



# ADITYA ENGINEERING COLLEGE

An Autonomous Institution

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Department of Mining Engineering

B.Tech - AR17 - Course Articulation Matrix

Note: Correlation Levels are 1 or 2 or 3. Where 1- Slight(Low), 2 - Moderate(Medium), 3 - Substantial (High).

|             | CO Statements                                                                                                                                      | POs |     |     |     |     |     |     |     |     |      |      |      | PSOs |      |      |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| I SEM       |                                                                                                                                                    |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
| Course Code | 171HS1T01 - ENGLISH – I                                                                                                                            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Summarize how Gandhi grew in introspection and the conditions to achieve a higher quality of life, strength and sovereignty of a developed nation. | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | -    | -    | -    | -    |
| CO2         | Identify that all men can come together and avert the peril.                                                                                       | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | -    | -    | -    | -    |
| CO3         | Comprehend texts from a literary perspective and familiarise the students with Figures of Speech.                                                  | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | -    | -    | -    | -    |
| CO4         | Explain the characteristic traits of renowned scientists who contributed enormously to the scientific advancement of India.                        | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | -    | -    | -    | -    |
| CO5         | Demonstrate Writing and basic concepts of Grammar skills.                                                                                          | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | -    | -    | -    | -    |
| Course Code | 171BS1T01- MATHEMATICS-I                                                                                                                           | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Associate linear differential equations of first order to various physical problems involving differential equations of first order                | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO2         | Solve linear differential equations of higher order.                                                                                               | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO3         | Solve linear systems of equations using the concept of rank, Gauss elimination, Gauss seidal method.                                               | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO4         | Find the eigen values and eigen vectors.                                                                                                           | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO5         | Associate the concepts of Partial Differentiation to maxima and minima of functions of several variables and to Partial differential equations.    | 3   | 2   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| Course Code | 171HS1T02 - ENVIRONMENTAL STUDIES                                                                                                                  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Identify the need for protecting the producers and consumers in various ecosystems .                                                               | -   | -   | -   | -   | -   | 1   | 3   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO2         | Outline the natural resources and their importance for the sustenance of the life                                                                  | -   | -   | -   | -   | -   | 2   | 3   | -   | -   | -    | -    | -    | -    | -    | -    |

|             | CO Statements                                                                                                                      | POs        |            |            |            |            |            |            |            |            |             |             |             | PSOs        |             |             |
|-------------|------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| CO3         | List out the biodiversity of India, threats and its conservation methods.                                                          | -          | -          | -          | -          | -          | 1          | 3          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO4         | Explain the different types of pollutions and their control technologies, Waste water treatment, Bio medical waste management etc. | -          | -          | 2          | -          | -          | 2          | 3          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO5         | Explain EIA- Environmental Impact Assessment, Sustainable developmental activities, environmental policies and regulations         | -          | -          | 2          | -          | -          | 2          | 3          | -          | -          | -           | -           | -           | -           | -           | -           |
| Course Code | <b>171BS1T03 - ENGINEERING CHEMISTRY</b>                                                                                           | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Explain polymeric materials their uses and moulding techniques of plastics.                                                        | 2          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO2         | Analyse fuel characteristics using Calorific value, knocking characteristics and flue gas analysis.                                | 2          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO3         | Explain the working principle of Electro chemical cells and corrosion characteristics.                                             | 3          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO4         | Explain the properties and applications of Nano, Superconductors, Semiconductors, Liquid crystals and fuel cells.                  | 3          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO5         | Summarize water purification techniques and boiler troubles.                                                                       | 2          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| Course Code | <b>171ES1T02 - ENGINEERING MECHANICS</b>                                                                                           | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Determine the resultant force and moment for a given force system.                                                                 | 3          | 2          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO2         | Explain the concept of friction.                                                                                                   | 2          | 1          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO3         | Calculate the forces in planar and spatial systems.                                                                                | 3          | 2          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO4         | Locate centroid of composite areas and centre of gravity of composite bodies.                                                      | 1          | 1          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO5         | Calculate the moment of inertia of composite areas and rigid bodies.                                                               | 3          | 2          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO6         | Apply the concepts of kinematics, kinetics, work - energy and impulse - momentum methods to particle motion.                       | 3          | 2          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| Course Code | <b>171ES1T01 -COMPUTER PROGRAMMING</b>                                                                                             | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Apply fundamental of C for mathematical and scientific problems.                                                                   | 1          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO2         | Use Control Structures, Arrays and strings in solving complex problems.                                                            | 1          | 2          | 2          | 3          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO3         | Develop modular programs to solve problems using functions.                                                                        | 1          | 3          | 2          | 2          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO4         | Demonstrate the pointers concept for allocating and deallocating memory dynamically.                                               | 1          | 2          | 2          | 3          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| CO5         | Solve real world problems using the concept of files, structures and unions.                                                       | 1          | 2          | 2          | 2          | -          | -          | -          | -          | -          | -           | -           | -           | -           | -           | -           |
| Course Code | <b>171HS1L01 - ENGLISH COMMUNICATION SKILLS LAB- I</b>                                                                             | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Make use of the concepts to communicate confidently and competently in English Language in all spheres.                            | -          | -          | -          | -          | 1          | -          | -          | -          | -          | 3           | -           | 1           | -           | -           | -           |

