MINE MANAGEMENT AND ECONOMICS		Semester	V
Course Code	**BMN501**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- To understand the basics of management and its application in mining industry.
- To understand the organization structure and their relative merits and demerits.
- To understand the role of personnel management, importance of communication and various motivation techniques.
- To understand the basics of financial management and cost accounting.
- To understand economic analysis required for mining project.
- To understand different methods of sampling and evaluation of mineral deposits.
- To be able to apply the techniques and methods of mine valuation.
- To identify the various investment function analysis and understand the elements of cost benefit analysis.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Brief History of Management: Evolution of Management, Scientific management, Functions of management, Principles of Management. Management and administration, Mine management: Duties and responsibilities of mines manager.

Organization: Characteristics of Organization, types of organization, management of conflict, management by exception, management by objective (MBO). Mine organization: Opencast and underground mines.

Module-2

Personal Management: Functions of personnel management, recruitment, and selection of employees. Manpower Planning in mines.

Communication: Formal and informal communication, barriers in communication and techniques to overcome barriers and improve communication.

Motivation: Definition, characteristics of motivation, kinds of motivation, factors affecting motivation, motivational techniques, and theories of motivation. Maslow's hierarchy of needs.

Module-3

Financial Management: Methods of financing industrial enterprises, structure, formation and capitalization. Sources of finance. Principles of book keeping as applied to mining industry and accountancy. Balance sheet, profit and loss accounts.

Cost Accounting: Introduction, need for cost accounting, elements of cost, overheads, breakeven analysis.

Module-4

Mineral Economics: Economic importance of mineral industry, special features of mineral industry, demand and supply analysis, National Mineral Policy, International Monetary system, Factors affecting mineral price.

Sampling: Definition, purpose, scope, methods: groove/channel sampling: Chip sampling; grab sampling; bulk sampling; application statistical method in sampling.

Evaluation of mineral Deposits: Classification of reserves. Preparation of assay plans, various methods of ore reserve estimation and problems on ore reserves estimation.

Module-5

Mine Valuation: Basic concept, Earlier approaches to mine valuation, recent approaches to valuation; Time value of money, Price Information – revenue estimates, annuity, accounting profits and cash flows.

Investment Appraisal: Elements of investment appraisal, static methods of investment appraisal, Dynamic methods of appraisal, Discounted Cash Flow (DCF) analysis.

Course outcome (Course Skill Set)

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

1. Summarize evolution of management, management vis-à-vis administration, functions of management, organization structure, MBE and MBO.
2. Understand functions of personnel management, essentials of communication, and motivational techniques.
3. Understand financial management and cost accounting applicable to mining industry.
4. Understand economic analysis required for mining project.
5. Understand the various investment function and the elements of cost benefit analysis.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Industrial Organization and Engineering Economics, Banga and Sharma, Khanna Publication, New Delhi, 1999.
2. Industrial Management, O. P. Khanna, Dhanpat Rai and Sons, 1999.
3. Mine Management, Legislation and Safety, Coal Fields Publisher, Asansol, 1999.
4. Mineral and Mine Economics by R.T. Deshmukh, Myra Publications, Nagpur, 1986
5. Mineral Economics by N.L.Sharma and Sinha, Oxford and IBH, 1992.
6. Mineral Economics by Truscot, John Wiley and Sons, Inc, 1987

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/122106031

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group Discussion
- Quizzes

MINE MACHINERY		Semester	V
Course Code	**BMN502**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

- Students will understand basic features of equipment, selection, environmental issues and design features.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE-1

Ropes: Wire ropes of different types and their construction and selection, rope capping, recapping and rope splicing. estimation of size of rope and safety factor for ropes used in winding. Numerical problems.

Mine winders: Drum, Friction, Blair winders; Rope attachments; Shaft fittings; Safety devices; Hoisting cycle; Productivity calculation; Cages; Skips; Wire ropes.

MODULE-2

Rope haulages: Classifications; Operation; Productivity calculation; Mine cars; Rope fittings; Scope and application.

Locomotive haulages: Electric, Battery, Diesel locomotives; Tractive effort; Drawbar pull; Ideal gradient; Optimum gradient; Neutral gradient; Super elevation; Track layouts & safety devices; Locomotive calculations; Scope & application.

Ancillary Equipment: Road header; LHD; Shuttle cars, LPDT, SDL. Man riding systems

MODULE-3

Ore Transporting Equipment in Surface Mines: Dumpers: Classifications; System components and functions Belt conveyors: System components and functions; Maintenance, Capacity & power calculations; Scope & application High Angle Conveyor: Constructional features; Operation; Scope & application Cable belt conveyor: Constructional features; Operation; Scope & application Pipe belt conveyor: System components and functions; Scope & application Aerial ropeways: Classifications; Operation; Angle stations; Loading & discharging stations; Buckets; Scope & application.
MODULE-4
Rock Drills: Types of rock drills, Constructional features and operation of electric and hydraulic coal drills; Jack hammers, Hydraulically operated drill machines, Electro hydraulic jumbo drills, Top hammer drills, DTH drills, Wagon drills, Blast hole drills, Drill bits, Drill rods, Flushing mechanisms. **Roof Supports:** Friction supports; Hydraulic supports; Power supports; Nomenclatures; Hydraulic circuits: Hydraulic oil & properties; Power pack unit, Roof bolts, Scope & applications.
MODULE-5
Production Machines in Underground Mines: Construction and operation of shearer, plough, continuous miner; Scope & application; Cutting picks; Cutting heads; AFC; Stage loader. **Excavating Equipment in Surface Mines:** Construction and operation of Surface miners, Electric rope shovels, Hydraulic shovels, Draglines, Bucket wheel excavators; Scope & application.

PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*

Sl.NO	Experiments
1	To study constructional details and functioning of Jack Hammer.
2	To study constructional details of different wire ropes.
3	To study the capping and recapping procedures of wire ropes.
4	To study the procedure for splicing the wire ropes.
5	Sketch and write details of safety hook and its function.
6	Suspension gear arrangement of the shaft.
7	Belt conveyors with their design parameters used in mines.
8	Different types of winding system and their comparative application.
9	Process of changing of winding rope and its requirement as per regulation. (**Can be Demo experiments for CIE)**
10	Designing direct rope haulage system in moderately dipping coal seam. (**Can be Demo experiments for CIE)**

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

- select different type of underground mining equipment.
- Impart conceptual knowledge on constructional features.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scoredby the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. De, A. (2015). Latest Development of Heavy Earth Moving Machineries, Lovely Prakashan.
2. Tatiya, R. R. (2005). Surface and underground excavations: methods, techniques and equipment. CRC Press.
3. Chugh, C. P. (1977). Drilling technology handbook. Oxford & IBH Publishing Company.
4. Deshmukh, D. J. (1982). Elements of mining technology. Vidyasewa Prakashan.
5. Mukharjee, S. N. (1993), Longwall Machinery and Mechanisation, Lovely Prakashan.

Web links and Video Lectures (e-Resources):

- **https://onlinecourses.nptel.ac.in/noc21_mm17/preview**

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

SURFACE MINING		Semester	V
Course Code	**BMN503**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	4:0:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Applying the basic concepts and unit operations incorporated in a surface mine.
- Selecting the appropriate equipments for excavating, loading and transporting material in open cast mines.
- Describing the application of various heavy earth moving machineries and conveyors.
- Analyzing the safety of various slope types during surface mining operation.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction

Surface mining - Basic concepts, applicability, advantages and disadvantages; Role of surface mining in total mineral production; Deposits amenable to surface mining vis-à-vis excavation characteristics; Surface mining unit operations; Surface mining systems vis-à-vis equipment systems – classification, applicability, advantages and disadvantages. Bench parameters and the factors influencing the bench parameters. Problems.

Opening up of deposits

Box cut – objective, types, parameters, methods; Factors affecting selection of site for box; Production benches – formation, parameters and factors affecting their selection.

Preparation for excavation

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

Estimation of number of drills required for a given mine production.

Module-2

Discontinuous/cyclic methods of excavation and transport

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

Dragline operation: Applicability and limitations, different modes of operation; Side cast diagram and calculation of reach; Cycle time and productivity calculation; Calculation of required bucket capacity for a given handling requirement; Maximum usefulness factor and its significance in selection of dragline for a given situation; Method of work by simple side casting.

Front-end-loaders: Applicability and limitations; Method and cycle of operation; Minimum tipping- load – concept, estimation and significance; Calculation of maximum working load and selection of bucket capacity of a front-end-loader for a given job condition.

Scrapers: Applicability and limitations, various types; Method and cycle of operation; Pusher dozer and pushpull operation.

Dozers: Applicability and limitations; Types and classification; Types of blade and corresponding merits and demerits; Method and cycle of operation.

Module-3

Continuous methods of excavation and transport

Bucket wheel excavators: Applicability and limitations; Types and principle of operation; Operational methods – lateral block / half block method, full block methods and their corresponding merits and demerits; Calculation of productivity.

Continuous surface miners: Types, classification, applicability and limitations; Principles of operation; Operational methods – classification; Wide / full bench method, block mining method and stepped cut method; Empty travel back method, turn back method and continuous mining method; Conveyor / truck loading method, side casting method and windrowing method, Respective merits & demerits and applicability & limitations of these methods.

Conveyors: Mode of operation, applicability and limitations; Merits and demerits of conveyor as a system of transportation; Load Area Calculation for a troughed belt conveyor; Shiftable and high angle conveyors.

Module-4

Semi-continuous methods of excavation and transport

Continuous excavation and partly/fully cyclic transport system: Different methods and applicability & limitations. Cyclic excavation and partly/fully continuous transport system: Different in-pit crushing and conveying methods and their respective applicability &limitations.

Dimensional stone Mining

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

Module-5

Slopes in surface mines

Types of mine slope – highwall and waste dumps; Common modes of slope failure; Factors influencing stability of slopes; Slope stability assessment techniques; Waste dumps - types and formation methods; Slope protection, stabilization and monitoring.

Course outcome (Course Skill Set)

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

1. Apply the basic concepts and unit operations incorporated in a surface mine.
2. Select the appropriate equipments for excavating, loading and transporting material in open cast mines.
3. Describe the application of various heavy earth moving machineries and conveyors.
4. To analyze the safety of various slope types during surface mining operation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Surface Mining Technology S.K.Das, Lovely Prakashan, Dhanbad, 1994.
2. Surface Mining G.B.Mishra, Dhanbad Publishers, 1978.
3. Opencast Mining R.T. Deshmukh M. Publications, Nagpur 1996
4. Rock Slope Engineering Hock and Bray, The Institution of Mining and Metallurgy, 1981.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc21_mm40/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

ROCK MECHANICS LAB		Semester	V
Course Code	BMNL504	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination type (SEE)	Practical		

Course objectives:

- Prepare rock specimen for lab tests.
- Select suitable lab testing method to determine strength of rock specimen.

Sl.NO	Experiments
1	Determination of Rock Quality Designation of rock.
2	Determination of modulus of elasticity, Poisson's ratio and compressive strength of rock.
3	Determination of tensile strength of rock.
4	Determination of shear strength of rock.
5	Determination of Point load Strength Index of rock.
6	Determination of Protodyakanov index of the given rock specimen.
7	Determination of slake durability of rock.
8	Schmidt hammer test.
	Demonstration Experiments (For CIE)
9	Preparation of rock sample for testing in laboratory.
10	Determination of triaxial strength of rock.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Ability to prepare suitable rock specimen for lab tests.
- Ability to select suitable testing methods to determine strength.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- Introduction to Rock Mechanics, Goodman, RE.
- Engineering Rock Mechanics-An Introduction and Principles: Pergamon, Hudson, J.P. and Harrison,J.P.

