



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

B. Tech – II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS	Numerical Methods and Transform Techniques	3	0	0	3
2	HSMC	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Engineering Geology	3	0	0	3
4	Professional Core	Development of Mineral Deposits	3	0	0	3
5	Professional Core	Mine Surveying	3	0	0	3
6	Professional Core	Mine Surveying Lab	0	0	3	1.5
7	Professional Core	Engineering Geology Lab	0	0	3	1.5
8	Skill Enhancement Course	Soft Computing and Applications Lab	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			16	2	8	20

B. Tech – II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Managerial Economics and Financial Accountancy	2	0	0	2
2	Engineering Science/Basic Science	Complex Variables, Probability and Statistics	3	0	0	3
3	Professional Core	Rock Mechanics	3	0	0	3
4	Professional Core	Mine Ventilation	3	0	0	3
5	Professional Core	Fluid Mechanics and Hydraulic Power	3	0	0	3
6	Professional Core	Rock Mechanics Lab	0	0	3	1.5
7	Professional Core	Mine Ventilation Lab	0	0	3	1.5
8	Skill Enhancement Course	Fluid Mechanics and Hydraulic Power lab	0	1	2	2
9	Engineering Science	Design Thinking & Innovation	1	0	2	2
Total			15	1	10	21
Mandatory Community Service Project Internship of 08 weeks duration during Summer Vacation						



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year I Semester

L	T	P	C
3	0	0	3

NUMERICAL METHODS AND TRANSFORM TECHNIQUES

Course Objectives:

- 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 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 Outcomes:

1. Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
2. Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3)
3. Apply the Laplace transform for solving differential equations (L3)
4. Find or compute the Fourier series of periodic signals (L3)
5. Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)

UNIT – I: Iterative Methods:

Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (Simultaneous Equations)

Interpolation: Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions:

Trapezoidal rule– Simpson's 1/3rd and 3/8th rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method –Runge-Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

UNIT –III: Laplace Transforms:



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Definition of Laplace transform - Laplace transforms of standard functions – Properties of Laplace Transforms – Shifting theorems–Transforms of derivatives and integrals – Unit step function – Dirac’s delta function – Inverse Laplace transforms – Convolution theorem (with out proof).

Applications: Solving ordinary differential equations (initial value problems) and integro differential equations using Laplace transforms.

UNIT – IV: 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.

UNIT – V: Fourier Transforms:

Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Infinite Fourier transforms – Sine and cosine transforms – Properties– Inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.

Text Books:

1. **B. S. Grewal**, Higher Engineering Mathematics, 44th 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. **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
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – I Semester

L	T	P	C
2	1	0	3

**UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND
ETHICAL HUMAN CONDUCT**

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Lecture 3: self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education

- PS1 Sharing about Oneself
- PS2 Exploring Human Consciousness
- PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

- PS4 Exploring the difference of Needs of self and body
- PS5 Exploring Sources of Imagination in the self
- PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

- PS7 Exploring the Feeling of Trust
- PS8 Exploring the Feeling of Respect
- PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

- PS10 Exploring the Four Orders of Nature
- PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

- PS12 Exploring Ethical Human Conduct
- PS13 Exploring Humanistic Models in Education
- PS14 Exploring Steps of Transition towards Universal Human Order



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

READINGS:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. *Jeevan Vidya: Ek Parichaya*, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – Pandit Sunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – I Semester

L	T	P	C
3	0	0	3

ENGINEERING GEOLOGY

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

Introduction: 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. Study of individual groups – Quartz – Feldspar – Pyroxenes – Amphiboles – Micas –Aluminum silicates–Garnets–Olivine. Identification of minerals, Study of geological maps.

UNIT–III

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

UNIT–IV

Structural Geology: Introduction to geological structures – attitudes of beds: strike and dip – Description and classifications of folds, faults, joints and unconformities - recognition of geological structures in the field and their significance in mineral occurrence and exploration.

Paleontology: Definition of fossil, Mode of preservation of fossil, Uses of fossils, Classification of animal and plant kingdom, Morphology and geological range of occurrence of animal fossils - Morphology and geological range of occurrence plant fossils-Glassopteris, gangamopteris, Ptolophillum.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

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.

Sedimentary petrology – Formation, structures, textures and classification of sedimentary rocks – Petrographic characteristics of conglomerate, breccia, sandstone, shale, limestone. Formation of various types of rocks and mineral deposits, engineering rocks.