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|             | CO Statements                                                                                                                                              | POs |     |     |     |     |     |     |     |     |      |      |      | PSOs |      |      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO4         | Compare the operation of 3-phase alternator and 3-phase induction motors.                                                                                  | 2   | 1   | -   | -   | -   | 2   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO5         | Distinguish the operation of half wave, full wave bridge rectifiers, and types of transistors.                                                             | 3   | 1   | 2   | 2   | -   | -   | 1   | -   | -   | -    | -    | -    | -    | -    | -    |
| Course Code | 171HS2L02 - ENGLISH COMMUNICATION SKILLS LAB- II                                                                                                           | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Make effective use of Body language in all situations and contexts to enhance effective communication in all aspects.                                      | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | 2    | -    | -    | -    |
| CO2         | Identify communicative competency to respond to others in different situations.                                                                            | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | 2    | -    | -    | -    |
| CO3         | Make use of effective delivery strategies to select, compile and synthesize information for oral presentation.                                             | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | 2    | -    | -    | -    |
| CO4         | Demonstrate in mock interviews, group discussion and public speaking.                                                                                      | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | 2    | -    | -    | -    |
| CO5         | Illustrate interpersonal skills using English language confidently and effectively for personal and professional growth.                                   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3    | -    | 2    | -    | -    | -    |
| Course Code | 171BS2L02 - ENGINEERING PHYSICS LAB                                                                                                                        | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Use spectrometer, polarimeter, travelling microscope for making measurements.                                                                              | 3   | 2   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO2         | Determine energy gap of a semiconductor, draw characteristic curves to estimate thermal coefficient of a thermistor, zener diode.                          | 2   | 2   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO3         | Determine the rigidity and determine frequency of an unknown electric vibrator.                                                                            | 3   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO4         | Determine wavelength of unknown source, the width of narrow slits, spacing Between close rulings using lasers and appreciate the accuracy in measurements. | 3   | 2   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO5         | Verify magnetic field along the axis of a circular coil.                                                                                                   | 3   | 2   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| Course Code | 171ES2L02 - ENGINEERING WORKSHOP AND IT WORKSHOP                                                                                                           | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Prepare carpentry, fitting joints as per the given requirement using Carpentry and Fitting tools                                                           | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | -    | -    | -    | -    |
| CO2         | Convert the metal rods and sheets into final shape using black smithy and tin smithy tools                                                                 | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | -    | -    | -    | -    |
| CO3         | Prepare the circuit for house wiring applications                                                                                                          | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | -    | -    | -    | -    |
| CO4         | Install the operating system software , networking and troubleshoot the problems                                                                           | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO5         | Develop documents using MS-Office and LaTeX tools                                                                                                          | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |

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|             | CO Statements                                                                                                                           | POs |     |     |     |     |     |     |     |     |      |      |      | PSOs |      |      |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| Course Code | 171MI3T03 - MINING GEOLOGY - I                                                                                                          | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Analyze applications of geology in mining.                                                                                              | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 1    | -    | -    |
| CO2         | Classify the minerals based on properties                                                                                               | 2   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | -    | -    |
| CO3         | Apply the knowledge on igneous rocks in mining                                                                                          | 1   | 3   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | -    | -    |
| CO4         | Compare the properties on sedimentary and Metamorphic rocks                                                                             | 1   | 3   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | -    | -    |
| CO5         | Apply the knowledge of mineralogy in mining                                                                                             | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 2    | -    | -    |
| Course Code | 171ME3T01 - COMPUTER AIDED ENGINEERING DRAWING PRACTICE                                                                                 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Construct the projection of solids inclined to both the planes.                                                                         | 1   | -   | -   | -   | -   | -   | -   | -   | -   | 2    | -    | -    | -    | -    | -    |
| CO2         | Draw the sectional view of the solids.                                                                                                  | 1   | -   | -   | -   | -   | -   | -   | -   | -   | 2    | -    | -    | -    | -    | -    |
| CO3         | Develop the surfaces of regular solids- prism, pyramid, cone and cylinder.                                                              | 1   | -   | -   | -   | -   | -   | -   | -   | -   | 2    | -    | -    | -    | -    | -    |
| CO4         | Practice the intersection of solids and perspective of projection.                                                                      | 1   | -   | -   | -   | 3   | -   | -   | -   | -   | 2    | -    | 1    | -    | -    | -    |
| CO5         | Draw the isometric and or thographic Projections of the machine parts through CAD software's                                            | 1   | -   | -   | -   | 3   | -   | -   | -   | -   | 2    | -    | 1    | -    | -    | -    |
| Course Code | 171ES3L12 - ELECTRICAL AND ELECTRONICS LAB                                                                                              | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Illustrate the efficiency of a a DC machines, transformer and 3-Phase induction motor                                                   | 2   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO2         | Apply Synchronous impedance method to Pre-determine the regulation of an alternator                                                     | 3   | -   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO3         | Apply the Field flux control method & Armature Voltage control method to Control the speed of a DC shunt motor                          | 3   | 2   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO4         | Explain the working of PN junction diode, BJT and CE amplifier                                                                          | 2   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO5         | Develop rectifier circuits for signal conversion from AC to DC                                                                          | 3   | -   | 1   | 1   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO6         | Explain the simple mathematical operations using Operational Amplifier- IC-741(inverting, non inverting, integrator and differentiator) | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| Course Code | 171ES3L13 - BASIC MECHANICAL ENGINEERING LAB                                                                                            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Calculate the coefficient of discharge for venturimeter of pipes and orificemeter.                                                      | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO2         | Estimate the head losses in pipe flow.                                                                                                  | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO3         | Analyse the performance characteristics of impulse of reaction turbines.                                                                | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO4         | Determine the coefficient of discharge slip and efficiency of Reciprocating Pump.                                                       | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |
| CO5         | Analyse the performance of characteristics of single stage and multi-stage centrifugal pumps                                            | 2   | 1   | -   | -   | -   | -   | -   | -   | 1   | -    | -    | 1    | -    | -    | -    |

