**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)*

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# 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<br>1. Rocks slope Engineering<br>2. Mine Subsidence Engineering<br>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**<br>**1.**Planning of Underground Metal Mining Projects<br>**2.**Long wall mining<br>**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***

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| 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:
Mineralindustryanditsroleinnationaleconomy;worldandnationalmineralresources;Mining - Auniqueinvestmentenvironment;specialriskfactorsinmineinvestmentandevaluation; national mineral policy.

**UNIT II** Ore reserve estimation :
Methodsofsampling,samplingfrequency;analysisofsamplingdata,estimationofreserves, 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;ratesofreturn;Hoskold'sTworatemethod;
Economic evaluation:
capitaland operating cost including wages, incentives, material, etc.; assets; liabilities; cash flows and discounted cash flow; profitability index – their implications in mine economic evaluation.
**UNIT IV** Projectappraisal:
Methodsofprojectevaluation–payback,annualvalue,benefit/costratio,ERRandIRR, etc., evaluationof exploratoryminingareas and operatingmines; mine project financing, its risksandconstraints;minetaxation;criticalimpactofdepreciation,depletion,typeoffunding, reserves, life, etc. on mine profitability.

**UNIT V** Financeandaccounting**:**
Sourcesofminefunds–shares,debentures,fixeddeposit,sinkingfund,capitalgearing,P& Laccount,balancesheet,typicalcasestudiesofminefeasibility.Costestimationofindividual 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.

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**TEXTBOOKS:**

1 Deshmukh, R.T., Mineral and Mine Economics, Mira Publications, Nagpur, 1986.
2 Arogyaswamy,R.N.P.CoursesinMiningGeology,OxfordandIBHPublishingCo.,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.

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| 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

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| IV Year -II Semester | | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |
| **PROFESSIONAL ELECTIVE COURSE-II)**<br>**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.

: Planning and scheduling of a cycle of operations.

**UNIT III**: Determination of number and dimentions of stops.

**UNIT IV**: Concept of Ore blending. Overall planning and scheduling of activities in metal mining and processing.

**UNIT V:** 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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**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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|---|---|---|---|---|---|
| | | 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. Design of haul roads, Extraction methods for beach and deposits.

**UNIT IV**
Mining of developed coal seams.

**UNIT V**
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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| 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.