

# **SYLLABUS**

**MASTER OF ENGINEERING  
(METALLIFEROUS MINING)  
2014-2015**

**JAI NARAIN VYAS UNIVERSITY  
JODHPUR**

	<i>Contents</i>
GENERAL INFORMATION FOR STUDENTS	1
MEMBERS OF TEACHING STAFF	4
TEACHING AND EXAMINATION SCHEME	5
SPECIALISATION : METALLIFEROUS	5

## **MASTER OF ENGINEERING GENERAL INFORMATION FOR STUDIES**

1. The Course of Study for M.E. degree in Civil, Electrical, Mechanical, Mining and Electronics and Communication Engineering shall extend over a period of not less than three Semesters spread over eighteen months. On satisfactory completion of the course and after passing the final examination including the dissertation, a candidate shall be awarded M.E. Degree in the respective branch.

2. No candidate shall be admitted to the course of study for the degree of M.E. in any of the above branches unless he produces satisfactory evidence to the effect that he has obtained at least 55 % in B.E. degree from the University or from any other University or Institute recognized as equivalent thereto.

3. (a) Teachers, Research Fellows/Scholars or Engineers employed in this University possessing at least 55 % in class bachelor's degree in Engineering from this University or Institute recognized as equivalent thereto, may be admitted to the M.E. Course as part-time students.

3. (b) Serving engineers in the departments/industries/self-employed engineering/teachers in Polytechnic/engineers employed in research laboratories and other organizations in Jodhpur and having a bachelor's degree with 55% marks in Engineering from this University or institute as recognized thereto, may be admitted to the M.E. Course as part-time students.

4. The course of study for a part-time student will extend over a period of not less than six semesters spread over 3 years. He shall be required to attend regular lecture classes, complete the prescribed course work including the practical and sectionals and submit a dissertation.

5. There shall be an examination at the end of each semester.

At the end of First Semester – First Semester Examinations for M.E. Degree.

At the end of Second Semester – Second Semester Examination for M.E. Degree.

At the of Third Semester – Second Semester Examination fro M.E. Degree.

At the end of Fourth Semester Dissertation Examination for M.E. Degree.

6. The examination shall be conducted by means of written papers. Practical including sessionals, viva-voce and dissertation

7. A candidate who has undergone regular course of study for the first semester shall be eligible to appear at the First Semester Examination for the M.E. Degree.

8. A candidate appearing at the First Semester Examination for the M.E. Degree shall be required to show competent knowledge of the subject mentioned in the teaching and examination scheme for the respective branch of study.

9. A candidate who has passed the First Semester Examination and has undergone a regular course of study for the Second Semester shall be eligible for appearing at the Second Semester Examination for the M.E. Degree.

10. A candidate appearing at the second semester examination for the M.E. Degree shall be required to show competent knowledge of the subject mentioned in the teaching and examination scheme of respective branch of study.

11. The attendance requirement for the candidate shall be as per University Ordinance.

12. Each candidate shall submit for examination a dissertation embodying the research work carried out by him during the course of study.

13. (a) A candidate who fails in the course work in any course shall be permitted to take examination in the theory paper of that course. He should join as a regular student in the course when it is offered next by the Department. In case, the course is discontinued in the Department, the student can take up, subject to approval of the Head of the Department, another course in lieu of the course discontinued.

13. (b) If a candidate passes in course work but fails in the corresponding theory paper, he shall reappear and pass in subjects in which he has failed at the next regular examination of the semester. The course work marks obtained by him in the previous semester shall be carried over to the semester in which he reappears.

13. (c) If a regular candidate fails in three or more units and a part-time student fails in two or more units in any semester, he shall not be permitted to continue his studies in the next semester. He should be required to join as a regular student whenever these courses are offered next by the Department. In case, any of these courses is discontinued in the department, the student can take up, subject to the approval of Head of the Department, another course in lieu of the course discontinued.

Rule No. 13 (c) is clarified as follows:

“Whenever a full time student fails in 3 or more units/course prescribed for the semester, he/she will have to repeat all the papers in that semester as a regular student and consequently re-appear in all the units/course in that semester as a regular student”.

For part-time students, the rules are clarified as follows:

“Whenever a part-time student fails in 2 or more units/course prescribed for that semester, he/she will have to repeat all the papers in that semester as a regular student and consequently re-appear in all the units/courses in that semester as a regular student.”

(Approved by the Academic Council held on 8-9-94)

14. A candidate who fails in the elective subject may be permitted by the Head of the Department to change the elective subjects. He shall be required to undergo a regular course of study for the new elective subject.

15. A candidate may be permitted by the Head of the Department to change his specialization. He shall undergo the regular course prescribed for specialization.

16. (a) In no case will a candidate, who has not passed finally after six years from the date of enrolment, be allowed to continue the course.

16. (b) Provided that the Vice-Chancellor in consultation with the Head of the Department may waive this limit of six years in the case of candidates who could not complete their M.E. Course

in one stretch. The reasons for granting exemption shall be recorded in writing. Such extension shall not exceed one year.

17. The subject for the dissertation shall be approved by the Head of Department.

18. Three copies of dissertation printed or type-written shall be submitted to the Registrar along with the supervisor that the work has been undertaken and completed, the dissertation has been written under his guidance and meets the requirement of the course. A certificate should also appended that dissertation has not formed the basis of award of any previous degree of diploma etc. of this or any other University.

19. The dissertation shall be referred to two examiners, one External and one Internal. They shall examine the dissertation, the candidate shall be required to appear for the Viva-voce examination conducted by a Board of Examiners consisting of the External Examiner, the Internal Examiner and the Head of the Department or his nominee who shall be the Chairman of the Board.

20. The dissertation examination shall be held only after the candidate has passed in all the theory papers, course work and Seminar.

21. (a) The number of part-time students to be admitted to a particular branch of study shall be decided by the Head of the Department concerned.

21. (a) The programme of instruction for a part-time student shall be drawn up by the Head of Department so as suit the requirements of the students concerned.

22. (a) For a pass, candidate should obtain 35 per cent marks in each theory paper, 50 per cent marks in each course work, 50 per cent marks in Seminar and the Dissertation should be “accepted”.

22. (b) In case the dissertation is found “unacceptable” the candidate shall be required to repeat the dissertation work.

23. The division shall be awarded to the M.E. student as follows”

- (a). Honors – 75 per cent marks or above
- (b). Five Division - 65 per cent marks or above
- (c). Second Division- 50 per cent marks or above

24. A candidate may be permitted to offer additional units, subject in excess of the minimum requirements for the M.E. Degree. The result of these additional units/subject shall be separately mentioned in the mark sheet and it will not be counted for the awarded of the division.

25. Candidates who have passed the Section ‘A’ and ‘B’ examination of the Institution of Engineers (India) shall be eligible for admission to the M.E. Course provided they pass a written and oral qualifying examination to be conducted by the required to offer and pass additional courses to make up the deficiency, if any. And when this is done correspondingly reduced. The admission of candidates under this category would restricted to maximum two for each course out of which not more than one may be on a regular basis. The candidate’s M.E. result will be announced only when he/she clears the deficiency papers.

26. Only those candidates will be eligible for U.G.C./A.I.C.T.E. scholarship who have qualified through the GATE (Graduate Aptitude Test for Engineers.)

## **MINING ENGINEERING DEPARTMENT**

### **MEMBERS OF TEACHING STAFF**

#### *Professors*

1 Dr. A. S. Sheoran (**Head**) : B.E., M.E., Ph. D

2 Dr. V. S. Palria : B.E., M.E., Ph. D

#### *Associate Professor*

1. Dr. S. K. Parihar : B.E., M.E., Ph. D.

TEACHING AND EXAMINATION SCHEME  
M.E. Mining Engineering (Metalliferous), 2014-15

	Period per week /marks			Course	Exam. Marks	Exam. Hrs.
	Unit	L	T/P			
<b>First Semester</b>						
Mi 601 Mathematical Methods ` in Engineering	1	3	2	50	100	3
Mi 602 Computational & Numerical Methods in Mining	1	3	2	50	100	3
Mi 603 Surface Mine Environmental Engineering (Mi)	1	3	2	50	100	3
Mi 604 Rock Engineering (Mi)	1	3	2	50	100	3
Mi 605 Mine Development and System Engineering	1	3	2	50	100	3
	<b>5</b>	<b>15</b>	<b>10</b>	<b>250</b>	<b>500</b>	<b>15</b>
<b>Second Semester</b>						
Mi 606 Methods of Extraction	1	3	2	50	100	3
Mi 607 Mine Environment Planning & Management	1	3	2	50	100	3
Mi 608 Elective I	1	3	2	50	100	3
Mi 609 Elective II	1	3	2	50	100	3
Mi 610 Dissertation						
	<b>4</b>	<b>12</b>	<b>8</b>	<b>200</b>	<b>400</b>	<b>12</b>
<b>Third Semester</b>						
Mi 611 Project and Seminar (50+50)			5	100		
Dissertation						
<b>Forth Semester</b>						
Dissertation			5			
Total	<b>9</b>		<b>28</b>	<b>325</b>	<b>900</b>	<b>27</b>
Semester Dissertation						
Total				<b>325</b>	<b>900</b>	
Grand Total of Marks					<b>1225</b>	

A per –time student shall take not more than three units and not less than two units in any semester. Except when the number of units to be completed is less than two towards the fulfillment of degree requirements.

Only that subject can be offered in the Electives for which facilities are available in the department.

Marks for course work will be awarded by the teacher concerned.

Marks for seminar will be awarded by the board consisting of Supervisor and other members to be nominated by Head of the Department.

Course work will comprise of tutorial assignments, practical class test, home assignment.

*\*List of Electives:*

The students are required of take any two subject:

- I. Mining Law
- II. Mine Planning and Project
- III. Mine Environment and Ecology
- IV. Engineering Geology
- V. Advances in Mineral Processing
- VI. Slope Engineering
- VII. Mine Hydrology

**Mi 601- MATHEMATICAL METHODS IN  
ENGINEERING**

**3L, 2T/P**

**3Hours, 100 Marks**

Tensor Analysis: Indicical notation and summation convention, covariant and contravariant vectors, metric tensor, covariant differentiation

Complex Variables: Introduction, complex number; Analytic functions of a complex variable: Conformal transformation; Bilinear transformation; Schwartz Christoffel transformation; Cauchy's integral theorem, Calculus of residue, Taylor's and Laurent's expansions; Analytic Continuation

Differential Analysis: Partial Differential equations of Second order including Monge's Methods. Classification of Second order partial differential equations viz. parabolic, elliptic and hyperbolic differential equations

Statistics: Random variable Mathematical expectation, basic theorems on expectation, correlation and regression in two and three variables. Probability function, density function, probability distributions

Such as binomial, Poisson's experimental distribution, normal distribution, Preliminary idea of chi-square and distribution and tests of Significance based on them, Large sample test

**Mi 602- COMPUTATIONAL AND NUMERICAL  
METHODS IN MINING**

**3L, 2T/P  
Marks**

**3 Hours, 100**

Programming: Overview of C Language; constants, variable's and data types; operator's and expressions; input/output statement's ; decision making and branching; looping; arrays; user defined functions; structures and unions; pointers; file management in C; dynamic memory allocation and linked lists. Programming in C++ basics; loops and decisions; structures; functions; object and classes; arrays; operator overloading, inheritance.

Computer programming relating to problems in Mining Engineering; Introduction to information technology tools; Application of Geostatistics; Advanced Computer application's relating to mining design, planning and scheduling; computer graphics.

Numerical Analysis Method: Introduction of Numerical Analysis Methods. Boundary element method, Finite difference method, basic principal of finite element method, Numerical methods as applied to Geomechanic problems

### **Mi 603- SURFACE MINE ENVIRONMENTAL ENGINEERING (MI)**

**3L, 2T/P  
Marks**

**3 Hours, 100**

1. Introduction: Environmental issues in mineral industry national and global; ambient environment in mining complexes.
2. Socio-Economic Environment; Parameters, social impact, primary and secondary economic impacts and their management including resettlement and rehabilitation.
3. Land Environment: Visual impacts; landscape analysis; land use pattern; landscape planning; post mining land use, degradation of soil ecology and reclamation.
4. Water Environment: Natural drainage pattern, Impact on surface water bodies and on sub-surface water its management.
5. Air Pollution: Sources, monitoring and control.
6. Airborne Respirable Dust: Generation, dispersion, measurement and control.
7. Noise: Impact on human health, level, noise abatement strategies standards.
8. Waste management: Solid wastes - generation, treatment and disposal.
9. Blasting: Environmental aspects of Vibrations, Flyrock.
10. Ecological Environment: Ecological Environment and its management including biological reclamation.

### **Mi 604- ROCK ENGINEERING (MI)**

**3L, 2T/P  
Marks**

**3 Hours, 100**

Present status of drilling and blasting practices in India and abroad, Drilling Methods, Percussive drilling, characterization and different types of machines and bits-design and wear, Rotary drilling applications, optimizations of drilling variables, bit types and bit selection, water jet drilling. Thermal drilling Mechanics of drilling, drillability of rock splitting and cutting rocks.

Explosive's and Blasting theory and calculations for design of blasting systems in surface mining and underground operations, control of blasting operations, Rock Mass and Rock Substances as a material, its properties and behavior, Rock Mass Classification and its applications in design. Water in Rock, concept of pressure and flow, measurements, hydrogeology and mine opening.

Rock boring-principles, types of design and performance of Tunnel boring machines, shaft and raise boring machines, Tool design and abrasion testing.

Rock Reinforcement, Rock bolting methods and material and installation, tensioning and testing, support and lining systems, and Rock grouting and freezing.

**Mi 605- MINE DEVELOPMENT AND SYSTEMS  
ENGINEERING (Mi)**

**3L, 2T/P  
Marks**

**3 Hours, 100**

Technical and economical consideration in opening of deposits, choice of access, shape, size and stability analysis of mine entries and their design, Factors governing choice of equipment ground control and safety considerations.

Engineering design phases of planning, Technological forecasting, Preliminary appraisal, economic considerations in Planning of opencast and underground deposits, optimal, size output and development parameters, investment and profitability, Determination of production targets, Marketability of products, feasibility report.

A systems approach to mine design, design of elements and subsystems, planning and scheduling of operations application of network analysis, computer techniques in mine system analysis.

**Mi 606- METHODS OF EXTRACTION (Mi)**

**3L, 2T/P  
Marks**

**3 Hours, 100**

Modern Concepts in stoping systems. Rock Mechanics and computer application in extraction methods, Recent developments in technique and machinery used in underground Problems of radiation in mines, utilization of mine waste and tailings, mine leaching and solution mining, Deep mining and exploitation of deep ore bodies Underground pillar extraction-recovery and design.

Selection of underground method of extraction, with geomechanical and environmental considerations, case studies.

Global roundup of surface mining practices and equipment, slope design, ultimate pit layout, overcasting by explosives and blast design, optimisation of load haul systems, environmental impacts and management plans, Reclamation, Technolo-econemics. Computer applications.

## Mi 607 – MINE ENVIRONMENT PLANNING & MANAGMENT

3L, 2T/P

3 Hours, 100 Marks

1. Environmental impact of Mining projects on various stages exploration, construction, Development, Exploitation and abandonment.
2. Waste and Mill Tailing disposal: site selection, impact on environment, reclamation.
3. Revegetation on mine waste dumps and Tailing dam: mine waste analysis, Revegetation objectives, Physical and Chemical properties, revegetation practice.
4. Acid Mine Drainage : AMD Generating Minerals, AMD Formation, problems in India, active and passive treatment technologies including constructed wetlands, its impact on the region.
5. Reclamation of drastically disturbed land, Eco-friendly mining for sustainable development Recycling and Total project Development.
6. Cumulative effect of a group of small scale mines on the region.
7. Preparation of Environment management plan; Public hearing, collecting baseline data, Environment impact assessment and prediction (qualitative and quantitative analysis), Environment management plan, environmental monitoring and management, Application of Remote sensing and geographical information system.
8. Environment Protection Act 1986 and other relevant provisions for the environment applicable to mining projects.
9. Mine closure Planning: Objectives, closure programme, closure schedule, closure design, closure options, Decommissioning, closure and reclamation, implementation sequence, post closure facility programme.
10. Environmental Management of New mining project development of an environmental monitoring programme, responsive environmental management, feedback interface with regulatory authorities.

## **Mi 608/609 (I) – MINING LAWS**

**3L, 2T/P**

**3 Hours, 100 Marks**

Development of mining laws, framing laws and necessity Various laws pertaining to mines such as:

Mine and Mineral Regulation and Development Act  
Mines Act, 1952  
Industrial Dispute Act  
Payment of Wages Act  
Workmen's Compensation Act  
Minimum wages Act  
Payment of Bonus Act  
Indian Electricity Act  
And legislations under above Acts

## **Mi 608/609 (ii) - MINE PLANNING AND PROJECT (Mi)**

**3L, 2T/P**

**3 Hours, 100 Marks**

Preliminary investigations, Feasibility studies –report and its approval, sanctioning mining project, main contents of Detailed Project report (DPR).

Mining deposits by open pit or underground methods.

Size of mine, life of mine, rate of production and mining losses Different modes of entries to mine underground deposits and their selection.

Optimum size, shape and location of these mine entries Dividing mining property into parts- Panels and levels.