ENVIRONMENTAL MANAGEMENT IN SURFACE MINE		Semester	V
Course Code	**BMN515A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	100
Examination type (SEE)	Theory		

Course objectives:

- To make student conversant with prevailing environmental legislation in India
- To provide knowledge in details about various sources of pollution in surface mines and mitigating measures against each source

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: Environmental issues in mineral industry — national and global; ambient environment mining complexes; environmental impacts of mineral exploitation - opencast mining and associated activities. Air Pollution: Sources, characterization, ill effects, measurement, monitoring, standards, mitigating measures.

Module-2

Water Pollution: Sources, ill effects, water quality parameters – physico-chemical, biological and bacteriological. Water quality criteria, standards, monitoring and mitigating measures. Heavy metal pollution and its abatement. Ground water pollution – detection and management. Acid mine drainage.

Module-3

Noise Pollution: Basics of acoustics. Sound power, intensity and pressure levels. Noise indices, effects, standards, instrumentation, monitoring and control. Blasting : Environmental aspects of blasting.

Module-4

Biological Land Reclamation: Environmental factors affecting revegetation – climatic, physical and chemical factors. Analysis and evaluation of site and soil. Plant species selection. Methods of vegetation establishment. Vegetation survey.

Societal Environment: Societal environment and its management including resettlement and rehabilitation; socio-economic impacts; sustainable development; concept of carrying capacity based planning.

Module-5

Environmental Administration in India: Administration and Management, Environmental Impact Assessment - Methods of EIA and their applicability; Environmental Management Plan - Structure and preparation of EMP; Environmental audit, salient features of Environment Protection Act; Environmental Laws.

Course outcome (Course Skill Set)

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

1. To develop expertise in legal requirement in connection with mine environment
2. To develop expertise environmental management capabilities

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Environmental Impact of Mining, C.G. Down. and J. Stock, Applied Science Publishers Ltd.

London, Second Edition, 1980.
2. Mining and Environment, B.B.Dhar, Ashish Publishing House, New Delhi, 1986.
3. Environmental Pollution Control Engineering, C.S. Rao, Wiley Eastern Ltd. 1992

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/113105107
- https://nptel.ac.in/courses/120108004
- https://www.youtube.com/watch?v=LwtGqpMStnk

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

GROUND CONTROL		Semester	V
Course Code	**BMN515B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Knowledge of underground excavation; stability around the excavation, subsidence and stress around the excavation
- To comprehend the rock mass classification and support system for underground excavation
- To monitor and predict subsidence and underground disasters
- To design single and multiple opening and support system for underground excavations

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Design and stability of structures in rock: Definition, types of underground excavation, excavation design and constraints. Methods for design and stability analysis of underground excavations; Energy released by making an underground excavation; Design of single and multiple openings in massive, stratified and jointed rock mass. Numerical problems.

Module-2

Design of mine pillars: Mine pillars and their classification; pillar mechanics; Design of mine pillars and shaft pillar: stresses acting on pillars; stress distribution in pillars; mechanics of pillar failure; interaction of pillar, floor and roof; design of rooms and pillars; design of barrier and yield pillars, Numerical Problems.

Module-3

Subsidence: Causes and impacts of subsidence; Mechanics of surface subsidence, discontinuous and continuous subsidence; Monitoring, prediction, control and management of subsidence, prediction of subsidence using graphical and analytical method, monitoring and determination. Numerical Problems.

Module-4

Caving of rock mass: Rock caving in mining; Mechanics of rock caving; Assessment of cavability; caving prediction and control.

Rockburst and coal bump: Phenomenology of rockbursts and coal bump; causes, prediction, monitoring and control of rockbursts; gas outbursts.

Module-5

Engineering classification of rocks and rock masses: Classification systems in rock engineering; Classification of intact rocks; Classification of rockmasses -Terzaghi's rock load, RQD, Rock Structure Rating, Bieniawski's RMR, Barton's Q-System, Laubscher's-MRMR, Hoek's-GSI, Palmstrom's RMi, CMRI-ISM Rock mass classification and Recent developments; correlations between different classification systems; Applications of Rockmass Classification in rock engineering.

Course outcome (Course Skill Set)

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

1. To be familiar with the types of underground excavation and to stabilize the excavation.
2. Support the rock mass based on different properties of rock.
3. Ability to estimate the subsidence and monitor the disasters.
4. To design an opening and support system for underground.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Coal Mine Ground Control, S.Peng, John Wiley and Sons, Inc. 1978.
2. Rock Mechanics and the Design of Structures in Rocks, L.Obert and W.I.Duvall, John Wiley and Sons, 1966.
3. Underground Excavations in rock, E. Hoek and E.T. Brown, IMM, 1980.
4. Strata Mechanics in Coal Mining, M. Jeremic, CRC Press, 1985.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/105105212
-

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

MINE ENVIRONMENTAL ENGINEERING		Semester	V
Course Code	**BMN515C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Understand the causes, preventive measures and methods of fighting associated with different types of mine fires.
- Understand the problems associated with mine disasters like mine explosion and inundation.
- Able to carry out the rescue and recovery operation in a mine by knowing the use of rescue equipments.
- Able to design the lighting in underground and open cast mine.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Mine fires: Causes and classification of mine fires; Spontaneous combustion - mechanism, stages of spontaneous combustion, susceptibility indices, factors affecting spontaneous combustion; Detection and prevention of spontaneous heating and accidental fires; Dealing with mine fires - direct and indirect methods, fire stoppings; Re-opening of sealed-off areas; Fires in quarries, Coal stacks and waste dumps.

Module-2

Mine explosions: Firedamp and coal dust explosions - causes and prevention, explosive limits, Problems on explosibility limit; Stone-dust and water barriers; Explosion in quarries over developed pillars; Investigation on mine explosions.