Metamorphic petrology – Formation, structures, textures and classification of metamorphic rocks – Petrography of gneiss, schist, slate, marble, quartzite, charnockite.

TEXTBOOKS:

- 1) Engineering and General Geology by Parbin Singh, S.K. Kataria Sons, 8th Edition, 2008.
- 2) Principles of Engineering Geology by K.M. Bangar, standard publishers and distributors
- 3) Engineering Geology by D. Venkat Reddy, Vikas Publications, 2nd Edition, 2017.

Reference Books:

- 1) A text book of Geology – G.B. Mahapatra
- 2) Billings, M.P. Structural Geology, Third Edition, Pearson Education Limited, 2016.
- 3) Nanda, H. Indian Stratigraphy, Anmol Publications Pvt. Ltd, 2014
- 4) Winter J.D. Principles of Igneous and Metamorphic Petrology, Second edition, Pearson Education Limited, 2014.
- 6) Ford, W.E. Dana’s Textbook of Mineralogy (4th edition), CBS Publishers, 2006.
- 7) Bell F.G. Engineering Geology, Elsevier Publications, 2007
- 8) Arthur Holmes. Principles of Physical Geology, Thomas Nelson and Sons, USA, 1964.

Course Outcomes: After completion of course, students will be able to:

CO#	Description	Blooms Taxonomy Level
CO1	Understand and explain the concepts such as all the materials (rock, mineral, soil etc.),	L2
CO2	Explain the concepts and processes viz. igneous, sedimentary and metamorphic, nature of the materials,	L2
CO3	Analyze the attitude of the beds, structures caused by deformed forces, etc.	L4
CO4	Analyze and choose the method of exploitation, finding the solution for the problems associated.	L4



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – I Semester

L	T	P	C
3	0	0	3

DEVELOPMENT OF MINERAL DEPOSITS

Course Objectives: To make the student learn and understand the ordinary methods of drilling, blasting and special methods of shaft sinking and also to make the student understand the detonators and drive of drifts.

UNIT I:

Various types of openings: shape, size and selection. Development of openings, raises, winzes or passes, orechutes.

UNIT II:

Location of shaft shape and size, incline and vertical shafts. Surface arrangements for sinking shafts, tools and equipment ordinary methods of sinking drilling, blasting removal of debris and water. Ventilation and lighting, temporary and permanent lining, widening and deepening of shafts.

UNIT III:

Special methods of shaft sinking piling, caisson, freezing and cementation method of shaft sinking, Modern techniques of shaft sinking, Raise boring, Design of shafts, inserts, and pit bottoms. Shaft fittings.

UNIT IV:

Classification and properties of explosives, detonators. Detonating cords, detonating fuse, noneldetonator and electronic detonators. Blasting systems, electrical and non-electrical methods, delay blasting techniques. Blasting in open pitmines, blasting in underground coal and metal mines. Mechanics of blasting.

UNIT-V:

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.

Text Books:

- 1) Surface Mining by Dr.G.B. Mishra, Dhanbad publishers,1978.
- 2) EMT Volume-I by D.J. Deshmukh (9thedition), Central Technical Publications.
- 3) Introductory to Mining Engineering by H. L. Hartman, JM Mutmanky, Willey Publishers, 2nd Edition, 2002.
- 4) Modern Coal Mining by R. D. Singh, New Age International Publishing, 2nd Edition, 2022.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Reference Books:

- 1) SMEH and Book
- 2) Blasting Manual-Sandhu & Pradhan.

Course Outcomes: After completion of course, students will be able to:

CO#	Description	Blooms Taxonomy Level
CO1	Explain the concepts such as all the materials (rock, mineral, soil etc.),	L2
CO2	Design the shafts along with surface arrangements, ventilation and lighting.	L4
CO3	Analyze the special methods and modern techniques of shaft sinking.	L4
CO4	Gain knowledge about the classification and properties of various explosives and detonators.	L4
CO5	Understand the electrical and non-electrical methods and different blasting methods.	L3
CO6	Analyze drivage of drifting, organization and cycle of various operations.	L4



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – I Semester

L	T	P	C
3	0	0	3

MINE SURVEYING

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 limination.

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. Intersection, traversing and resection. 2-point and 3-point problem.