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|             | CO Statements                                                                                 | POs        |            |            |            |            |            |            |            |            |             |             |             | PSOs        |             |             |
|-------------|-----------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| CO4         | Apply the knowledge of economic geology.                                                      | -          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO5         | Estimate the ore reserves and its importance                                                  | -          | 3          | -          | 2          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171MI4T06 - MINE SURVEYING – I</b>                                                         | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Analyze different types of surveying.                                                         | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO2         | Determine levels and Contours.                                                                | 3          | 2          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO3         | Apply modern instruments of surveying.                                                        | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO4         | Evaluate the geodetic surveying GIS & GPS.                                                    | 3          | 2          | -          | -          | -          | -          | -          | -          | 2          | -           | -           | -           | 3           | -           | -           |
| CO5         | Estimate volumes of borrow pits and areas of fields                                           | 3          | 2          | -          | -          | -          | -          | 1          | -          | 1          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171MI4T07 - SURFACE MINING</b>                                                             | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Analyze different surface mining methods.                                                     | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO2         | Design the layout and open of a large open cast mine.                                         | 3          | 2          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO3         | Design drilling and blasting for Surface mining.                                              | 3          | 2          | 1          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO4         | Choose the better excavation and loading method.                                              | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO5         | Organize the transportation system.                                                           | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171MI4T08 - FUNDAMENTALS OF ROCK MECHANICS</b>                                             | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Estimate stress and strain in various mining applications.                                    | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO2         | Evaluate the properties of rocks.                                                             | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO3         | Use various measuring devices to measure the load.                                            | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO4         | Analyze the failure criteria in mines.                                                        | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO5         | Analyze stress concentration around mine openings                                             | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171MI4L01 - GEOLOGY LAB</b>                                                                | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Apply the knowledge of geology in the field of Mining engineering.                            | 1          | -          | -          | -          | -          | -          | -          | -          | 1          | 1           | -           | 1           | 3           | -           | -           |
| CO2         | Determine the megascopic identification of physical properties of various minerals and rocks. | 1          | -          | -          | 3          | -          | -          | -          | -          | 1          | 1           | -           | 1           | 3           | -           | -           |
| CO3         | Interpret with Geological, topographical and satellite imagery.                               | 1          | -          | -          | -          | 3          | -          | -          | -          | 1          | 1           | -           | 1           | 3           | -           | -           |
| CO4         | Identify various geological formations.                                                       | 1          | -          | -          | -          | -          | -          | -          | -          | 1          | 1           | -           | 1           | 3           | -           | -           |
| CO5         | Distinguish various landforms and rock formations in constructional areas.                    | 1          | -          | 2          | -          | -          | -          | -          | -          | 1          | 1           | -           | 1           | 3           | -           | -           |
| Course Code | <b>171MI4L02 - COMPUTER APPLICATION IN MINING LAB</b>                                         | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Apply the knowledge of computers in mine planning                                             | 1          | -          | -          | -          | 3          | -          | -          | -          | 1          | 1           | -           | 1           | -           | 3           | -           |
| CO2         | Assess the cut-off grade optimization & Stockpiling                                           | -          | -          | 1          | 1          | -          | -          | -          | -          | 1          | 1           | -           | 1           | -           | 3           | -           |
| CO3         | Design pit and dump                                                                           | -          | 1          | -          | -          | 3          | -          | -          | -          | 1          | 1           | -           | 1           | -           | 3           | -           |
| CO4         | Design mine planning and scheduling                                                           | -          | 1          | -          | -          | 3          | -          | -          | -          | 1          | 1           | -           | 1           | -           | 3           | -           |
| CO5         | Design block modelling                                                                        | -          | 1          | -          | -          | 3          | -          | -          | -          | 1          | 1           | -           | 1           | -           | 3           | -           |
| Course Code | <b>171HS4A08 - INTELLECTUAL PROPERTY RIGHTS AND PATENTS</b>                                   | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Compare various types of Intellectual Property rights.                                        | -          | -          | -          | -          | -          | -          | -          | 3          | -          | -           | -           | 2           | -           | -           | -           |

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|             | CO Statements                                                                                                                                                       | POs        |            |            |            |            |            |            |            |            |             |             |             | PSOs        |             |             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| CO3         | Solve the various problems on mine surveying.                                                                                                                       | 3          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO4         | Choose the methods need to be adopted in deep seam mining.                                                                                                          | 3          | 1          | 2          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO5         | Apply special modern surveying in mining industries.                                                                                                                | 3          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171HS5T04 - MANAGERIAL ECONOMICS &amp; FINANCIAL ANALYSIS</b>                                                                                                    | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Explain the Managerial Economic concepts for decision making and forward planning.                                                                                  | -          | -          | -          | -          | -          | -          | -          | -          | 1          | -           | -           | -           | -           | -           | -           |
| CO2         | Illustrate the law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services.                      | -          | -          | -          | -          | -          | -          | -          | -          | -          | 2           | -           | -           | -           | -           | -           |
| CO3         | Identify the cost behavior, costs useful for managerial decision making and Break Even Point (BEP) of an enterprise.                                                | 1          | 1          | -          | -          | -          | -          | -          | -          | -          | -           | 1           | -           | -           | -           | -           |
| CO4         | Outline the different types of business organizations along with basic knowledge on business cycle.                                                                 | -          | -          | -          | -          | -          | -          | -          | -          | -          | -           | 1           | -           | -           | -           | -           |
| CO5         | Make use of the process & principles of accounting and prepare Journal, Ledger, Trial Balance, Trading A/c., Profit & Loss A/c. and Balance Sheet of an enterprise. | 1          | 1          | -          | -          | -          | -          | -          | -          | -          | 3           | -           | -           | -           | -           | -           |
| CO6         | Utilize various techniques on investment project proposals with the help of capital budgeting techniques for decision making.                                       | 1          | 1          | -          | -          | -          | -          | -          | -          | -          | -           | 2           | -           | -           | -           | -           |
| Course Code | <b>171MI5E01 - MAINTENANCE AND RELIABILITY ENGINEERING (PROFESSIONAL ELECTIVE - I)</b>                                                                              | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Illustrate the fundamentals of maintenance management and control.                                                                                                  | 1          | -          | -          | -          | -          | -          | -          | -          | -          | -           | 2           | -           | -           | 3           | -           |
| CO2         | Categorize the various types of maintenance.                                                                                                                        | 1          | -          | -          | -          | -          | 3          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO3         | Illustrate the fundamentals of reliability.                                                                                                                         | 1          | -          | -          | -          | -          | -          | -          | -          | -          | -           | 2           | -           | -           | 3           | -           |
| CO4         | Analyze the component reliability and hazard models.                                                                                                                | 1          | -          | -          | 3          | -          | -          | 2          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO5         | Explain the concept of reliability management                                                                                                                       | 1          | -          | -          | -          | -          | -          | -          | -          | -          | -           | 2           | -           | -           | 3           | -           |
| Course Code | <b>171MI5E02 - MINE CONSTRUCTION AND MANAGEMENT (PROFESSIONAL ELECTIVE - I)</b>                                                                                     | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Analyze the criteria of selection of sites for mine openings.                                                                                                       | 1          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO2         | Determine different types of linings.                                                                                                                               | 1          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO3         | Explain the basic principles of first aid room and office                                                                                                           | 3          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO4         | Analyze the drivage through soft and hard rock, lateral and vertical pressures.                                                                                     | 1          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO5         | Apply modern instruments of surface layouts pit top circuits and coal handling and coal preparation plant.                                                          | 1          | -          | 3          | -          | -          | -          | -          | -          | -          | -           | 2           | -           | -           | 3           | -           |