Module-3

Inundation: Causes and prevention; Precautions and techniques of approaching old workings; Dewatering of waterlogged working, safety boring apparatus, pattern of holes; Design and construction of water dams.

Module-4

Rescue and recovery: Rescue equipment and their uses, classification of rescue apparatus; Resuscitation; Rescue stations and rescue rooms; Organisation of rescue work; Emergency preparedness and response system.

Module-5

Airborne respirable dust: Generation, dispersion, measurement and control; Physiological effects of dust, dust-related diseases.

Illumination: Cap lamps; Layout and organisation of lamp rooms; Standards of illumination; Photometry and illumination survey; Luminance calculations.

Course outcome (Course Skill Set)

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

1. Understand the causes, preventive measures and methods of fighting associated with different types of mine fires.
2. The mine disasters like mine explosion and inundation.
3. Carry out the rescue and recovery operation in a mine by knowing the use of rescue equipments.
4. Design the lighting in underground and open cast mine.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Mine Disasters and Mine Rescue, M.A. Ramulu, Oxford & IBH Publishing Co. Ltd., 1991.

2. Mine Ventilation, Vol. I S. Ghatak, Coal Field Publishers, Asansol, 1983.
3. Environmental Engineering in Mines, V.S. Vutukuri & R.D. Lama, Cambridge University Press, 1992.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/123106002

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes
- Enacting

MINE VENTILATION		Semester	VI
Course Code	**BMN601**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

- To gain insights of mine air, mine climate and mine ventilation.
- To comprehend the ventilation requirements of an underground mine.
- Analysis of mine air, mine climate, natural ventilation, mechanical ventilation and to conduct ventilation survey.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE-1

Composition of mine atmosphere: Mine gases - production, properties and effects; Sampling and analysis of mine air; Methane content; Methane drainage; Flame safety lamp and its uses; Methanometers; Methane layering; Radon gas and its daughter products; Monitoring of gases.

MODULE-2

Heat and humidity: Sources of heat in mines; Effects of heat and humidity; Psychrometry, Kata thermometer; Air-conditioning.

MODULE-3

Air flow through mine openings: Laws of flow, resistance of airways, equivalent orifice, losses in airways, distribution of air, economic design of airways; Flow control devices; Permissible air velocities in different types of workings/openings; Standards of ventilation.

MODULE-4

Natural ventilation: Causes, effect of seasonal variations, calculation of NVP from air densities, thermodynamic principles and other methods. **Mechanical ventilation:** Types of mine fans; Theory, characteristics and suitability of fans; Selection, testing and output control; Fans in series and parallel; Forcing and exhaust configurations; Reversal of flow; Fan drifts, diffusers, evasees; Booster and auxiliary ventilation; Venturi blowers; Ventilation of deep mines - underground and open pit.
MODULE-5
Ventilation planning: Planning of ventilation systems and economic considerations; Ventilation layouts for underground coal and metal mines; Calculation of air quantity required for ventilating a mine; Calculation of total mine head; Ventilation network analysis principles and computer applications; Ventilation surveys.

PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*

Sl.NO	Experiments
1	Constructional features and applications of Flame Safety Lamp
2	Gas testing using Flame Safety Lamp
3	Determine the relative humidity of the atmosphere
4	Measurement of airflow using Velometer and Vane Anemometer
5	Estimation of air cooling power using Kata Thermometer
6	Plotting of fan characteristic curves.
7	Detection of mine gases, viz. CO, CO2, O2, CH4 using Multi-gas Detector.
8	Detection of methane using Methanometer
9	Analysis of mine gases using Gas Chromatograp (**Can be Demo experiments for CIE)**.
10	Demonstration of fire extinguishers to quench the fire

Course outcomes (Course Skill Set):

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

- To be familiar with the mine air composition, climate and physiological effects
- An ability to estimate the requirements of ventilation in an underground mine
- An ability to analyze the components of mine air sample, design natural and mechanical ventilation and conduct ventilation survey.
- An ability to decide and design ventilation system for underground mine.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE

(Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scoredby the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. Mine Environment and Ventilation by G. B. Misra.
2. Mine Ventilation by S. P. Banerjee.
3. Mine Ventilation and Air Conditioning by H.L. Hartman, J. Mutmansky and Y.J. Wang.
4. Subsurface Ventilation and Environmental Engineering by M.J. McPherson.

Web links and Video Lectures (e-Resources): https://archive.nptel.ac.in/courses/123/106/123106002/
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Demonstrations of Videos • Group Discussion • Quizzes

UNDERGROUND METAL MINING		Semester	VI
Course Code	**BMN602**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	4:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	04	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Understand the construction of the mine developments to the deposit.
- Understand the different methods of extraction of ore blocks in metal mine.
- Understand the modern methods of extraction of ore blocks in metal mine.
- the problems, method of extraction in deep mining and machineries used.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

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

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

Module-2

Review of excavation process: ground breaking, mucking, ventilation and support; Modern methods of raising - Alimak and Jora-lift raising, longhole method including vertical crater retreat method of raising; Raise boring - systems and their details; Modern methods of winzing.

Stoping methods: Classification of stoping methods, factors affecting the choice of stoping methods like depth, dip, width, grade of ore, physio mechanical characteristics of ore and wall rock. Factors affecting the stope design.

Module-3

Open stoping & Unsupported stoping: room and pillar, sublevel, large diameter blast hole/DTH, shrinkage and vertical crater retreat methods - their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping. Case studies.

Supported stoping: post and pillar, square set, longwall, cut and fill- their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping. Case studies.

Module-4

Stoping by Caving method: top slicing, sublevel caving, and block caving; their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping. Case studies.

Innovations in support and reinforcement systems for hard rock mines.

Module-5

Special methods: Solution mining, in-situ leaching, borehole mining, underground retorting, Problems of deep mining and their remedial measures. Case studies; Mining of parallel and superimposed veins, Pillar recovery Dilution, loss and recovery in stoping.

