

<b>MINE ENVIRONMENT AND VENTILATION ENGINEERING</b> [As per Choice Based Credit System (CBCS) scheme] <b>SEMESTER – V (Mining Engineering)</b>			
<b>Sub Code</b>	<b>15MN51</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of LectureHours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 04</b>			
<b>Course objectives:</b> This course will enable students to:			
<ol style="list-style-type: none"> <li>1. To gain insights of mine air, mine climate and mine ventilation</li> <li>2. To comprehend the ventilation requirements of an underground mine.</li> <li>3. Analysis of mine air, mine climate, natural ventilation, mechanical ventilation and to conduct ventilation survey</li> </ol>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>MODULE- 1: Mine Air and Study of Fire Damps</b>			
<p>1. <b>Mine Air:</b> Atmospheric air and composition of mine air, Mine Gases: - Occurrence, properties, detection, measurements and physiological effects. Problems.</p> <p><b>Study on Fire Damps:</b> Methane content, emission of methane, degree of gassiness of a coal mine, gas blowers, gas outbursts, dealing of firedamp in mines. Methane streaming and layering, methane drainage, testing of firedamp. Problems.</p>			<b>10 Hours</b>
<b>MODULE- 2: Mine Climate</b>			
<b>Mine Climate:</b> Physiological effects of mine climate, objective of mine ventilation, air quantity requirement, pressure, barometric pressure, temperature, sources of heat in mines, moisture content of mine air, effects of heat and humidity on the miner, cooling power of mine air, psychometry and air conditioning. Problems.			<b>10 Hours</b>
<b>MODULE- 3: Air Flow Through Mine Openings</b>			
<b>Air flow through mine openings:</b> Fundamentals of air flow, Reynolds number, laminar and turbulent flow, pressure losses due to friction and shock resistance, resistance of airways:- laws of mine air friction, co- efficient of friction, resistance of roadways in series and parallel, resistance of leaky airways, characteristic of an airway (or) mine, equivalent orifice, Economic design of an airway. Distribution of air and flow control devices. Problems.			<b>10 Hours</b>
<b>MODULE- 4: Natural and Mechanical Ventilation</b>			
<p><b>Natural Ventilation:</b> Mechanism, causes, calculation of Natural Ventilation Pressure from air densities, other methods of determining Natural Ventilation Pressure, motive column. Problems.</p> <p><b>Mechanical Ventilation:</b> Types of fans, theory, efficiencies, characteristic curves and suitability of fans, selection, testing and output control of a mine fan. Fans in series and parallel, forcing and exhaust ventilation, reversal of air currents, diffusers, evasees, ventury, booster and auxiliary fans. Problems.</p>			<b>10 Hours</b>
<b>MODULE- 5: Ventilation Survey and Elements of Ventilation Planning</b>			
<p><b>Ventilation survey:</b> Importance of ventilation survey, types: - qualitative surveying, pressure survey and quantity survey. Problems.</p> <p><b>Elements of Ventilation Planning:</b> Objective, steps in ventilation planning, desirable features of a ventilation system, types of ventilation system, quantity requirement, analysis of ventilation cost. Problems.</p>			<b>10 Hours</b>
<b>Course outcomes:</b>			

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

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

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Elements of Mining Technology Vol II- D.J. Deshmukh, 9 th Edition, Central Techno Publication, Nagpur, 1998.
2. Mine Environment and Ventilation – G.B. Mishra, Oxford University Press, 1994.

**REFERENCE BOOKS:**

1. Mine ventilation and air conditioning – Howard L. Hartman. Wiley International, 1976.
2. Environmental Engineering in Mines – Vutukuri& Lama, Cambridge University Press, Cambridge, 1992.
3. Legislation in Indian mines a critical appraisal Vol. I and Vol. II – Prasad and Rakesh. Vivek Publications, Varanasi 1999.
4. Mine Ventilation Vol. – II, S. Ghatak, Coalfield Publishers, 1993.
5. Numerical Problems on Mine Ventilation, L.C. Kaku, Lovely Prakashan, Dhanbad.
6. Basics of Mine Ventilation, P.C. Shyam, Lovely Prakashan, Dhanbad.