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, Fault and dip problems.

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

UNIT– V

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



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Text Books:

1. “Surveying (Vol – 1, 2 & 3), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd., NewDelhi.
2. DuggalSK, “Surveying (Vol–1&2),Tata Mc GrawHill Publishing Co.Ltd. NewDelhi,2004.

Reference Books:

1. Surveying and leveling by R.Subramanian, Oxford university press, New Delhi, 2007.
2. Mine surveying and leveling by S.Gatak, Vol. 1, 2, 3. Lovely Prakasan, 2012.
3. Surveying by Kanetkar, Kulkarni,Vol. 1 and 2, Pune Vidyarthi Griha Prakashan, 2008.

Course Outcomes: After completion of course, students can be able to:

CO#	Description	Blooms Taxonomy Level
CO1	Explain the measurements of distances and angles.	L2
CO2	Determine different levels of and level differences.	L4
CO3	Compute the areas, volumes include determination of capacity of reservoirs.	L4
CO4	Analyze and apply various instruments to survey the mines.	L4
CO5	Design and setup of curves and global positioning systems.	L5



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

L	T	P	C
0	0	3	1.5

II Year – I Semester

MINE SURVEYING 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. Traversing by compass.
2. Triangulation survey by the odolite
3. Measure horizontal and vertical angles by the odolite
4. Measure horizontal angles by method of repetition and reiteration using the odolite
5. Trigonometric Leveling-Heights and distance problem
6. Study of various plans and sections of open cast and underground mines.
7. Finding heights and distance using Principles of tachometric surveying
8. Curve setting–different methods by total station
9. Setting out works for buildings & pipelines.
10. Traversing, contouring and determination of area using total station
11. Determination of remote height using total station
12. Distance, gradient, Difference, height between two inaccessible points using total station.
13. Traversing and recording position of points by GPS
14. Determination of height of tunnel.
15. Demonstration of DGPS and drone surveying (Call experts from field).

Course outcome: Familiar with equipment and capable to do work independently at anytime (L4).

Equipment to be used:

1. The odolites, and leveling staffs.
2. Tacho meters.
3. Total Station



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – I Semester

L	T	P	C
0	0	3	1.5

ENGINEERING GEOLOGY LAB

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

List of Experiments:

- 1) Study of Physical properties in minerals.
- 2) Study of Silicate structures minerals.
- 3) Demonstration of Crystal models.
- 4) Demonstration of Optical properties of minerals.
- 5) Study of important Igneous rocks.
- 6) Study of important sedimentary rocks.
- 7) Study of important metamorphic rocks.
- 8) Recognition of folds from models and maps.
- 9) Recognition of faults from models and maps.
- 10) Recognition of unconformities from models and maps.
- 11) Simple problems on strike.
- 12) Simple problems on dip.
- 13) Study of fossils.

Course Outcomes: Students will be able to identify Megascopic Minerals, Megascopic 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 and dip problems (L4).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – I Semester

L	T	P	C
0	1	2	2

SOFT COMPUTING AND APPLICATIONS LAB

Course objectives: To impart knowledge about basic soft computing tools and model physical systems using Matlab Simulink and Lab view software.

NOTE: Number of experiments should be minimum 2 based on each topic given below and all the experiments should be relevant to Mining Engineering.

- 1) Introduction to Matlab & Lab view Software.
- 2) Modeling of physical systems in Matlab and Simulink.
- 3) Application of different toolbox and modules.
- 4) Programming using subsystems.
- 5) Slope stability analysis in pit and dumps.
- 6) Real-time control and data acquisition (DAQ).

Course Outcomes: Students will be able to model the physical systems in Matlab as well as can discuss real time data acquisition techniques using Lab view (L4).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – I Semester

L	T	P	C
2	0	0	0

ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – 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, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

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 the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment 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 – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Erach Bharucha, Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- <http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf>
- <https://www.youtube.com/watch?v=5QxxaVfgQ3k>

Course Outcomes:

COs	Statements	Blooms Level
CO1	Grasp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.	L2
CO2	Understand flow and bio-geo- chemical cycles and ecological pyramids.	L2
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	L2
CO4	Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	L2
CO5	Illustrate the causes of population explosion, value education and welfare programmes.	L3



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year I Semester

L	T	P	C
2	0	0	2

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

UNIT - I Managerial Economics

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT - III Business Organizations and Markets