Course outcome (Course Skill Set)

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

1. Ability to construct the mine developments to the deposit
2. Ability to extract the ore block by different methods.
3. Ability to extract the ore block by modern methods.
4. Ability to identify the machineries used, methods of extraction and to analyse the problems in deep underground mine.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Introduction to Mining Engineering by Ratan Raj Tatia.
2. Introductory Mining Engineering by Howard L Hartman
3. SME Mining Engineering Hand Book by Howard L Hartman.
4. Y. P. Chacharkar, *A study of Metalliferous Mining Methods*, Lovely Prakashan, Dhanbad , 1994

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/123/105/123105006/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

OPEN PIT SLOPE ANALYSIS AND DESIGN		Semester	VI
Course Code	**BMN613A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- To explain slopes, their modes of failure and various factors/ parameters that influence stability of slopes in surface mines.
- To identify the geotechnical parameters that are required for stability studies of a slope.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: Types and formation of slopes in surface mines, pit slope vis-à-vis mine economics, mechanism of common modes of slope failure, factors influencing stability of slopes, and planning of slope stability investigations.

Module-2

Geotechnical Information: Site investigation and geological data collection for highwall slope, Waste Overburden Dump, Tailings Pond Embankment and their interpretation for stability studies. Physico-Mechanical Properties of rock, soil, tailings slime, flyash

Module-3

Shear Strength: Shear strength of intact rock, discontinuity surfaces, filled discontinuities and rock-mass - estimation and determination; Surface roughness, joint roughness coefficient – estimation and determination.

Module-4

Water Flow : Concepts of water flow through a material and its permeability; water flow through rock-mass, water flow through soil type material and broken spoil material; Estimation and measurement of permeability and water pressure; Graphical solution of seepage problems

(flow nets), seepage forces and seepage patterns under different conditions.

Module-5

Analysis and Design of Pit Slopes and Waste Dumps: Slope stability assessment methods and techniques; Analysis and design criteria and methodology for high wall slopes and backfill and waste dumps; Probabilistic approaches of slope analysis and design

Course outcome (Course Skill Set)

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

1. Explain slopes, their modes of failure and various factors/ parameters that influence stability of slopes in surface mines.
2. Identify the geotechnical parameters that are required for stability studies of a slope.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Rock Slope Stability: Charles A. Kliche, Published By Society For Mining, Metallurgy, And Exploration, Inc., 1919 (Latest Edition)

Reference Books:

1. Rock Slope Engineering Civil Applications, Fifth Edition, Duncan C. Wyllie, Crc Press

2. Rock Slope Engineering, 3rd Ed., Evert Hoek And John Bray, Taylor & Francis Routledge

3. Slope stability In Surface Mining, William A. Hustrulid, Michael K. Mccarter And Dirk J.A. Van Zyl, Society For Mining, Metallurgy, And Exploration

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/123105007

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

UNDERGROUND MINE PLANNING & DESIGN		Semester	VI
Course Code	**BMN613B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Understand the basic principles of mining law in India and role and influence of government on mining industries. To identify software for mine planning and designing.
- Explain the process of strategic mine planning and its impact on decision-making during project development and the factors considered in underground coal mine planning.
- Illustrate surface layouts, pit bottom and pit top layouts for different transport systems.
- Analyze and select suitable mine development and working methods.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Government Role and Influence in Mining: Social-Legal-Political-Economic impacts, Mining Laws, Health and safety standards, Environmental consequences. air, water and land pollution; causes and preventive measures.

Module-2

Coal Mines: Principles of mine planning, stages of planning of new mines: pre-feasibility report, feasibility report and DPR, selection of mine sites, geological aspects, and division of a coal field into mining areas. Surface layouts, pit bottom layout, transport system. Application of computers in mine planning.

Module-3

Longwall panel design: Mining Area, Term of life and mine capacity, division of mining property into parts, length, number and position of productive Longwall faces, dimensions of development workings.

Module-4
Metal Mines **Stope planning:** Evaluate stope boundaries, selection of a stoping methods, application of computer in stope design, economics of each stope. **Production planning:** Stope reserve, development, manpower, ore/waste handling, equipment, essential services, production scheduling, time and work study for improvement of production, Optimization of mine size (mine production capacity) based on techno-economic considerations.
Module-5
Mine closure planning: Initial, Progressive and Final Mine closure Planning and its components; Auditing; Legal and Financial Aspects. **Clearances and Approvals for Mining Projects for mine plan**: FC, EC, LA and others.
Course outcome (Course Skill Set) At the end of the course, the student will be able to : 1. Knowledge of Mining laws in India and role and influence of government on mining industries and software for mine planning and designing. 2. Ability to explain Process of strategic mine planning, Factors considered in underground coal mine planning 3. Ability to apply Surface layouts, pit bottom and pit top layouts for different transport systems. 4. Ability to analyze and select suitable mine development and working methods.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. SME Mining Engineering Hand book-H.L. Hartman
2. Surface and underground excavations – R. R. Tatiya
3. Coal Mine Planning by S.P.Mathur
4. Mine Planning: Jayant Bhattacharya

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/123105006

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

OCCUPATIONAL HEALTH AND SAFETY		Semester	VI
Course Code	**BMN613C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Understand the mine safety related rules, regulation and bye-laws in mines.
- Explain the mine safety related rules, regulation and bye-laws in mines.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: Safety conference and their impact, Safety Education and training; Pit Safety committee, health and safety program, Feedback on safety.

Module-2

Occupational Health: Safety and occupational health survey, notified and general miners diseases and their preventive measures. Permissible standard of dustiness. The Mines Rescue Rules, 1985.

Module-3

Safety Rules and Regulations: Standing order in event fire, inundation and failure of main mechanical ventilator.

Bye-Laws: ANFO Explosive, A.C. mains firing, Bulk transportation of explosives, Diesel Locomotives.

Module-4

Accidents: Classification of accidents, statistics, causes and preventive measures of various accidents; Accident enquiry report for accidents due to roof fall, blasting, machinery failure etc.

Module-5

Accidental Planning: Collection and presentation of accidental records, zero accidental planning (ZAP) and minimum accidental planning (MAP). Inspection for safety. Accident Compensation, Job safety Analysis.

Course outcome (Course Skill Set)

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

1. Understand the mine safety related rules, regulation and bye-laws in mines.
2. Explain the mine safety related rules, regulation and bye-laws in mines.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Legislation in Indian Mines – A critical Appraisal, Prasad and Rakesh, Tara Printing Works, 5th edition, 1990.
2. Encyclopedia of Mining Law, D.D. Seth., Law Publishers (India) Pvt. Ltd., Allahabad, 1999.

3. Mine Management Legislation and General Safety, Ghatak, Coal Field Publishers, Asansol, 1998.

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

MINE AUTOMATION		Semester	VI
Course Code	**BMN613D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- different automation techniques including virtual reality applicable tomining systems for the betterment productivity and safety in today's competitive world.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Basic Elements of an Automated System, Automation in Production System, Principles and Strategies of Automation, Advanced Automation Functions, Levels of Automations, Introduction to automation productivity. Autonomous mining systems - Operations Centre, Autonomous haulage systems,

Module-2

Automation of drilling and drill rig, drilling process. Automation of underground loading and transportation systems. Automation in tunnelling projects. Automation in monitoring of environments in longwall and continuous mining system, Automation of transportation system in surface mining.

Module-3

Fleet Management System: TDS, CMMS, ERP for Mining Industry; Mining Remote Operations & Control: Robotics & Armchair Mining; Use of robotics in mining for production and disaster management purpose.

Overview of Material Handling Systems - Principles and Design Consideration, Material Transport Systems, Storage Systems. (DCS - automation).

Module-4

Automated Communication and Tracking Technologies: Proximity Systems, GNSS/UPS, Vision Based Systems, Radar Systems, RFID and Geo-fencing, CCD camera, Data Logging Systems, SCADA, Image Processing etc.

Module-5

Virtual Reality Applications: Mining Equipment Concept development, Mine Safety Applications, Mining operation simulations.

Course outcome (Course Skill Set)

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

1. aware about the comprehensive overview of state-of-the-art mining automation used in mining industries.
2. learn automation system in material transport and handling.
3. come to know mining process in virtual platform for safe mine operations.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. G. Almgren, U. Kumar, N. Vagenas : Mine Mechanization & Automation 1st Edition.
2. J. O'Shea M. Polis : Automation in Mining, Mineral and Metal Processing (1st Edition), Proceedings of The 3Rd Ifac Symposium, Montreal, Canada 18-20 August 1980 .

3. Peter V. Golde : Implementation of Drill Teleoperation in Mine Automation.
Web links and Video Lectures (e-Resources):
• https://study.curtin.edu.au/offering/unit-ug-automation-and-data-analytics-in-mining--mine3011/
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Demonstrations of Videos • Group Discussion • Quizzes

INTRODUCTION TO MINING		Semester	VI
Course Code	**BMN654A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- To introduce the basic elements of mining engineering with a view to recognize the key aspects of opening of mineral deposits and different mining methods.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Mining: Definition and economic importance; Mine – definition, different types and classification; Mine life cycle, Exploratory Drilling; Mineral deposit – different types and their classification; Mineral resources of India

Module-2

Opening-up of Deposits: Choice of mode of entry - adit, shaft, incline, decline and combined mode, their applicability, number and disposition. Box cut- types and location

Module-3

Vertical/Inclined Shafts, Inclines/Declines: Location, shape, size, and organisation of shaft sinking, sinking methods, construction of shaft collar, shaft inset, shaft fittings. Methods of incline/decline drivage.

Module-4

Overview of underground mining: Different coal mining methods and their applicability & limitations; Different metal mining methods and their applicability & limitations; Basic concepts of transportation, ventilation, illumination and support in underground mines.

Module-5

Overview of surface mining: Types of surface mines, applicability & limitations, unit operations and equipment selection, pit geometry and layout.

Course outcome (Course Skill Set)

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

1. General understanding on mining lifecycle and mineral resources.
2. Decision to choose a suitable location of a mine entry.
3. Shaft sinking and drifting technology.
4. Underground mining unit operations and basic layouts.
5. Surface mine unit operations and basic layouts.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Introductory Mining by H L Hartman
2. Elements of Mining Technology (Volume 1, 2 and 3) by D J Deshmukh
3. Principles and Practices of Coal Mining by R D Singh
4. SME Mining Engineering Handbook, 3rd Edition by Peter Darling

Web links and Video Lectures (e-Resources):

• https://www.studocu.com/en-gb/document/imperial-college-london/mining-engineering/mining-engineering-lecture-notes-1/13619457
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Demonstrations of Videos • Group Discussion • Quizzes

INTRODUCTORY ROCK MECHANICS		Semester	VI
Course Code	**BMN654B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- To describe the importance of Rock Mechanics in the field of mining and identify of the physical and mechanical properties of rocks.
- To understand stress and strain in rocks and the physical and mechanical properties of rocks, and failure criteria for rock and rockmass.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Rock Mechanics: Definition, Scope and importance, development and application of rock mechanics in mining. Discontinuities; Description of discontinuities, hemispherical projection of discontinuities.

Module-2

Analysis of Stress: Introduction, definition and basic concepts, stress in a plane, (two dimensional stress), Mohr's Circle of stress, equations of equilibrium, plane stress equations. Simple numerical problems.

Module-3

Analysis of Strain: Introduction, definition and basic concepts, strain in a plane, (two dimensional strain), Mohr's Circle of strain, equations of compatibility, stress-strain relationship, plain strain equations, elasto plastic behaviour of rocks.