<b>MINE MECHANIZATION– II</b> [As per Choice Based Credit System (CBCS) scheme] <b>SEMESTER – V (Mining Engineering)</b>			
<b>Sub Code</b>	<b>15MN52</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 04</b>			
<b>Course objectives:</b> This course will enable students to:			
<ol style="list-style-type: none"> <li>1. Gain knowledge of various types of pumps, inflow of water into mine working, basic principles of drilling, cutting and ploughing.</li> <li>2. Comprehend the performance and characteristics of the pumps, layouts of underground pumping station, operating parameters of underground mine machinery and maintenance of machinery.</li> <li>3. Know applications of different types of support and underground mine machinery under given conditions.</li> <li>4. Select pumps for underground mines under given conditions.</li> </ol>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>MODULE- 1: Drainage and Pumping and Performance and Characteristic of Pumps</b>			
<b>Drainage and Pumping:</b> Methods to prevent inflow of water into mine workings, mine pumps, different types of pumps-centrifugal, turbine, roto pump, mono block pump, drill operated pump, displacement pumps. Problems. <b>Performance and Characteristic of Pumps:</b> Performance and characteristic of centrifugal and turbine pumps. Pumps in shafts and roadways and their maintenance. Sumps: location and capacity. Layout of main underground pumping stations. Problems.			<b>10 Hours</b>
<b>MODULE- 2: Face Mechanization and Allied Face Machineries</b>			
<b>Face Mechanization:</b> Classification-continuous and intermittent road headers, Shearer, their application, limitation and specification. <b>Allied Face Machineries:</b> Coal Ploughs, coal cutting machines, their application, limitation and specification.			<b>10 Hours</b>
<b>MODULE- 3: Allied Machinery and Development of Face Mechanization</b>			
<b>Allied Machinery:</b> Basic Principles of drilling, cutting and ploughing machines. Working principles, Specifications, applications and limitations of hydraulic props, chocks, chock shields, canopies, armoured face conveyors and stage loader. Development of Face Mechanization: Recent developments in face mechanization. Working principles, Specifications, applications and limitations of L.H.D., S.D.L., L.P.D.T. and Rocker Shovel.			<b>10 Hours</b>
<b>MODULE- 4: Trackless Equipment's</b>			
Trackless equipment's: Types, working principles, Specifications, applications and limitations.			<b>10 Hours</b>
<b>MODULE- 5: Machinery Maintenance</b>			
Machinery Maintenance: Maintenance management and safety, CAD, Remote monitoring and controlling in mines and automation. Application of Computer for Maintenance.			<b>10Hours</b>
<b>Course outcomes:</b> At the end of the course students will be able to:			
<ol style="list-style-type: none"> <li>1. Familiar with the various types of pumps, inflow of water into mine workings, basic principles of drilling, cutting and ploughing.</li> </ol>			

2. Ability to understand the performance and characteristics of pumps, layouts of underground pumping station, operating parameters of underground mining machinery.
3. Ability to select different types of supports and mine machinery under given conditions.
4. Capable of choosing pumps for underground mines under given conditions.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Elements of Mining Technology Vol. III – D.J.Deshmukh, 6th edition Central Techno Publication, Nagpur, 1998.
2. Modern Coal Mining Technology – S. K. Das, 2nd edition, Lovely Prakashan.

**REFERENCE BOOKS:**

1. Coal Mining – I.C.F. Statham Vol. I and Vol. III The Caxton Publishing Company Ltd. Inc. 1958.
2. Longwall Mining – Syd. S. Peng and H.S. Chang, John Wiley and Sons Inc. 1983.
3. Selection, Installation and maintenance of mine pumps. – rakesh and M.G. Lele. 2 nd edition, Nishkam Press Meerut 1975.
4. Mine Pumps, Haulages and Winding, S. Ghatak, Coal Field Publisher, Asansol, 1995.
5. Mine Hoisting, M.A. Ramulu, Oxford and IBH 1996.

<b>MINE SURVEYING –II</b> [As per Choice Based Credit System (CBCS) scheme] <b>SEMESTER – V (Mining Engineering)</b>			
<b>Sub Code</b>	<b>15MN53</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 04</b>			
<b>Course objectives:</b> This course will enable students to:			
<ol style="list-style-type: none"> <li>1. Knowledge of distance and elevation using optical means, area and volume of underground and opencast mine, network of triangles, baseline in underground and surface, the duties and responsibilities of surveyor.</li> <li>2. Application of the network of triangles, setting of curve in mine survey, transfer reduced level from surface to underground.</li> <li>3. To evaluate the accuracy of the survey.</li> </ol>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>MODULE- 1:Tachometric Survey</b>			
<b>Tachometric Survey:</b> <b>Stadia method</b> -Principles, applications and limitations, distance measurement, anallactic lens, errors. Problems <b>Non Stadia method</b> -horizontal base subtense measurement, tangential method. Problems.			<b>10 Hours</b>
<b>MODULE- 2:Curve Ranging</b>			
<b>Curve Ranging:</b> <b>Setting out curves on surface</b> - Definition and elements of simple curve, Linear and angular methods, Problems <b>Setting out of simple curves in underground</b> - Linear and angular methods, requirements and functions of a transition curve. Problems			<b>10 Hours</b>
<b>MODULE- 3: Correlation Survey</b>			
<b>Correlation Survey</b> <b>Correlation methods:</b> Principles, procedures and limitations.Assumed Bearing, Weisback Triangle, Coplanning, Weisback quadrilateral, degree of accuracy. Problems. <b>Underground Survey</b> -Underground traversing, Shaft plumbing, transfer of levels, direction control, Problems.			<b>10 Hours</b>
<b>MODULE- 4: Stope and Subsidence Survey</b>			
<b>Stope Surveying:</b> Definition, purpose, methods: Tape triangulation, Ray, steeply dipping ore bodies, moderately dipping ore bodies, degree of accuracy. <b>Subsidence Survey:</b> Principles, method and degree of accuracy, underground traversing, setting out gradients in tunnels and adits, Mine plans and sections, duties and responsibilities of surveyors, care and precaution in storage, statutory responsibilities.			<b>10 Hours</b>
<b>MODULE- 5: Photogrammetry and Remote Sensing</b>			
<b>Photogrammetry:</b> Introduction, Basic Principles, Definition, Photo theodolite and aerial camera, horizontal and vertical angles from terrestrial photograph, horizontal position of a point from photographic measurement for camera axis horizontal, elevation of a point by photographic			<b>10 Hours</b>