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|             | CO Statements                                                                             | POs        |            |            |            |            |            |            |            |            |             |             |             | PSOs        |             |             |
|-------------|-------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| CO4         | Discuss the planning and designing layouts of ventilation.                                | -          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO5         | Explain coal gasification.                                                                | -          | 3          | 2          | -          | 2          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171MI7E12 - PLANNING OF SURFACE MINING PROJECT (PROFESSIONAL ELECTIVE - IV)</b>        | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Prepare feasibility report of mining project.                                             | 1          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO2         | Design open pit slope angels & ultimate pit limit                                         | 1          | -          | 3          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO3         | Select transport and dumping systems in open pit mines.                                   | 1          | -          | 3          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO4         | Examine stability analysis in surface mines.                                              | 1          | 3          | -          | 2          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO5         | Explain transition of underground to opencast mines.                                      | 1          | -          | 3          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171MI7E13 - MINE MECHANIZATION (PROFESSIONAL ELECTIVE - V)</b>                         | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Assess the mine mechanization system.                                                     | -          | -          | -          | -          | -          | -          | -          | -          | 3          | -           | 2           | -           | 3           | -           | -           |
| CO2         | Choose surface & underground transport medium for ore and waste.                          | -          | -          | -          | 1          | 3          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO3         | Predict optimist conveyor system in mines.                                                | -          | -          | -          | -          | -          | 3          | -          | -          | -          | -           | 2           | -           | 3           | -           | -           |
| CO4         | Design winding system                                                                     | -          | -          | 3          | -          | -          | 2          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| CO5         | Select equipment in surface and underground mines.                                        | -          | -          | -          | -          | 2          | -          | -          | -          | -          | -           | -           | -           | 3           | -           | -           |
| Course Code | <b>171MI7E14 - ADVANCE UNDERGROUND COAL MINING TECHNOLOGY (PROFESSIONAL ELECTIVE - V)</b> | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Explain the extraction of thick seam mining methods.                                      | -          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO2         | Identify and solve the problems and issues on multiple seam mine workings.                | -          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO3         | Choose the advanced techniques for design of underground workings.                        | -          | -          | -          | 3          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO4         | Evaluate the methods need to be adopted in extraction of locked up pillars.               | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO5         | Design supports for underground mines.                                                    | -          | -          | 3          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| Course Code | <b>171MI7E15 - MINE BLASTING OPERATION (PROFESSIONAL ELECTIVE - V)</b>                    | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Differentiate between explosives and initiating systems.                                  | -          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO2         | Use blasting accessories to design blasting operations.                                   | 3          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO3         | Analyse problems associated with open cast blasting and mitigation.                       | -          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 2           | -           |
| CO4         | Analyse problems associated with underground blasting and mitigation.                     | -          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| CO5         | Assess blasting in metal mines.                                                           | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | -           | 3           | -           |
| Course Code | <b>171MI7L07 - MINE PLANNING AND DESIGN LAB</b>                                           | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
| CO1         | Determine stripping ratio and pit limits.                                                 | 3          | 2          | 2          | -          | -          | -          | -          | -          | 1          | 1           | -           | 1           | 3           | -           | -           |
| CO2         | Design blasting in open cost and underground mines.                                       | 3          | -          | 2          | -          | -          | -          | -          | -          | 1          | 1           | -           | 1           | 3           | -           | -           |

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|             | CO Statements                                                                                                                                                       | POs |     |     |     |     |     |     |     |     |      |      |      | PSOs |      |      |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| Course Code | 171MI8003 - FUNDAMENTALS OF COMMUNICATION (OPEN ELECTIVE)                                                                                                           | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Demonstrate types of signals and relation of time domain representation to frequency domain.                                                                        | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO2         | Apply signal concepts to continuous wave modulation.                                                                                                                | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO3         | Interpret the basic concepts of pulse modulation.                                                                                                                   | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO4         | Analyze the concepts of digital modulation techniques.                                                                                                              | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| CO5         | Summarize different advanced communication networks.                                                                                                                | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | -    | -    | -    |
| Course Code | 171MI8004 - REMOTE SENSING AND GIS (OPEN ELECTIVE)                                                                                                                  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Analyze the elements of photogrammetry.                                                                                                                             | 1   | -   | -   | -   | -   | -   | 1   | -   | -   | -    | -    | -    | -    | 1    | -    |
| CO2         | Determine multi concept remote sensing and false color composite.                                                                                                   | 1   | 1   | -   | -   | -   | -   | 1   | -   | -   | -    | -    | -    | -    | 1    | -    |
| CO3         | Analyze the edge detection and filtering.                                                                                                                           | 2   | 1   | -   | -   | -   | -   | 1   | -   | -   | -    | -    | -    | -    | 1    | -    |
| CO4         | Explain the principal components and image classification.                                                                                                          | 1   | -   | -   | -   | -   | -   | 1   | -   | -   | -    | -    | -    | -    | 1    | -    |
| CO5         | Apply the remote sensing ion various fields.                                                                                                                        | 1   | 1   | -   | -   | -   | -   | 1   | -   | -   | -    | -    | -    | -    | 1    | -    |
| Course Code | 171MI8005 - QUANTITATIVE DECISION MAKING (OPEN ELECTIVE)                                                                                                            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Describe a set of data using histograms, scatter diagrams and summary statistics.                                                                                   | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    | -    | -    |
| CO2         | Develop statistics from sample data to support confidence interval estimation.                                                                                      | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    | -    | -    |
| CO3         | Construct effective models of decision making.                                                                                                                      | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    | -    | -    |
| CO4         | Estimate optimal solutions to decision making models.                                                                                                               | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    | -    | -    |
| CO5         | Analyze spreadsheet simulation models.                                                                                                                              | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | -    | -    | -    | -    |
| Course Code | 171MI8P02 - MAJOR PROJECT                                                                                                                                           | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1         | Develop technical procedure of planning and scheduling of an identified project work through technical survey in line with societal and environmental implications. | 1   | -   | -   | -   | -   | 2   | 2   | -   | -   | -    | 1    | -    | 3    | -    | -    |
| CO2         | Demonstrate technical skills of data collection and data analysis adhering to professional ethics                                                                   | 1   | -   | -   | -   | -   | -   | -   | 2   | -   | -    | 1    | 1    | 3    | -    | -    |
| CO3         | Design the solutions for the critical problem areas marked in data analysis                                                                                         | 2   | 2   | 3   | 2   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | -    | -    |
| CO4         | Build a team of people to work together and communicate well in the critical stages of project progress.                                                            | -   | -   | -   | -   | -   | -   | -   | -   | 1   | 2    | 1    | 1    | 3    | -    | -    |
| CO5         | Use modern tools to derive conclusions and communicating the results of the project work effectively                                                                | -   | -   | -   | -   | 3   | -   | -   | -   | -   | 2    | 1    | 1    | 3    | -    | -    |