Module-4

Physico-mechanical properties of rock: Determination of physical properties, strengths, strength indices and static elastic constants; Parameters influencing strength; Abrasivity of rock and its determination.

Module-5

Rock mass Classification: Rock mass classification methods and their applications.

Failure criteria for rock and rockmass: Theories of rock failure; Coulomb, Mohr and Griffith criteria; Empirical criteria.

Course outcome (Course Skill Set)

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

1. describe the importance of Rock Mechanics in the field of mining and identify of the physical and mechanical properties of rocks.
2. calculate the stress and strain in rocks and rockmass.
3. understand the rock mass classification
4. Understand failure criteria for rock and rock mass.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Fundamental of Rock Mechanics by Jaeger, J.C. and Cook, NGW
2. Underground Excavation in Rock, Hoek, E and Brown, ET

3. Rock Mechanics for Underground Mining, Brady, BHG and Brown, ET
4. Introduction to Rock Mechanics, Goodman, RE.
5. Coal Mine Ground Control: Syed Peng

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/105105212

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

MINING, ENERGY AND CLIMATE CHANGE		Semester	VI
Course Code	**BMN654C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- This course will emphasize on the importance of global warming and its effect on the society.
- It will also discuss on different mining and energy scenarios and their contribution for increasing the carbon footprint which in turn produces global warming. All important research and development contributing to reduction of its effect will be presented in the class.
- In addition, India's commitment for reduction of carbon footprint and the actions planned for implementation will be the subject of discussion for energizing the young students for their contribution in thoughts and actions for fulfilling the international commitments for saving the Mother Earth

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Basics of Global Warming and Climate change: Global warming and glacial change, the rise of carbon, Alpine "Hot Box" experiment, the atmosphere as a dam built across a river, Royal Institution Laboratory and findings of John Tyndall, Guy Callendar, Arrhenius etc., the age of discovery : findings of Roger Rivelle, Keelings Curve, large scale geophysical experiments, modelling of climate and road to Rio, journey to Paris protocol.

Module-2

India's Initial and Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC): National Circumstances, GHG Inventory Information, Vulnerability Assessment and Adaptation, Research and Systematic Observations, Education, Training and Public Awareness, Programmes Related to Sustainable Development, Constraints and Gaps, and Related Financial, Technical and Capacity Needs.

Module-3

Coal and Uranium Mining for Energy security Coal mining and electrical age, Wizards of Menlo Park, Battle of the currents, Metering of the energy, Regulatory bargain, The growth of electrical age, Uranium mining and nuclear cycle, Nuclear navy, Disaster of Three Mile Island, Chernobyl Disasters and Fukushima Daiichi, Growth of India's coal and uranium mining industry.

Module-4

Oil and Natural Gas – Adventure in Energy resources Growth of world's liquid fuel production, Fluctuation of demand, supply and prices, Fear of running out of oil, Gulf war – Desert storm, Pipeline battle, Influence of different nations in the Persian Gulf, Major discoveries of oil and innovations in the oil and gas industry for higher recovery.

Module-5

Carbon dioxide sequestration and reduction of carbon footprint Different methods for carbon dioxide sequestration: Geological reserves, marine water and other methods for sequestration, other uses of carbon dioxide for reduction of global warming.

India's commitment for augmenting global warming Paris protocol, India's commitment for reduction of global warming and actions envisaged

Course outcome (Course Skill Set)

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

1. Facts of global warming and its significance; the need for addressing the emerging environmental issues.
2. Role of coal and uranium mining for energy security and potential dangers and disasterswith nuclear options.
3. Role of gas and oil, associated issues and their impact on environment.
4. Different methods for Carbon dioxide sequestration and reduction of carbon footprint
5. India's commitment for augmenting global warming.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Future of Energy : Brian F. Towler (2014)
2. The Quest: Energy, Security, and the Remaking of the Modern World : Daniel Yergin (2011)

Web links and Video Lectures (e-Resources):

- .

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Quizzes

NUMERICAL MODELLING LAB		Semester	VI
Course Code	**BMNL606**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination type (SEE)	Practical		

Course objectives:

- To provide skills in operating latest software in numerical modelling.

Sl.NO	Experiments
1	Determine the safety factor or probability of failure, of circular or non-circular failure surfaces in soil or rock slopes.
2	Determine the safety factor or probability of failure, of planar failure in soil or rock slopes.
3	Determine the safety factor or probability of failure, of wedge failure in soil or rock slopes.
4	Design the stability of a tunnel
5	Determine the stability of an underground structure using EX3
6	Plotting of discontinuities planes using the hemispherical/stereonet projections
7	Assess the stability of crown pillar using CPillar
8	To assess the risk of rockfall using RocFall
	Demonstration Experiments (For CIE)
9	Determine the stability of an underground structure using RS3
10	To compare the rock's strength criteria and observed stress-strain behaviours using field and lab test data against numerical simulations of the same tests.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

-

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

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Introduction to IOT		Semester	VI
Course Code	BMN657A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- Demonstrate to install IDE to create IoT application
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Develop Python programming language to develop programs for solving real-world problems
- Analyse sensor technologies for sensing real world entities

Sl.NO	Experiments
1	Design a smart bin using IoT with Arduino / Raspberry Pi
2	Design water level monitoring system using IoT with Arduino / Raspberry Pi
3	Design temperature monitoring system using IoT with Arduino / Raspberry Pi
4	Design car parking management system using IoT with Arduino / Raspberry Pi
5	Design automated pet feeder using IoT with Arduino / Raspberry Pi
6	Design smart agriculture system using IoT with Arduino / Raspberry Pi
7	Design smart street light monitoring system using IoT with Arduino / Raspberry Pi
8	Design smart anti-theft system using IoT with Arduino / Raspberry Pi
	Demonstration Experiments (For CIE)
9	Demonstrate Alexa based smart home monitoring system using IoT
10	Demonstration ECG monitoring using IoT
11	Demonstration home automation system using IoT
12	Demonstration of face recognition bot using IoT

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Understand basic concepts of IoT, Arduino / Raspberry Pi
- Build application-oriented projects using IoT
- Develop algorithm to solve real time problems by interface sensors and controller

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743).

2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.(ISBN:978-8173719547)

2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

TEMPLATE for AEC (if the course is a theory) Annexure-IV

GENDER SENSITISATION		Semester	VI
Course Code	**BMN657B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	16	Total Marks	100
Credits	01	Exam Hours	01
Examination type (SEE)	Theory		

Course objectives:

- Figure out the current practices of a patriarchal society.
- Balance the roles and responsibilities of different genders in a civil society.
- Appreciate the importance of family and the values it stands for.
- Balance gender issues and emphasise on gender equality at work place and society.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Power point Presentation, video

Module-1
Understanding Gender and Related Concepts, Gender in Everyday Life, Gender of Work
Module-2
Gender and Sexualities, Masculinities, Family, Love and Power Marriage, Motherhood.
Module-3
Gendering Work, Gender and Employment , Gender Issues in Work and Labour Market, Sexual Harassment at the Workplace
Module-4
Health in Social Contexts, Reproductive Health and Rights, Gender and Disability. Gender-Based Violence.
Module-5
Towards Gender Equality.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Appreciate gender issues prevalent in the society.
2. Value the role of each gender in family, society and state.
3. Analyse the gender sensitivity at work place and evolve proper perception of the other gender.
4. Sensitise oneself towards gender equality.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

1. The question paper will have ten questions. Each question is set for 10 marks.
2. There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
3. The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

1. IGNOU: Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi.
2. Jane Pilcher and Imelda Whelehan (2005): Fifty Key Concepts in Gender Studies.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.swayam2.ac.in/nou21_hs03/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Presentation on any social issues

TEMPLATE for AEC (if the course is a theory) Annexure-IV

INDUSTRY 4.0		Semester	VI
Course Code	**BMN657C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	16	Total Marks	100
Credits	01	Exam Hours	01
Examination type (SEE)	Theory		

Course objectives:

- This course is designed to offer learners an introduction to Industry 4.0, its applications in the business world.
- Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Power point Presentation, video

Module-1

Introduction to Industry 4.0: The Various Industrial Revolutions, Digitalisation and the Networked Economy Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0. The Journey so far: Developments in USA, Europe, China and other countries. Comparison of Industry. Factory and Today's Factory. Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

Module-2

Road to Industry 4.0: Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services. Smart Manufacturing. Smart Devices and Products. Smart Logistics. Smart Cities. Predictive Analytics**.**

Module-3

Related Disciplines, System, Technologies for enabling Industry 4.0: Cyber physical Systems. Robotic Automation and Collaborative Robots. Support System for Industry 4.0. Mobile Computing. Related Disciplines. Cyber Security.

Module-4

Role of data, information, knowledge and collaboration in future organizations: Resource-based view of a firm. Data as a new resource for organizations. Harnessing and sharing knowledge in organizations. Cloud Computing Basics. Cloud Computing and Industry 4.0.

Module-5

Other Applications and Case Studies: Industry 4.0 laboratories. IIoT case studies.

Business issues in Industry 4.0: Opportunities and Challenges. Future of Works and Skills for Workers in the Industry 4.0 Era. Strategies for competing in an Industry 4.0 world.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the drivers and enablers of Industry 4.0.
2. Appreciate the smartness in Smart Factories, Smart cities, smart products and smart services.
3. Able to outline the various systems used in a manufacturing plant and their role in an Industry 4.0 world.

4. Appreciate the power of Cloud Computing in a networked economy.
5. Understand the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

1. The question paper will have ten questions. Each question is set for 10 marks.
2. There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
3. The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

1. https://drive.google.com/file/d/17CPu--DdQHwUGzcbjDdNZbEcvHQ56-Cf/view
2. Industry 4.0: The Industrial Internet of Things, Alasdair Gilchrist, 1st ed. Edition, Apress, 2016.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106105195

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstrations of Videos
- Group Discussion
- Presentation on any industrial issues

Data analytics with Excel		Semester	VI
Course Code	BMN657D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	2
Examination type (SEE)	practical		

Course objectives:

- Understand the use of Spreadsheet for data collection and analysis.
- Evaluate the equations using Excel functions
- Learn the data quality and consistency of data

Sl.NO	Experiments
1	Introduction to Data Analysis Using Spreadsheets: Fundamentals of spreadsheet applications, Excel interface, and learn how to navigate around a worksheet and workbook.
2	Using Excel Spreadsheets: Perform basic spreadsheet tasks, such as viewing, entering and editing data, and moving, copying and filling data. Learn about the fundamentals of formulas, and learn about the most common functions used by a data analyst. Finally, you will learn how to reference data in formulas.
3	Cleaning & Wrangling Data Using Spreadsheets: Importance of data quality, how to import file data in to Excel, fundamentals of data privacy, remove duplicate and inaccurate data, and how to remove empty rows in your data..
4	How to deal with inconsistencies in your data and how to use the Flash Fill and Text to Columns features to help you manipulate and standardize your data
5	Analyzing Data Using Spreadsheets: Fundamentals of analyzing data using a spreadsheet, and learn how to filter and sort data. Learn how to use some of the most useful functions for a data analyst
6	How to use the VLOOKUP and HLOOKUP reference functions. In addition, learn how to create pivot tables in Excel, and use several pivot table features
7	Final Project: In this final module, you will be introduced to a hands-on lab where you will complete a graded assignment for cleaning and preparing data, and then analyzing data using an Excel spreadsheet.
8	Submission of report for final assessment

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Prepare the data sets and perform the analysis.
- Analyse and perform repetitive calculations using several functions
- Design and apply solutions to verify the data sets

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- https://www.coursera.org/learn/excel-basics-data-analysis-ibm
- Any online platform with the above course content like YouTube videos and NPTEL courses