<p>measurement, determination of focal length of the lens.Problems</p> <p><b>Remote Sensing:</b> Introduction, basic principle, idealized remote sensing system, electromagnetic energy and spectrum, wavelength regions and their applications in remote sensing, application of remote sensing.</p>	
<p><b>Course outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Ability to use optical means determine distance, elevation, area and volume. To set out baseline according to the rules and responsibilities of surveyor.</li> <li>2. To set out a curve and to locate the underground features through survey.</li> <li>3. Determination of the reduced level in underground.</li> <li>4. Ability to determine the accuracy of the surveyed area.</li> </ol>	
<p><b>Question Paper Pattern:</b></p> <ul style="list-style-type: none"> <li>• The question paper will have ten questions.</li> <li>• Each full Question consisting of 16 marks</li> <li>• There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.</li> <li>• The students will have to answer 5 full questions, selecting one full question from each module.</li> </ul>	
<p><b>TEXT BOOKS:</b></p> <ol style="list-style-type: none"> <li>1. Surveying Vol. II – B.C. Punmia, 12th edition, Lakshmi Publications, 1994.</li> <li>2. Surveying Vol. III – B.C. Punmia, 12th edition, Lakshmi Publications, 1994.</li> <li>3. Metalliferous Mine Surveying Fedrick Wini Berg, 2nd edition Mining Publications, London, 1935.</li> <li>4. Surveying Vol. I and II – DrB.C. Punmia, Er Ashok K. Jain, Dr Arun K. Jain, 15th edition, Lakshmi Publications, 2005.</li> </ol>	
<p><b>REFERENCE BOOKS:</b></p> <ol style="list-style-type: none"> <li>1. Mine Surveying Vol. I, II, III, Ghatak, 5th edition, Coal Field Publishers, 1996.</li> <li>2. Mine Surveying by V.Borsheh – Komponiets, Mir-Publishers, 1989.</li> <li>3. A Text Book of Advanced Surveying Jawaharlal Sharma, C.B.S. Publishers and Distributors, 1985.</li> </ol>	

