:
1. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi.
2. Deborah E.Bouchoux: Intellectual Property, Cengage Learning, New Delhi.

REFERENCE BOOKS:
1. PrabhuddhaGanguli: Intellectual Property Rights, Tata Mc-Graw –Hill, New Delhi
2. Richard Stim: Intellectual Property, Cengage Learning, New Delhi.
3. Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4. Cyber Law - Texts & Cases, South-Western's Special Topics Collections.
5. R.Radha Krishnan, S.Balasubramanian: Intellectual Property Rights, Excel Books. New Delhi.
6. M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, Serials Pub.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		0	0	2	1.5
COMPUTER APPLICATION IN MINING LABORATORY					

Course Objectives: Providing basic introduction on CAD applications, with reference to generation of basic CAD drawings for mine planning. Different types of drawing commands, editing, query based commands, for the preparation of CAD graphics.

Part-A

1. Learning of the following commands using a CAD package.
2. Drawing Commands: Line, arc, circle; polygon, Donut, Solid, Spline Pline, Text, M Line, ellipse, dimensioning, object snaps point, Hatch, layers, Units.
3. Editing Commands: Limits, Erase, Array, Copy, Move, Offset, Stretch, Pedit, change properties, Trim, Extend, Fillet, Chamfer, Break, Mirror, Scale, Rotate, Zoom, Pan. Enquiry Commands: Id, list, Dist, Area, DB list, Status Selection sets i.e. window, crossing, fence, W polygon. Plotting.

Part-B

8 exercises (mining drawing) using any of the above commands.

Course Outcomes: The students will be provided with exposure on CAD graphics, to demonstrate these abilities in the form of CAD mine drawings.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - I Semester		L	T	P	C
		0	0	2	1.5
MINE PLANNING AND DESIGN LAB					

Course objectives: Creation and utilization of data base for various studies and applications of the same for planning and design of mining projects.

1. Determination of stripping ratio.
2. Determination of Pit limits.
3. Calculations of powder factor of blasting in open cast & underground mining blasting.
4. Calculation of fleet size for shovel, dumper combination in open cast mine.
5. Estimation/calculation of production in underground mine using, LHD, SDL ,RH, CM, long wall equipments.
6. Ventilation study & Calculation for bord &pillar and long wall panels in underground coal mines.
7. Design of Pillars.
8. Subsidence Predictions.
9. Problems on network analysis for ventilation
10. Slope stability problems.

Course Outcomes: Students can simulate the geomining parameters for planning and design of open cost and underground mines including selection of required machinery and equipment

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - II Semester		L	T	P	C
		3	0	0	3
MINE ECONOMICS AND INVESTMENT					

Course objectives: Study of estimation and valuation of mineral deposits, Study of project appraisal and Study of finance and accounting

UNIT I Introduction:
Mineral industry and its role in national economy; world and national mineral resources; Mining - A unique investment environment; special risk factors in mine investment and evaluation; national mineral policy.

UNIT II Ore reserve estimation :
Methods of sampling, sampling frequency; analysis of sampling data, estimation of reserves, introduction to geo-statistica l methods, classification of reserves.

UNIT III Mine valuation :
Time value of money; annuity; redemption of capital, net present value; depletion allowance; depreciation; inflation; escalation; rates of return; Hoskold's Two rate method;

UNIT IV Economic evaluation:
capital and operating cost including wages, incentives, material, etc.; assets; liabilities; cash flows and discounted cash flow; profitability index – their implications in mine economic evaluation.

UNIT V Project appraisal:
Methods of project evaluation – pay back, annual value, benefit/cost ratio, ERR and IRR, etc., evaluation of exploratory mining areas and operating mines; mine project financing, its risks and constraints; mine taxation; critical impact of depreciation, depletion, type of funding, reserves, life, etc. on mine profitability.

UNIT VI Finance and accounting:
Sources of mine funds – shares, debentures, fixed deposit, sinking fund, capital gearing, P & L account, balance sheet, typical case studies of mine feasibility. Cost estimation of individual mining operations and overall mining cost, cost control methods.

Course Outcomes:
The students will have knowledge on estimation and valuation of mineral deposits. They will possess about project appraisal, finance and accounting.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

TEXTBOOKS:

1 Deshmukh, R.T., Mineral and Mine Economics, Mira Publications, Nagpur, 1986.
2 Arogyaswamy, R.N.P. Courses in Mining Geology, Oxford and IBH Publishing Co., 1994.

REFERENCE BOOKS:

1 Sloan, D.A., Mine Management, Chapman and Hall, London, 1983.
2 Chatterjee, K.K., Mineral economics, Wiley Eastern, 1992.
3 Park, R.J., Examination and Valuation of mineral property
4 How to read a balance sheet ILO 1992.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year - II Semester		L	T	P	C
		3	0	0	3
NUMERICAL MODELLING IN MINING					

Course Objectives: To study the finite element methods, finite difference methods and boundaryelement methods. To understand the practical applications of numerical methods in mining field

UNIT-I: Introduction to Elastic and Plastic Models
Fundamentals, elastic, plastic, homogeneous and isotropic, non-linear elastic and elasto- plastic models.

UNIT -II: Finite Difference Methods:
Concept, formation of mesh element, finite difference patterns, solutions, application to mining.

UNIT -III: Finite Element Methods
A: Concept, discretization, element configuration, element stiffness, assemblage and solutions, two and three dimensional solutions.
B: Linear and non-linear analysis, applications in geomechanics; simulation of joints in strata.

UNIT -IV: Boundary Element Method
Concept, discretization, different methods of solution for isotropic and infinite media.

UNIT -V: Practical Applications in Mining and Rock Mechanics
Practical Applications in stress analysis, slope stability, subsidence prediction, and pillar design, rock burst, etc.

Course Outcomes: Students will get experience in application of various numerical methods to solve the design aspects of safe slopes,pillar design etc,. for underground and open cost mines.

TEXT BOOKS:
1. Desai, C.S. and Abel, J.F., Introduction to the finite Element Method, Van Nostrand Riehokl Co., New York, 1983.
2. Zienkiewicz, O.C., The Finite Element Method in Engineering Science, Tata McGraw Hill 1972

REFERENCE BOOKS:
1. Segerlind, L.J., Applied Finite Element Analysis, John Wiley and Sons, New York, 1987.
2. Mukhopadyay, M., Matrix Finite Element – Computer and Structural Analysis, Oxford and IBH Publishing co., 1984
3. Brown, E.T., (Ed) Analytical and Computational Methods in Engineering and Rock Mechanics, Allen and Unwin, London, 1987

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF MINING ENGINEERING

IV Year -II Semester		L	T	P	C
		3	0	0	3
PROFESSIONAL ELECTIVE COURSE-II)					
PLANNING OF UNDERGROUND METAL MINNING PROJECT					

Course Objectives:

The objective is to introduce the basic concepts and principles of underground metal mining methods and practices. The planning of different methods for stoping for the exploitation of ores, strata control problems followed by discussions on some case studies to enhance the understanding of these methodologies for mine planning process.

UNIT I: Planning and scheduling of insets, shaft bottoms. Winding and transport system.

UNIT II: Surface layouts including mill and consentrator plants.

UNIT III: Determination of number and dimentions of stops.

UNIT IV: Planning and scheduling of a cycle of operations.

UNIT V: Concept of Ore blending. Overall planning and scheduling of activities in metal mining and processing.

UNIT VI: Case studies of planning of Mining operations.

Course Outcomes:

The concept of mine planning process is required for the student for developing underground metal mining project. The discussions on case studies on different mining methods will help in understanding that what types of stoping methods can be adopted to different types of mineral deposits.

Text Books:

1.Agoshkov M.,et al., Mining of ores and non metallic minerals, Mir publishers, Moscow.
2.Jayanth bhattacharya , principles of mine planning allied publishers,Delhi,2003.

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IV Year -II Semester		L	T	P	C
		3	0	0	3
PROFESSIONAL ELECTIVE COURSE-II)					
LONG WALL MINING					

Course Objectives: To pioneer the history of longwall mining and its development stages. To understand the extraction,support and transport on a longwall face. To learn ventilation methods and strata monitoring instruments

UNIT-I: Planning:
History of longwall mining and its development, techno-economic consideration of the modified longwall retreat panels, longwall advance panels with caving method and stowing method, design of gate roadways and their size disposition, layout of panels, production and manpower planning, sublevel caving systems for thick seams, caving system in thin seams, multi-slice longwall mining, application of longwall mining for steep seams, longwall caving in metal mines.

UNIT -II: Supports:
Types of supports used in longwall mining in the past and present, design of powered supports for different situations, longwall face end problems, supports in longwall gate roadways during drivage and extraction, pressure distribution around a moving longwall face, caving of thick seams and thin seams. Main roof fall, local fall and induced roof wall, floor heaving, precautions during main fall and surface subsidence.

UNIT -III: Extraction and Transportation on a Longwall Face:
PART A: Methods of mining coal on longwall faces, machines – shearers, ploughs etc., methods of cutting and face advancement, stables and Sumping, gate road pillar extension.
PART B:Mode of transporting coal or ore in longwall face and machinery used. Shortwall Mining – a modified longwall mining. Remotely operated longwall faces. Shifting of longwall equipment.

UNIT -IV: Development and Working of Longwall Faces:
Methods of driving gate roadways, choice of selection of machinery, road headers and dinters,special problems associated with working of longwall faces - faults, roof caving, face spalling,overburden movement, subsidence control, hydraulic stowing, dealing with spontaneous heatingwhile working thick seams in coal.

UNIT -V: Environment and Ancillary:
Methods of ventilating longwall faces and gate roadways. Methane control, dust control and noisecontrol, monitoring at longwall faces. Assessment of cost of ventilation. Electric and hydraulic circuits. Surface and ground water effects. Strata monitoring with instruments

Course Outcomes: Students will learn to design longwall panels, selection of equipment suitable to the desired production and geo mining conditions.

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DEPARTMENT OF MINING ENGINEERING

TEXT BOOKS:

1. Peng , S.S., Longwall Mining, 2rd Edition, John Willey and Sons, New York, 2006
2. Singh, R.D., Principles and Practices of Modern Coal Mining, New Age International, 1997.

REFERENCE BOOKS:

1. Mathur, S.P., Mining Planning for Coal, M.G. Consultants, Bilaspur, 1999
2. Singh T.N., Dhar, B.B. Thick Seam Mining, problems and Issues, Oxford & IBH Publishers, 1992.
3. Das S.K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1994.
4. Longwall Mining in Company Seminar – Proceedings – The Singareni Collieries Co. Ltd., 1990.

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DEPARTMENT OF MINING ENGINEERING

IV Year -II Semester		L	T	P	C
		3	0	0	3
(PROFESSIONAL ELECTIVE COURSE-II)					
PLANNING OF SURFACE MINING PROJECTS					

Course Objectives: The basic objective is to introduce the entire concept of Planning of the surface mining operations in which the entire phasing and sequencing of equipment planning, selection components are discussed for the optimization of the production and increasing the production cycle coupled with financial analysis.

UNIT I
preliminary investigations, Stages of planning. Feasibility Report, Planning Inputs, Monitoring of Projects.

UNIT II
Estimation of mine life. Open pit Slope angels, Ultimate pit limit, Interrelation and planning of unit operations.

UNIT III
Transport and dumping systems, Ore blending, Equipment selection.

UNIT IV
design of haul roads, Extraction methods for beach and deposits.

UNIT V
Mining of developed coal seams.

UNIT VI
Selective mining Estimation of profitability, Productivity and quality control, Surface Mining of Tar sands.

Course Outcomes:
The basic concept is to introduce the basic concepts of mine planning, different components involved, selection of proper types of equipment for improving the productivity in surface mining operations, optimization of production capacities in surface mining operations covering different types of mineral deposits.

TEXT BOOKS:
1. Open Cast Mining Unit Operations by Rzhevsky, V.V., Mir publishers.
2. Opencast Mining Technology and Integrated Mechnizations by Rzhevsky, V.V., Mir publishers.

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DEPARTMENT OF MINING ENGINEERING

IV Year - II Semester		L	T	P	C
		0	0	4	8
Major Project					

Course Objectives:

The aim of the course is to make the student perform a comprehensive project work that involves either or all of the following: optimum design of a mechanical component or an assembly, thermal analysis, computer aided design & analysis, cost effective manufacturing process, material selection, testing procedures or fabrication of components and prepare a detailed technical thesis report. The completed task should also take into account the significance of real time applications, energy management and the environmental affects.

Course Outcomes:

After completing the project work the student should learn the technical procedure of planning, scheduling and realizing an engineering product and further acquire the skills of technical report writing and data collection.

Course content:

The student should work in groups to achieve the aforementioned objectives and the outcomes.