Size of Panel, order of extraction in Panel. Level in interval size of longwall face.

Micro Planning, scheduling, target setting fixing norms.

Management information and control. Work study, market research and system analysis. Economic factors in Mining, mineral processing and market, organisational set-up.

**Mi 608/609 (iii)- MINE ENVIRONMENT AND  
ECOLOGY (Mi)**

**3L, 2T/P**

**3 Hours, 100 Marks**

General principles and concept of ecology, Biosphere: an overview, structure and functioning and Eco-system.

Ecology and man.

Nature of the environment.

Major components of the life support system of the environment: atmosphere, hydrosphere and biosphere. Impact of urbanization of the environment.

Human demography, Resource management, pattern of world food production and demand  
Consequences of intensive agricultural techniques. Land for forestation, agriculture and urbanization.

Air, water, soil and noise pollution. Pesticides and quality of food. Society and environment.  
Evaluation, monitoring and control of pollution standards.

The dominion of man, engineer and nature. National environmental policies.

Environmental Impacts associated with mineral mining and processing-Ecological pollution  
Future trends in mining. Major environmental concern associated with mining and its managements

Reclamation of opencast mine with special reference to cost benefit approaches.

Land use management in mining industry with special reference to degradation and reclamation,  
Role of geology in environment studies.

Air Pollution in mining areas and its control. Dust Pollution Acid mine water drainage and control.

Noise Pollution and control.

Environmental determinants for mining, settlements, design of living environment of mining, settlements. Pollution as a result of tailing disposal from mineral process/coal process plants  
Utilisation of mine waste and tailings.

Case histories-economics and control measures of pollution in general.

**Mi 608/609 (iv)-ENGINEERING GEOLOGY (Mi)**

**3L, 2T/P**

**3 Hours, 100 Marks**

Role of Structural Geology—Stress strain in two dimensions, Description and significance of folding, faulting, jointing and minor structures. Graphic analysis of structure using projection technique and computer simulation. Graphic techniques of structural analysis.

Mechanism of formation of minor structures and their interpretations, lineation, cleavages, schistosity, superimposed folding.

Effect of the above structural deformations in the design of extraction techniques.

Application of hydrology, Geological consideration for dams, underground chambers.

Utilisation of mine waste and tailings.

**Mi 608/609 (V)-ADVANCES IN MINERAL  
PROCESSING (MI)**

**3L, 2T/P**

**3 Hours, 100 Marks**

Recent advances in mineral processing, characterisation of comminution. Ultra fine comminution. Concentrations and separations of fine minerals.

Feasibility testing and process design. Stream analysis and automations of floatation processes, selected treatment for ore and coal. Ash and sulphur monitoring.

Gravity concentration. Floatation, Pneumatic separation, Agglomeration and solid liquids separation Thermal drying Preparation of non-ferrous and ferrous ore Pelletisation, sintering and direct reduction.

Product blending and handling, Pre-concentration techniques Concept of energy utilisation in mineral dressing operations, Process Plant design.

Reclamation and processing of waste materials, Effluent treatment, tailing disposal. Secondary recovery, leaching.

### **Mi 608/609 (vi) SLOPE ENGINEERING (Mi)**

**3L, 2T/P**

**3 Hours, 100 Marks**

Introduction, Basic Mechanics rock and spoil slope failures, Geological data collection. Geophysics for open pit sites, shear strength, Groundwater flow.

Design of slopes. Principles and scope. Slope design of plane wedge and circular failures. Stability analysis.

Support and reinforcement of rock slopes.

Monitoring of slopes. Blasting practice for rock slopes.

Economic and Planning consideration.

### **Mi 608/609/(vii)-MINE HYDROLOGY (Mi)**

**3L, 2T/P**

**3 Hours, 100 Marks**

Introduction, Elements in the hydrology cycle, hydrologic budgets.

Definition of ground water flow systems.

Infiltration.

Soil moisture reservoir, its role in hydrologic cycle, water in the capillary state and the capillary fringe.

Soil and Rock-Water systems. Effective stress, pore-water pressure, total stress, seepage forces, mechanics of compaction Unconfined and confined aquifers, Definition of steady state groundwater flow systems, Flow nets.

Nature of pumping cone of depressing, steady and non steady state conditions. Barrier boundaries and image well theory.

Chemical properties of water, pollution Acid mine drainage.

Water Sources in mine rocks and soils.

Hydrological investigations for mine planning.

Hydrological Modelling under mining conditions.