<b>UNDERGROUND COAL MINING</b> [As per Choice Based Credit System (CBCS) scheme] <b>SEMESTER – V (Mining Engineering)</b>			
<b>Sub Code</b>	<b>15MN54</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 04</b>			
<b>Course objectives:</b> This course will enable students to:			
<ol style="list-style-type: none"> <li>1. Understand the mode of access to reach coal seams and choice of mine seam</li> <li>2. Gain knowledge of bord and pillar method of mining</li> <li>3. Gain knowledge of longwall method of mining</li> <li>4. Knowledge of extracting of thick coal seams by special methods</li> </ol>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>MODULE- 1: Introduction to Coal Mining</b>			
<b>Introduction:</b> Coal mining in major coal producing countries, Growth of coal mining industry in India, Grading and analysis of coal. <b>Opening of Coal Seams:</b> Access by adits, Opening up of coal seams by surface drifts on incline, vertical shafts, Division of mine into blocks. <b>Choice of Coal Mining Methods:</b> Basic Mining Methods, Board and Pillar, Longwall and Shortwall, Factors influencing choice of mining methods.			<b>10 Hours</b>
<b>MODULE- 2: Board and Pillar Mining</b>			
<b>Board and Pillar Mining:</b> Board and Pillar Mining System. Design of Board and Pillar workings, Mining Processes, Development of Panels, Extraction of Pillars and Examples of Pillar extraction techniques. <b>Room and Pillar Mining:</b> Applicability, Merits and Demerits. Variants of Room and Pillar Mining Method. Simple Problems.			<b>10 Hours</b>
<b>MODULE- 3: Longwall Mining</b>			
<b>Longwall Mining:</b> Elements of a Longwall face, Classification of Modern Longwall faces, Planning of Longwall Mining System, <b>Development of Panel and faces-</b> Face support system, Power supply, and material supply and face organization. Strata mechanics around Longwall panel.			<b>10 Hours</b>
<b>MODULE- 4: Thin Seam Mining by Longwall Method and Thick Seam Mining</b>			
<b>Thin seam Mining by Longwall Method:</b> Method of working thin, medium thick and thick seams by Longwall Mining with case studies of Indian and foreign Mines. Simple Problems <b>Thick seam Mining:</b> Problems of Mining Thick Coal Seams, Choice of Method of Mining Thick Coal Seams, Inclined Slicing, Horizontal Slicing, Diagonal Slicing, Transversely Inclined Slicing, Sublevel Caving, Working Steep and Moderately Thick Seams, The Velenjee Method, Descending Shield Method of Mining.			<b>10 Hours</b>
<b>MODULE- 5: Special Methods of Mining</b>			
<b>Special Methods of Mining:</b> Inseam Mining and Horizon Mining, Hydraulic Mining, Blasting Gallery Method, Coal Bed Methane. <b>Goaf Control:</b> Caving, strip packing or solid stowing, Hydraulic Stowing etc.			<b>10 Hours</b>

Procurement of stowing materials and its transportation, theoretical aspects and case studies.

**Course outcomes:**

At the end of the course students will have:

1. Ability to identify mode of access to reach coal seam and choice of mining method
2. Ability to design bord and pillar method of mining
3. Ability to design longwall method of mining
4. Ability to design the extraction of thick coal seams by special methods.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

1. Underground Coal Mining Methods – J.G.Singh, BrajKalpa Publishers, Varnasi, 2000.
2. Coal Mining – I.C.F. Statham, Vol. I, II, III and Vol. III. The Caxton Publishing Company Ltd. Inc. 1958.
3. Longwall Mining – S.Peng&H.S.Chang, John Wiley and Sons Inc. 1983.
4. Winning & Working of Coal, Vol. I, II – D.J.Deshmukh, Asia Publsiing House, Bombay, 1967.
5. Universal Mining School Volumes. Cardiff [GT. Britain], 1931.
6. SME Mining Engg. Hand Book – Hartman, 2 nd edition S.M.M. & Exploration Inc. 1992.
7. Underground Winning of Coal – T.N. Singh, Oxford and IBH. 1992.
8. Advanced Coal Mining, Vol. 1 and 2 – Vorbojev& Deshmukh, Asia Publishing House, Bombay, 1964.
9. Thick Seam Mining – T.N. Singh and B.B.Dhar, Oxford and IBH, 1992.



<b>Professional Elective-I</b> <b>Mineral Economics</b> [As per Choice Based Credit System (CBCS) scheme] <b>SEMESTER – IV (Mining Engineering)</b>			
<b>Sub Code</b>	<b>15MN551</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 03</b>			
<b>Course objectives:</b> This course will enable students to: <ol style="list-style-type: none"> <li>1. Gain knowledge on role of mineral industry in national economy, national mineral policy, financial management and cost accounting applicable to mining industry.</li> <li>2. Comprehend sampling, classification of ore reserves and resources.</li> <li>3. Learn various methods of ore reserve estimation and mine valuation.</li> <li>4. Evaluate the economic feasibility of a mining project.</li> </ol>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>MODULE- 1:</b>			
<b>Introduction:</b> Economic importance of mineral industry, special features of mineral industry, demand and supply analysis, National Mineral Policy. <b>Mineral Price and Pricing:</b> International Monetary system, Factors affecting mineral price, Kinds of price quotation, Mineral Price Index, Mineral Price.			<b>10 Hours</b>
<b>MODULE- 2:</b>			
<b>Sampling:</b> Definition, purpose, scope, common methods of sampling, types of samples, errors in sampling. <b>Estimation of reserves:</b> Classification of reserves, tenor, grade. Preparation of assay plans, various methods of ore reserve estimation and problems on ore reserves			<b>10 Hours</b>
<b>MODULE- 3:</b>			
<b>Mine Valuation –1 :</b> Factors affecting mine valuation, life of mine, redemption of capital, project assessment by D.C.F., net present value methods, Hoskold’s two rate formula. <b>Mine valuation – 2:</b> mining fixed costs, operating costs, feasibility study, project evaluation, depreciation, problems on mine valuation and depreciation.			<b>10 Hours</b>
<b>MODULE- 4:</b>			
<b>Financial Management:</b> Methods of financing industrial enterprises, structure, formation and capitalization. Sources of finance. <b>Principles of book keeping</b> as applied to mining industry and accountancy. Balance sheet, profit and loss accounts.			<b>10 Hours</b>
<b>MODULE- 5:</b>			
<b>Cost Accounting:</b> Introduction, need for cost accounting, elements of cost, overheads, allocation of over heads, breakeven analysis. <b>Budget and Budgetary control:</b> Definition of budget, Principle of budget and budgetary control, types of budgets.			<b>10 Hours</b>