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV Capital Budgeting

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT - V Financial Accounting and Analysis

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja HI Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

<https://www.slideshare.net/123ps/managerial-economics-ppt>
<https://www.slideshare.net/rossanz/production-and-cost-45827016>
<https://www.slideshare.net/darkyla/business-organizations-19917607>
<https://www.slideshare.net/balarajbl/market-and-classification-of-market>
<https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>
<https://www.slideshare.net/ashu1983/financial-accounting>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – II Semester

L	T	P	C
3	0	0	3

COMPLEX VARIABLES, PROBABILITY AND STATISTICS

Course Objectives:

- To familiarize the complex variables.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

UNIT– I: Functions of a complex variable and Complex integration:

Introduction–Continuity –Differentiability–Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates–Harmonic and conjugate harmonic functions–Milne–Thompson method.

Complex integration: Line integral –Cauchy’s integral theorem –Cauchy’s integral formula–Generalized integral formula (all without proofs) and problems on above theorems.

UNIT–II: Series expansions and Residue Theorem:

Radius of convergence–Expansion in Taylor’s series, Maclaurin’s series and Laurent series.

Types of Singularities: Isolated–Essential–Pole of order n –Residues–Residue theorem (without proof) –Evaluation of real integral of the types $\int_a^b f(x)dx$ and $\int_c^d f(\cos \theta, \sin \theta)d\theta$.

UNIT–III: Probability and Distributions:

Review of probability and Baye’s theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT–IV: Sampling Theory:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only)–Central limit theorem(without proof)–Representation of the normal theory distributions– Introduction to t , χ^2 and F-distributions- point and interval estimations – maximum error of estimate.

UNIT–V: Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples)–Tests on proportions.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers.
2. Millerand Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

Reference Books:

1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9/e, Mc-Graw Hill, 2013.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sul an Chand & Sons Publications, 2012.
3. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8/e, Cengage.
4. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8/e, Pearson 2007.
5. Sheldon, M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4/e, Academic Foundation, 2011.

Online Learning Sources:

- <https://archive.nptel.ac.in/courses/111/103/111103070/>
- <https://biet.ac.in/pdfs/PROBABILITY%20AND%20STATISTICS%20&%20COMPLEX%20VARIABLES.pdf>
- <https://archive.nptel.ac.in/courses/111/105/111105090/>
- <http://acl.digimat.in/nptel/courses/video/111102160/L23.html>
- https://onlinecourses.nptel.ac.in/noc21_ma57/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic	L3
CO2	Make use of the Cauchy residue theorem to evaluate certain integrals	L3
CO3	Infer the statistical inferential methods based on small and large sampling tests	L4
CO4	Find the differentiation and integration of complex functions used in engineering problems	L5
CO5	Design the components of a classical hypothesis test	L6



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – II 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, Protodyakonov 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, Coulomb-Navier, Mohr's, Mohr's-Coulomb, Hoek-Brown, Drucker-Prager empirical criteria, etc. and their field of applications. Stress distribution in underground openings.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Text Books:

1. Fundamentals and applications of Rock Mechanics by Deb. D and Verma. A.K. PHI, 2016.
2. Hand book on Mechanical Properties of Rocks by Vutukuri, V.S., and Lama, R.D, Vol.I, II, III and IV, Transtech Publication, Berlin, 1974/78.
3. Peng, S.S., Ground Control, Wiley Inter Science, New York, 1987.
4. Engineered rock structures in mining and civil construction/ by R.N. Singh and A.K. Ghose, Taylor & Francis, 2006.

Reference Books:

1. Obert, L. and Duvall, W.I., Rock Mechanics and Design of Structure in Rock John Wiley and Sons 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

Course Outcomes: After completion of course, Students will be able to:

CO#	Description	Blooms Taxonomy Level
CO1	Understand the application of Rock Mechanics in mining and allied engineering	L2
CO2	Gain knowledge about Physico-Mechanical properties of rocks, non-destructive testing methods, time dependent properties of rock.	L4
CO3	Explain the theories of failure and approaches used for open pit and underground designs.	L2



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – II Semester

L	T	P	C
3	0	0	3

MINE VENTILATION

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 characteristics, factors 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, Ascensional, descensional, homotropical, anti – tropical ventilation plan. Central and boundary ventilation systems– layouts and comparisons. Standard of ventilation including permissible air velocities, 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 studies.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

Text Books:

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

Reference Books:

- 1) Mine ventilation and air conditioning–Howard L.Hartman.WileyInternational, 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.
- 4) Vivek Publications, Varanasi1999.
- 5) Mine Ventilation Vol.–II, S.Ghatak, Coalfield Publishers, 1993.