**Course outcomes:**

At the end of the course students will have:

1. An overall knowledge of mineral industry and related policy issues, basics of financial and cost accounting aspects.
2. An ability to select proper sampling method and to classify the ore reserve and resources.
3. An ability to compute ore reserve and value of a mining project.
4. An ability to evaluate the economic feasibility of a mining project given the geological, mining and financial parameters.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Mineral and Mine Economics by R.T. Deshmukh, Myra Publications, Nagpur, 1986.
2. Mineral Economics by N.L.Sharma and Sinha, Oxford and IBH, 1992.

**REFERENCE BOOKS:**

1. Mineral Economics by Truscot, John Wiley and Sons, Inc, 1987.
2. Mining Geology by Arogyaswamy. R.N.P. 4 th edition, Oxford and IBH, 1992.
3. Prospecting for Atomic Minerals by Knoerr, A.W. and Lutgetn. GP. Oxford and IBH, 1992.
4. Industrial Management O.P. Khanna, DhanpatRai and Sons, 1999.

<b>Professional Elective-I</b> <b>Maintenance Management in Mines</b> [As per Choice Based Credit System (CBCS) scheme] <b>SEMESTER – V (Mining Engineering)</b>			
<b>Sub Code</b>	<b>15MN552</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 03</b>			
<b>Course objectives:</b> This course will enable students to: <ol style="list-style-type: none"> <li>1.To gain knowledge of various types of maintenance practices</li> <li>2.Knowledge of maintenance facilities and scheduling for mining.</li> <li>3.Concept of reliability, availability and maintainability of mining machinery.</li> <li>4. Knowledge of maintenance management system</li> </ol>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>MODULE- 1:Maintenance of Mining Machinery and Elements of down time of machinery</b>			
<b>Maintenance of Mining Machinery:</b> Objectives and types, corrective, plant, preventive and predictive maintenance: Reliability centered maintenance: upkeep of maintenance record. <b>Elements of down time of machinery:</b> Possible cause for machine delay and production stoppage. Data selection regarding machine delay and their analysis.			<b>10 Hours</b>
<b>MODULE- 2:Maintenance Facilities in Mines for Minor and Major Repairs</b>			
<b>Maintenance Facilities:</b> Maintenance planning and scheduling; short-term maintenance plans. <b>Long-term</b> maintenance plans, determining the optimal maintenance policy.			<b>10 Hours</b>
<b>MODULE- 3: Maintenance Scheduling</b>			
<b>Maintenance Scheduling:</b> Maintenance scheduling by the application of network technique. <b>Application</b> of queuing theory in maintenance of mining equipment.			<b>10 Hours</b>
<b>MODULE- 4: Definitions of Reliability, Availability and Maintainability</b>			
<b>Definitions of Reliability, Availability and Maintainability:</b> Possible measures to increase the availability of mining machinery, maintenance. <b>Budgeting:</b> estimation of cost of resources required to meet the expected maintenance load.			<b>10 Hours</b>
<b>MODULE- 5: Maintenance Management System</b>			
<b>Maintenance Management System:</b> Computerized documentation of plant and equipment management. <b>Advanced Maintenance Procedures and Techniques:</b> Online diagnostic maintenance, tribology techniques vibration and temperature monitoring of machinery. Illustrative examples of maintenance of an operating underground mine and open cast mine.			<b>10 Hours</b>
<b>Course outcomes:</b> At the end of the course students will be able to: <ol style="list-style-type: none"> <li>1. To be familiar with various types of maintenance practices</li> <li>2. An ability to prepare maintenance plan and scheduling for mining machineries.</li> </ol>			

3. An ability to increase the availability of mining machinery by proper maintenance
4. Ability to prepare and implement maintenance management system

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Maintenance Planning and control, Anthony Kelley, Affiliated East West Press, New Delhi 1981.
2. Reliability Engineering, Govil A.K., Tata Mc. Graw Hill Company, New Delhi, 1983.