Course Outcomes: After completion of course, students will be able to:

CO#	Description	Blooms Taxonomy Level
CO1	To understand the composition and comparison of mine air and its effects	L2
CO2	To understand the mine climate	L2
CO3	To analyze various types of mine ventilation systems	L3
CO4	To analyze and apply different types of mechanical ventilation systems.	L4
CO5	To plan and design a ventilation system.	L5



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – II Semester

L	T	P	C
3	0	0	3

FLUID MECHANICS AND HYDRAULIC POWER

Course Objectives: 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 meta center 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.

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
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

UNITV

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, Hydraulic systems-hydraulicram, hydrauliclift, hydraulic coupling.

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/RKBansal/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(Chapter12–FluidFlow Measurements)
- 5) Fluid Mechanics and Hydraulic Machines by Domkundwar & D omkundwar, Dhanpatrai & Co.

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

CO#	Description	Blooms Taxonomy Level
CO1	To gain knowledge about the concepts of fluid statics, buoyancy and flotation	L2
CO2	To understand the concepts of fluid kinematics and fluid dynamics	L2
CO3	To understand the dimensional analysis and to apply boundary layer theory	L3
CO4	To analyze the basics of turbo-machinery along with centrifugal and reciprocating pumps	L4
CO5	To analyze the hydraulic systems and turbines	L4



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – II 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 and to study the operation of various instruments and equipment.

List of experiments:

1. Determination of Core recovery and RQD of rocks.
2. Determination of Protodyakonov index of a given rock sample.
3. Determination of point load index strength of a given rock sample
4. Determination of Density, porosity and void ratio of rocks.
5. Determination of slake durability index of a given rock sample.
6. Determination of uniaxial compressive strength, young's modulus and Poisson's ratio of a given rock sample
7. Determination of tensile strength of a given rock sample.
8. Determination of shear strength of rocks
9. Determination of cohesion, angle of internal friction using triaxial test of a given sample.
10. Determination of permeability of a given rock or soil sample.
11. Determination of RMR for a coal seams and other strata.
12. Study of different types of supports used in mines.
13. 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 (L3)
- 2) Knowledge of various instruments and equipment (L3)
- 3) Design the supports for mine openings (L4).
- 4) Design mine pillars (L4).
- 5) Knowledge of various equipment (L3).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – II Semester

L	T	P	C
0	0	3	1.5

MINE VENTILATION LAB

Course objectives: Students to understand various mine ventilation instruments and to detect different gases and properties of gases.

List of experiments:

1. Determination of CO, CH₄, H₂S, SO₂, O₂, CO₂, Nitrous fumes by various detectors.
2. Study and application of infrared gas analyzer.
3. Detection of different gases by Gas–Chromatograph.
4. Detection of methane by different types of methanometers.
5. Detection of methane, CO₂ and O₂ by flame safety lamp.
6. Determination of air quantity by Anemometer.
7. Determination of air pressure by manometer.
8. Determination of cooling power of air by kata-thermometer.
9. Measurement of air velocity by Velometer.
10. Determination of relative humidity using whirling Hygrometer.
11. Study of mine ventilation plans.
12. Study of various mine fans.

Course outcomes: After completion, students will be able to understand various mine ventilation instruments and to detect different gases and properties of gases (L4).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year – II Semester

L	T	P	C
0	1	2	2

FLUID MECHANICS AND HYDRAULIC POWER LAB

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

- 1) Impact of jetson 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 Venturi meter.
- 9) Calibration of Orifice meter.
- 10) Determination of friction factor for a given pipeline.
- 11) Determination of loss of head due to sudden contraction in a pipe line.
- 12) Turbine flow meter.

Course Outcomes:

Students 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 (L5).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

II Year II Semester

L	T	P	C
1	0	2	2

DESIGN THINKING & INNOVATION

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
MINING ENGINEERING (R23- IInd YEAR COURSE STRUCTURE & SYLLABUS)

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, & Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5