**REFERENCE BOOKS:**

1. Special Issues of Journals of Mines, Metals and Fuels on Mine Mechanization, Vol. 59, 1992.

<p style="text-align: center;"><b>Open Elective-I</b>  <b>Industrial Safety Engineering</b>  [As per Choice Based Credit System (CBCS) scheme]  <b>SEMESTER – V (Mining Engineering)</b></p>			
<b>Sub Code</b>	<b>15MN561</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 03</b>			
<p><b>Course objectives:</b>  This course will enable students to:</p> <ol style="list-style-type: none"> <li>1. Gain insights of hazards and accidents of different working conditions in industries.</li> <li>2. Have knowledge of occupational health and safety in different industries</li> </ol>			
<b>Modules</b>			<b>Teaching Hours</b>
<b>MODULE- 1:HOT WORKING AND COLD WORKING OF METALS</b>			
<p>Introduction, Hot working of metals, Cold working of metals, Foundry operations, Steps in casting process, Different types of furnaces, Process wise hazards and safety measures in casting, Major health hazards and safe methods in foundry, Forging operations, Specific safety measures in different forging operations, Preventive maintenance of forging machines, Safe work practices in forging, Operation in hot and cold rolling mills.</p> <p><b>Preventive maintenance and periodic check-</b> safe operations, Heat treatment operations, Heat treatment methods, Hazards and safety measures, Control measures, Safety in handling medium-Disposal methods, Power presses(all types)Shearing, Bending, Rolling, Drawing, Turning, Boring, Milling, Planning, Grinding.</p>			<b>10 Hours</b>
<b>MODULE- 2:SAFETY IN OPERATION</b>			
<p><b>Work safety-</b>Permit to work-safety in operations, confined spaces, Safety in painting, welding, cutting and soldering operations, Safety in finishing operations like cleaning, polishing and buffing and related hazards.</p> <p><b>Selection, care and maintenance-</b> associated equipment's and instruments, Maintenance of these machines and selection of equipment w.r.t safety, Shot blasting.</p>			<b>10 Hours</b>
<b>MODULE- 3: SAFETY IN CONSTUCTION INDUSTRY</b>			
<p><b>Work at Height-</b>High incidence of serious accidents in working at heights, Types of operations, Safety features associated with design, construction and use of stairways, rungs, ramps, gangways, floors, ladders of different types, working on roofs, other safety requirements while working at height, Bootswain's chair-safety harness etc.,</p> <p><b>Safety Methods:</b>Prevention of fall of persons at floor level, Potential tripping and slipping hazards, Erection, Inspection and Certification and safe use of various types of scaffolds, Safety of high rise building, Bridges and tunnels</p> <p>Safety in demolition operation, Safety in underground works such as Excavation, Drilling and Blasting, Tunnelling, Pneumatic, Trenching, Safety in working of fragile roof</p>			<b>10 Hours</b>
<b>MODULE- 4: SAFETY IN SPECIFIC INDUSTRIES</b>			
<p><b>Industry-1:</b>operation, maintenance and safety in Mining industry, Ceramic industry, Cement industry</p> <p><b>Industry-2:</b>operation, maintenance and safety in Textile industry, Sugar</p>			<b>10 Hours</b>

industry, Fertilizer industry, , Tanneries	
<b>MODULE- 5: EMERGING ISSUES ON OSH</b>	
<b>Safety:</b> Safety measures in Nano Technology, Safety in Robots, Safety in hospital, Safety in film industry <b>Standards:</b> Guidelines and safety standards as per OSHAS	<b>10 Hours</b>
<b>Course outcomes:</b> At the end of the course students will be able to: <ol style="list-style-type: none"> <li>1. Be familiar with hazards in different industries.</li> <li>2. Decide precautions of safety and health in different occupation.</li> </ol>	
<b>Question Paper Pattern:</b>	
<ul style="list-style-type: none"> <li>• The question paper will have ten questions.</li> <li>• Each full Question consisting of 16 marks</li> <li>• There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.</li> <li>• The students will have to answer 5 full questions, selecting one full question from each module.</li> </ul>	
<b>TEXT BOOKS:</b>	
<ol style="list-style-type: none"> <li>1. Industrial Safety, Dr. K U Mistry,Siddharth Prakashan; Ahmedhabad-380014</li> <li>2.Fundamentals of Industrial Safety and Health, Dr. K U Mistry,Siddharth Prakashan; Ahmedhabad-380014</li> </ol>	
<b>REFERENCE BOOKS:</b>	
<ol style="list-style-type: none"> <li>1. Industrial Safety Management, L M Deshmukh,Mcgrawhill Education, July 2017</li> </ol>	

**Open Elective-I**  
**INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP**  
 [As per Choice Based Credit System (CBCS) scheme]  
**SEMESTER – V (Mining Engineering)**

<b>Sub Code</b>	<b>15MN562</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>03(L)+02(T)</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>Exam Marks</b>	<b>80</b>

**Credit = 03**

**Course objectives:**

This course will enable students:

1. To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
2. To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business.
3. To explain need of coordination between the manager and staff, the social responsibility of business and leadership.
4. To discuss the importance of Small Scale Industries and the related terms and problems involved.
5. To discuss methods for generating new business ideas and business opportunities in India and the importance of business plan.
6. To introduce the concepts of project management and discuss capital building process.
7. To explain project feasibility study and project appraisal and discuss project financing

<b>Modules</b>	<b>Teaching Hours</b>
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**MODULE- 1:MANAGEMENT AND PLANNING**

<p><b>Management:</b> Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management &amp; Administration, Management as a Science, Art &amp; Profession</p> <p><b>Planning:</b> Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.</p>	<b>10 Hours</b>
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**MODULE- 2:ORGANIZING, STAFFING, DIRECTING AND CONTROLLING**

<p><b>Organizing and Staffing:</b> Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Vs. Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.</p> <p><b>Directing and Controlling:</b> Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling.</p>	<b>10 Hours</b>
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**MODULE- 3: SOCIAL RESPONSIBILITIES OF BUSINESS AND ENTREPRENEURSHIP**

<p><b>Social Responsibilities of Business:</b> Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance.</p> <p><b>Entrepreneurship:</b>Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison</p>	<b>10 Hours</b>
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between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.	
<b>MODULE- 4: MODERN SMALL BUSINESS ENTERPRISES AND INSTITUTIONAL SUPPORT FOR BUSINESS ENTERPRISES</b>	
<p><b>Modern Small Business Enterprises:</b> Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).</p> <p><b>Institutional Support for Business Enterprises:</b> Introduction, Policies &amp; Schemes of Central–Level Institutions, State-Level Institutions.</p>	<b>10 Hours</b>
<b>MODULE- 5: PROJECT MANAGEMENT</b>	
<p><b>Project Management:</b> Meaning of Project, Project Objectives &amp; Characteristics, Project Identification- Meaning &amp; Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human &amp; Administrative aspects of Project Management, Prerequisites for Successful Project Implementation.</p> <p><b>New Control Techniques-</b> PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM.</p>	<b>10 Hours</b>
<p><b>Course outcomes:</b></p> <p>At the end of the course the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Explain the field of management, task of the manager, planning and the need of proper staff, recruitment and selection process.</li> <li>2. Discuss work allocation, the structure of organization, the modes of communication and importance of managerial control in business.</li> <li>3. To explain need of coordination between the manager and staff in exercising the authority and delegating duties.</li> <li>4. To explain the social responsibility of business and leadership</li> <li>5. Show an understanding of the role and importance of Small Scale Industries, business plan and its presentation.</li> <li>6. Discuss the concepts of project management, capital building process, project feasibility study, project appraisal and project financing.</li> <li>7. Discuss the state /central level institutions / agencies supporting business enterprises.</li> </ol>	
<b>Question Paper Pattern:</b>	
<ul style="list-style-type: none"> <li>• The question paper will have ten questions.</li> <li>• Each full Question consisting of 16 marks</li> <li>• There will be 2 full questions (with a maximum of four sub questions) from each module. Each full question will have sub questions covering all the topics under a module.</li> <li>• The students will have to answer 5 full questions, selecting one full question from each module.</li> </ul>	
<b>TEXT BOOKS:</b>	
<ol style="list-style-type: none"> <li>1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017.</li> <li>2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education, 2<sup>nd</sup> Edition, 2014.</li> </ol>	
<b>REFERENCE BOOKS:</b>	
<ol style="list-style-type: none"> <li>1. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007.</li> <li>2. Essentials of Management: An International, Innovation and Leadership perspective by</li> </ol>	





[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – V (Mining Engineering)			
<b>Laboratory Code</b>	<b>15MNL57</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>01 Hour Tutorial(Instructions)+02 Laboratory</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Hours</b>	<b>42</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 02</b>			
<b>Course objectives:</b>			
This course will enable students to:			
<ol style="list-style-type: none"> <li>1. Gain knowledge of the percussive drilling, track laying and their turnouts and cross overs</li> <li>2. Comprehend the cage/skip winding, construction and working of pumps.</li> <li>3. Select the type of rope according to the given conditions</li> </ol>			
<b>Part-A (Any one question 35 marks)</b>			
<b>Experiment No. 01:</b> To study constructional details and functioning of Jack Hammer.			
<b>Experiment No.02:</b> To study constructional details of different wire ropes.			
<b>Experiment No. 03:</b> Sketch and write details of safety hook and its function.			
<b>Experiment No. 04:</b> To study the procedure for splicing the wire ropes			
<b>Experiment No. 05:</b> To study the capping and recapping procedures of wire ropes			
<b>Part-B (Any one question 35 marks)</b>			
<b>Experiment No. 06:</b> To study construction and working of a turbine pump			
<b>Experiment No. 07:</b> To study Lilly controller and automatic contrivances in a winder.			
<b>Experiment No. 08:</b> To study skip loading and unloading arrangement and skip design.			
<b>Experiment No. 09:</b> Write details of good track laying and also details of diamond crossing.			
<b>Experiment N0.10:</b> To study the constructional details of lubricator and air leg.			
<b>Part-C (Viva Voce 10 marks)</b>			
<b>Courseoutcomes:</b>			
On the completion of this laboratory course, the students will be:			
<ol style="list-style-type: none"> <li>1. Familiar with the percussive drilling, their turnouts and cross overs</li> <li>2. Able to understand the cage/skip winding, construction and working of pumps.</li> <li>3. Capable of choosing the type of rope according to the given conditions.</li> </ol>			
<b>Conduction of Practical Examination:</b>			
<ul style="list-style-type: none"> <li>• All laboratory experiments (Part - A &amp; Part - B) are to be included for practical examination.</li> <li>• Students are allowed to pick one experiment from each of the lot.</li> <li>• Strictly follow the instructions as printed on the cover page of answer script for breakup of marks</li> <li>• PART –A: Procedure + Conduction + Viva: 10 + 25 +05 (40)</li> <li>• PART –B: Procedure + Conduction + Viva: 10 + 25 +05 (40)</li> <li>• Change of experiment is allowed only once and marks allotted to the procedure part to be made zero</li> </ul>			

<b>MINE SURVEYING LABORATORY-II</b> [As per Choice Based Credit System (CBCS) scheme] <b>SEMESTER – V (Mining Engineering)</b>			
<b>Laboratory Code</b>	<b>15MNL58</b>	<b>IA Marks</b>	<b>20</b>
<b>Number of Lecture Hours/week</b>	<b>01 Hour Tutorial(Instructions)+02 Laboratory</b>	<b>Exam Hours</b>	<b>03</b>
<b>Total Hours</b>	<b>42</b>	<b>Exam Marks</b>	<b>80</b>
<b>Credit = 02</b>			
<b>Course objectives:</b> This course will enable students:			
<ol style="list-style-type: none"> <li>1. To gain insights to measure distance and elevation using optical instruments</li> <li>2. To set out an curve in underground and surface</li> <li>3. To connect the baseline from surface to underground</li> <li>4. To know the location of a point in underground traverse</li> </ol>			
<b>Part-A (Any one question 35 marks)</b>			
<b>I. Demonstration of precise level, digital planimeter EDM and total station.</b>			
<b>II. Tacheometric survey</b>			
<ol style="list-style-type: none"> <li>1. Determine the constant K and C of the tachometer.</li> <li>2. Determine the distance and elevation by a) Stadia Method b) Tangential Method</li> <li>3. Determine the gradient between two points by Tachometric Survey</li> </ol>			
<b>III. Curve Ranging</b>			
<ol style="list-style-type: none"> <li>1. Simple curve ranging by linear and angular method using Deflection distance Method</li> <li>2. Simple curve ranging by linear and angular method using Rankine's Method.</li> </ol>			
<b>Part-B (Any one question 35 marks)</b>			
<b>IV. Correlation Survey:</b>			
<ol style="list-style-type: none"> <li>1. Correlation survey by Direct Traversing through Incline</li> <li>2. Correlation survey by Direct Traversing through Incline and Shaft.</li> <li>3. Correlation survey by Weisback Co-planning Method.</li> <li>4. Correlation survey by Weisback Triangle Method</li> <li>5. Correlation survey by assumed bearing method.</li> </ol>			
<b>V. Underground survey</b>			
<ol style="list-style-type: none"> <li>1. Underground Traversing</li> <li>2. Transfer of levels from surface to underground.</li> <li>3. To control the directions of underground workings.</li> <li>4. To determine the center of the shaft.</li> </ol>			
<b>Part-C (Viva Voce 10 marks)</b>			
<b>Courseoutcomes:</b>			
On the completion of this laboratory course, the students will have:			
<ol style="list-style-type: none"> <li>1. An ability to measure distance and elevation using optical instruments</li> <li>2. An ability to set out an curve in underground and surface</li> <li>3. An ability to connect the baseline from surface to underground</li> <li>4. An ability know the location of a point in underground traverse</li> </ol>			
<b>Conduction of Practical Examination:</b>			
<ul style="list-style-type: none"> <li>• All laboratory experiments (Part - A &amp; Part - B) are to be included for practical examination.</li> <li>• Students are allowed to pick one experiment from each of the lot.</li> <li>• Strictly follow the instructions as printed on the cover page of answer script for</li> </ul>			

breakup of marks

- PART –A: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- PART –B: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero