DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,BHOPAL

SCHEME OF STUDIES & EXAMINATIONS (IMPLEMENTED FROM SESSION : JULY 2023)

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	MINE SURVEYING	M11	FIFTH (V)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT								PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS
				HRS PER WEEK	CREDITS	TERM WORK				THEORY PAPER		HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA			
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS	DURATION				MARKS	DURATION		
							I	II										
1	7583	501	MINE SURVEYING - III	5	5	10	10	10	30	70	03 Hrs.	6	3	20	30	03 Hrs.	8	150
2	7584	502	MINING TECHNOLOGY - III	3	3	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	5	150
3	7585	511	APPLIED ROCK MECHANICS OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7586	512	TUNNEL TECHNOLOGY															
4	7587	521	MINE MACHINERY OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7588	522	ROCK EXCAVATION ENGINEERING															
5	7601	531	RENEWABLE ENERGY TECHNOLOGIES OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7602	532	INTERNET OF THINGS															
6			SUMMER INTERNSHIP-II**	0	0	0	0	0	0	0	0	0	3	20	30	03 Hrs.	3	50
7			MAJOR PROJECT***	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
8			RECOVERY CLASSES/LIBERARY etc.	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
TOTAL				17	17				150	350		19	8	60	90		25	650

NOTE - (1)* Two Best, out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.

(2)** 4-6 Weeks Summer Internship after IV Semester.

(3)***One Credit will be carried forward to the Six semester major project evaluation.

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	650

DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	MINE SURVEYING - III
PAPER CODE	:	7583
SUBJECT CODE	:	501
TREORY CREDITS	:	05
PRACTICAL CREDITS	:	03

Course Objectives:

Following are the objectives of this course:

- To understand types of Techeomatric surveying.
- To know setting out of simple curve methods.
- To know the purposes, & its methods of correlation survey.
- To understand the basic concept of triangulation Survey.
- To measure the subsidence on proper way.

Course Contents

Unit–I Tacheometric Surveying

- General, Different System of tacheometric Measurement
- Principal of Stadia Method.
- Distance & Elevation formulae for Staff Vertical: Inclined
- Distance & Elevation formulae for Staff Normal.
- Anallactic Lens.
- Movable Hair Method – Vertical Base Observation & Horizontal base Observation.
- Tangential Method.
- Determination of Additive & Multiplying Constant & its related numerical problems.

Unit–II Curve Surveying

- General, Definition, Designation and Type of curve.
- Element of Simple Curve.
- Method of Setting out of Simple Curve- Linear and Angular Method.
- Linear Method of Setting out- By ordinates from long chord, by successive bisection of arc, By offsets from tangents and Deflection distance method.
- Angular Method - Two Theodolite Method and Tacheometric Method.
- Transition curve & Super -elevation in curve

Unit–III Correlation Surveying

- Purpose of Correlation Surveying.
- Different Method of Correlation Surveying and its accuracy.
- Shaft Plumbing-One Wire in each of Two shaft and Two or more wire in a Single shaft
- Co-planning Method, Weisbach Triangle Method, Weiss Quadrilateral Method.
- Precise Magnetic Correlation.
- Correlation with Gyro theodolite.
- Correlation through a shaft and a drift.

Unit–IV Triangulation Survey

- Principle of Triangulation survey.
- Classification of Triangulation Systems.
- Triangulation Figures & Systems.
- Signals & Towers.
- Base Line Measurement – Colby Apparatus, Wheeler's method and Jaderin's method.
- Calculation of Length of Base: Tape Corrections.
- Satellite Station: Reduction to Centre.

Unit–V Subsidence Survey and Stope Surveying

- Definition and purpose of Mine Subsidence.
- Theory of Subsidence.
- Angle of draw, angle of fracture and factor affecting the angle of draw.
- Critical, Sub-critical and Super-critical Subsidence.
- Formulae regarding Subsidence.
- Subsidence Measurement (Horizontal & Vertical).
- Definition and purpose of Stope Surveying.
- Stope Surveying in mine worked by Shrinkage Stoping.
- Stope Surveying in Moderate Inclination.

Suggested learning resources:

1 Punmia, B.C,; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.

2 Basak, N. N., Surveying and Levelling, McGraw Hill Education, New Delhi.

3 Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling volume I, Pune Vidyarthi Gruh Prakashan.

4 Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.

5 Saikia, M D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.

6 Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.

7 Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning New Delhi.

8 Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.

9 Arora K R , Surveying Vol. I, Standard Book House.

10 Mine Surveying and Levelling Vol. I, II, & III-S..Ghatak

Course out comes:

After completing this course, student will be able to:

- Compute elevations & constants of thedolite traversing.
- Conduct different type of setting out of simple curve methods.
- Transfer of surface base reference to underground reference though correlation methods.
- Familiar with feature of triangulation surveying.
- Measure the subsidence as per mine regulations.

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MINE SURVEYING - III LAB

Course Objectives:

Following are the objectives of this course:

- To determine the elevations & constants of Techeomatric surveying.
- To know setting out of simple curve methods.
- To know the purposes, & its methods of correlation survey.
- To measure the baseline of triangulation Survey.
- To measure the subsidence on proper way.

List of Practical's to be performed

1. Determination of elevation of an object from stadia methods of tacheometer.
2. Determination of elevation of an object from tangential methods of tacheometer.
3. Determination of tacheometric constant.
4. Setting out of Simple Curve - By ordinates from long chord.
5. Setting out of Simple Curve - By ordinates from long chord
6. Setting out of Simple Curve - By successive bisection of arc.
7. Setting out of Simple Curve - By offsets from tangents.
8. Setting out of Simple Curve - By Deflection distance method.
9. Setting out of Simple Curve - By Angular Method - Two Theodolite Method.
10. Sketch & describe Shaft Plumbing-One Wire in each of Two shaft and Two or more wire in a Single shaft.
11. Sketch & describe Coplaning Correlation Method.
12. Sketch & describe Weisbach Triangle Method.
13. Sketch & describe Weiss Quadrilateral Method.
14. Sketch & describe Base Line Measurement – Colby Apparatus, Wheeler's method and Jaderin's method.
15. Sketch & describe Critical, Sub-critical and Super-critical Subsidence.
16. Sketch & Layout of Subsidence Measurement (Horizontal & Vertical).

Suggested learning resources:

1. Punmia, B.C,; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education, New Delhi.
3. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling volume I, Pune Vidyarthi Gruh Prakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.
6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.
7. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning New Delhi.
8. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
9. Arora K R , Surveying Vol. I, Standard Book House.
10. Mine Surveying and Levelling Vol. I & II-S..Ghatak

Course outcomes:

After completing this course, student will be able to:

- Determine the Tacheometric Constant.
- Setting out the simple curve.
- Known the Base Line Measurement method.
- Known the different method of correlation.
- Perform the subsidence survey.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	MINING TECHNOLOGY - III
PAPER CODE	:	7584
SUBJECT CODE	:	502
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	02

Course Objectives:

Following are the objectives of this course:

- To know the pit top & pit bottom layout of mines.
- To know the basic of opencast mining & its benches.
- To understand the method of working of blasting practices in mines.
- To know the concept of underground coal gasification method and spatial methods likes Horizon mining, Hydraulic mining & Contiguous seam working.

Course Contents:

Unit-I Pit top and pit bottom layouts & Choice of Opencast Mining

- Ideal pit top and pit bottom layout.
- Tub circuit.
- Study of pit top and pit bottom lay outs of important U/G mines of India.
- State factors affecting choice of Opencast Mining method.
- Stripping ratio.
- Determine overburden/ore ratio.
- Find cut off stripping ratio.
- Determine quarriable limit.
- State favourable condition for mechanized Opencast Mining.
- Define Box cut and determine the location of Box cut.

UNIT – II Benching & Slope Stability

- Determine bench parameters- height, width & slope.
- Determine length of bench for overburden and ore.
- Define slope stability.
- Factors affecting slope stability.
- Type of slope stability.
- Causes & prevention of slope stability.

UNIT – III Blasting Practices in Mine

- Define blasting efficiency.
- State & describe plaster shooting & pop shooting, toe shooting.
- State & describe pre-spliting, cushion blasting, muffle blasting, coyote hole blasting, chambered hole blasting, directional blasting and Electronics Blasting System.

Unit-IV Underground Coal Gasification (UCG)

- Concept, Chemistry, conditions suitable for UCG, Principles of UCG., Merits and Demerits.
- UCG Process Component factors: Technology of UCG, opening up of coal seam for UCG.
- Mining methods of UCG: Chamber method, Stream method, Borehole procedure method, Blind bore hole method.
- Non-Mining methods of UCG: Level seams, Inclined seams.
- Linkage Techniques: Percolation linkage, Electro linkage, Boring linkage, compressed-air-linkage, Hydraulic fracture linkage.

Unit- V Special methods of Mining

- Horizon mining –Applicable condition ,suitability , imitation & working method
- Hydraulic mining- Applicable condition ,suitability , limitation & working method
- Contiguous seam working- Applicable condition, suitability, limitation &working method.

Suggested learning resources:

1. Elements of Mining Technology - D.J. Deshmukh, Volume I and II
2. Introductory Mining Engineering, H.L. Hartman
3. Surface Mining Technology - S.K. Das
4. Slope Stability in Surface Mining, Hustrulid - W. A., Mccarter, M. K., And Van Zyl, D. J. A., Ed.,Littleton, 2000.
5. Underground Mining Methods Handbook Society of Mining Engineering- Hustrulid, W.A. Ed.,AMIE, New York, 1990
6. Surface Mining, Mishra G.B., Dhanbad Publishers, Dhanbad, 1990.
7. Underground Coal Mining Methods – J.G. SINGH

Course outcomes:

After completing this course, student will be able to:

- Layout of ideal pit top & pit bottom.
- Determine the bench parameter.
- Knowledge of blasting efficiency with their special condition.
- Familiar with some spatial methods likes Horizon mining, Hydraulic mining & Contiguous seam working.

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MINING TECHNOLOGY-III LAB

Course Objectives:

Following are the objectives of this course:

- To layout the pit top & pit bottom of mines.
- To show the acceptable condition for opencast mining.
- To correlated the opencast bench height with favourable mining condition.
- To choose the well defines blasting practices with different condition.
- To observe the spatial feature of underground coal gasification.

List of Practical's to be performed

1. Layout of Ideal pit top and pit bottom.
2. Showing the favourable condition for mechanized Opencast Mining.
3. Layout of Box cut and determines the location of Box cut.
4. Showing bench parameters- height, width & slope.
5. Discuss the Causes & prevention of slope stability.
6. Showing the plaster shooting & pop shooting, toe shooting in blasting practices.
7. Showing the pre-spliting, cushion blasting, muffle blasting, coyote hole blasting, chambered hole blasting, directional blasting and Electronics Blasting System.
8. Discuss the concept & principle of underground coal gasification.
9. Showing the different method of underground coal gasification.
10. Study & draw the linkage technique of underground coal gasification.
11. Study & draw the horizon mining method.
12. Study & draw the hydraulic mining.
13. Study and draw the contiguous seam working method.

Suggested learning resources:

1. Elements of Mining Technology Vol.I : D.J.Deshmukh
2. Wining and working coal : R.T. Deshmukh & D.J. Deshmukh, Vol. 1&
3. Longwall Mining : Samir Kumar Das
4. Modern coal Mining Technology : Samir Kumar Das
5. Principle &Practices of Coal Mining : R.D. Singh
6. Coal Mining practice : Stathum
7. Surface Mining Technology : Samir Kumar Das.
8. Surface Mining : T.N.Singh

Course outcomes:

After completing this course, student will be able to:

- Layout the pit top & pit bottom of mines.
- Familiar with Opencast layout & its benching with their stability.
- Select the different blasting practices with respect to their requirement mining condition.
- Known the underground coal gasification with their different methods.
- Identify the feature of different method of workings in mines.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	APPLIED ROCK MECHANICS
PAPER CODE	:	7585
SUBJECT CODE	:	511
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:

- To understand the physical properties of rocks and rock indices.
- To understand the mechanical properties of rocks
- To understand the non-destructive testing methods and time dependent properties of rocks
- To understand theories of failure of rocks & Design of underground workings.
- To carryout monitoring, predict and supervise and carryout preventive measures for rock burst,bumps etc.
- To carryout and supervise roof bolting and stitching operation.

Course Contents:

UNIT - I Introduction and Physical properties of rock

- Definition of rock mechanics.
- Scope of rock mechanics in mining.
- Application of Rock mechanics to mining field.
- **Physical properties:** Density, porosity, void ratio, moisture content, permeability.

UNIT – II Mechanical properties of rock

- Preparation of rock samples, determination of mechanical properties of rocks: compressive strength, tensile strength, shear strength, modulus of elasticity.
- Possion's ratio, cohesion, angle of internal friction, Protodyaknov's strength index, Longitudinal wave velocity, rock burst ability index.
- Schmidt rebound hardness number, slake durability index.

UNIT -III Rock mass classification & Stress and strain analysis

- Core recovery, Rock quality designation, Rock mass rating.
- Indian- geo mechanics classification, Q System, Geological strength index, Slope mass rating, rippability classification.
- Coal mines roof rating.
- Stress & strain in two and three dimensions.
- Principal stress, stressellipsoid & determination of principal stress and strain invariants.
- Differential equilibrium equations, compatibility equation of stress and strains, Stress and strain transformation, Mohr's circle of stress andstrain, Plane stress and plane strain condition.

UNIT -IV Rock mass behavior & Rock failure theories

- Confining pressures, effect of water, time, temperature.
- Insitu stress and their estimation; flat jack method, over coring method and hydro fracturing method; Horizontal and vertical stress, intact rock strength and deformability, measuring devices for load, stress and strain.
- Dynamic loading of rocks Time dependent properties of rock, creep, mechanism of creep of rocks — different stages, rheological models
- Rock failure theories: Coulomb, Mohr's – Coulomb, Hoek and Brown, Griffiths and Drucker – Prager.

UNIT-V Rock Burst and Bumps & Roof Bolting

- Rock burst, Bumps, causes controlling measures, factors affecting proneness to rock burst/Bumps.
- Pillar Design- factors considered. Pillar design by tributary area approach, determination of factor of safety.
- Theory of roof bolting, Function of roof bolts, Varieties of Roof Bolts - Slotand Wedge, Expansion shell, Grouted Roof Bolts, Resin Roof Bolts.
- Anchorage Testing of Roof Bolts.
- Roof stitching Cable Bolting.

Suggested learning resources:

- ROCK MECHANICS FOR ENGINEERS – B.P. VERMA
- ROCK MECHANICS – B.S. VERMA
- ELEMENTS OF MINING TECHNOLOGY VOL I – D.J. DESHMUKH
- FUNDAMENTAL AND APPLICATION OF ROCK MECHANICS - DEB D AND VERMA AK,
- ROCK MECHANICS AND GROUND CONTROL, V SINGH AND B P KHARE

Course outcomes:

After completing this course, student will be able to:

- Classify to rock mass.
- Identify the kind of support required to the excavation.
- Conduct different laboratory test to determine properties of rock.
- Carryout monitoring, predict and supervise and carryout preventive measures for rock burst,bumps etc.
- Carryout and supervise roof bolting and stitching operation.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	TUNNEL TECHNOLOGY
PAPER CODE	:	7586
SUBJECT CODE	:	512
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:

- To familiarize the subjects with the recent trends in tunneling methods.
- To understand the design of supports.
- To familiar with maintenance off tunnels.
- To understand provision of facilities such as ventilation, illumination etc. in tunnels.

Course Contents

UNIT-I Introduction

- Introduction to tunneling geological parameters to be considered for tunneling.
- Influence of geologicalaspects on design & construction of tunnels. Types of underground excavations.

UNIT-II Different methods of tunneling

- Conventional and special drill & blast roadway drivage methods.
- TunnelBoring Machine (TBM).

UNIT-III Stresses and displacements & Design of Supports of Tunnels

- **Stresses and displacements** associated with excavating tunnels, ground control or treatment in tunneling and drivages.
- **Design of Supports of Tunnels:-** Steel supports, rock enforcements, new Australian tunneling methods (NATM)

UNIT-IV Design of Tunnels

- Rock conditions, RMR, Q-system, RSR, rock mass behavior, stress strain behavior, and stress analysis of tunnels.
- Maintenance: Dewatering, ventilation and illumination drivages tunnels.

UNIT-V Application of Tunneling

- Tunneling in soft ground, Excavation of large tunnels, hazards in tunneling.
- Ground treatment in excavation, application of road headers and drill jumbos in tunneling: principle of operation, applicability, advantages and limitations.
- Applications of numerical techniques and relevant software's in tunneling (in brief).

Suggested learning resources:

- Tunneling and Underground Construction Techniques – Richards E. Bullock
- Hand Book of Mining and Tunneling Machinery –Stack Barbara John Wiley & Sons.
- Rock Tunneling with Steel Supports – R.V. Proctor.
- Modern Trends in Tunneling and Blast Design – J. Johnsen.

Course outcomes:

After completing this course, student will be able to:

- Gain knowledge about the geo-mechanical properties of rock mass.
- Understand maintenance of tunnels based on ventilation, illumination and dewatering.
- Acquire knowledge on various methods of tunneling.
- Know about design of support system in surface and underground tunnels.
- Able to use latest numerical techniques for tunnel design, stability analysis and ground controlmeasures.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	MINE MACHINERY
PAPER CODE	:	7587
SUBJECT CODE	:	521
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objective:

Following are the objectives of this course:

- To supervise the transportation of coal/mineral by different types of rope haulages.
- To provide and maintain the safety devices to be provided on rope haulages.
- To supervise the operation of locomotive haulages and different types of conveyers fortransportation of mineral/material.
- To supervise the operation of coal cutting machines and power loaders on the coal faces.
- To supervise the installation and operation of water pumps for dealing with water in undergroundmines.
- To supervise the winding of coal/minerals from underground to surface and movement ofcoal/mineral on the surface.
- To supervise installation, maintenance of ropes and attachments; safe operation and understandthe methods of dealing with breakdowns.
- To supervise operations of coalface machineries.

Course Content

Unit- I TRANSPORT OF ORE :

- Different types of haulages , Description of Direct rope haulage, Endless rope haulage, Main and Tail rope haulage, Gravity haulage, Calculation of rope haulage.
- Safety devices used on rope haulage system - Stop block/Buffers,Back stay,Monkey catch, Jazz rail, Runaway Switch, Drop Warwick .
- Locomotive Haulage - different types/ Applicability, Diesel locomotive,Electric locomotive , Air compressed locomotive, Battery locomotives.
- Conveyor system- Chain conveyor, Belt conveyor, ApplicabilityAdvantages and disadvantages of each type.
- Introduction to Arial Ropeways - Bicable and Monocable, advantages and disadvantages.

Unit-II WIRE ROPES :

- Construction of wire ropes , different types of wire ropes- Stranded rope, Non stranded rope, Lays of rope- Lang's lay and ordinary lay, Differentdefinition like static load, dynamic load, factor of safety.
- Selection of wire rope, Care and maintenance of ropes, Types ofdeterioration in the ropes, testing of wire ropes.
- Rope capping - White metal capping (cone socket type capel), Wedge type capping (Reliance rope capel), Capping with split capel and rivets (Split capel), Recapping ,
- Rope splicing – importance & procedure.

Unit-III WINDING IN SHAFT

- Purpose of Winding, Main equipments used for Winding - Head gear, Headgear pulley, Cage, Skip, Winding drum, Guides, Keps, Suspension Gear, Electric motor, Different types of winding- Drum winding & KoepeWinding.
- Drum winding - different types - Cylindrical drum, Conical drum, Cylindroconical drum, Bicylindro conical drum, safety provisions onwinding drum, Depth indicator, Mechanical Brakes (different types), Automatic Contrivance.
- Angle of fleet, Guides used in mines - Rigid guides & Flexible guide.
- Cage attachment to winding rope- Rope capel, D link and bull chain, Safetyhook-king safety hook its construction and working, Triangular distribution plate.
- Different types of keps & Safety devices used in winding.
- Koepe winding- description , advantages and disadvantages.

Unit-IV MINE PUMPS & ELECTRIC POWER SUPPLY

- Sources of water in Mines, Classification of Mine Pumps - ReciprocatingPump, Centrifugal Pumps, Turbine Pumps, Roto pump.
- Installation of pump, Operation of pump, Fitting on pump, Starting and stopping of pump, Characteristics Curves of Centrifugal and turbine pumps.
- Calculations for pump discharge & efficiency of pump.
- Types of cables used in mines- Permanent cable, Semi flexible cable, & flexible cable, Screening of cable, Cable joint box, storage and maintenance of cables.
- GATE END BOX -Construction of gate end box, Safety provision in gate end box, Pilot Circuit, Different protection circuits.
- Electric coal drill machine – construction & working.
- Jack hammer drill machine

Unit-V FACE MECHANISATION –

- Construction, advantages disadvantages & Applicability, of machineries like- Continuous miners, Drum Shearer, LHD, SDL , Power Support & Roof bolter Machine
- Rope shovel, Hydraulic shovel, Grader, Ripper, Dozer, Surface Miner, Short wall & High wall Miner, Bucket wheel excavator, Dragline.

Suggested learning resources:

- Elements of mining vol III- D.J. Deshmukh
- Mine pumps, haulage & winding - S.Ghatak.
- Mining Coach III A Mine machinery - Arvind kumar
- Mine Transport - Karelin

Course outcomes:

After completing this course, student will be able to:

- To supervise the transportation of coal/mineral by different types of rope haulages.
- To provide and maintain the safety devices to be provided on rope haulages.
- To supervise the operation of locomotive haulages and different types of conveyers fortransportation of mineral/material.
- To supervise the operation of coal cutting machines and power loaders on the coal faces.
- To supervise the installation and operation of water pumps for dealing with water in undergroundmines.
- To supervise the winding of coal/minerals from underground to surface and movement ofcoal/mineral on the surface.
- To supervise installation, maintenance of ropes and attachments; safe operation and understandthe methods of dealing with breakdowns.
- To supervise operations of coalface machineries.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	ROCK EXCAVATION ENGINEERING
PAPER CODE	:	7588
SUBJECT CODE	:	522
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:

- To understand the rock mechanics.
- To identify rock cutting technology.
- To understand rock cutting tools androck excavating machine.

Course Contents

UNIT – I Introduction:

Concepts, historical developments in rock excavation systems, factors affecting the rock fragmentation, mechanism of rock breakage and fracture; their application to rock fragmentation methods– explosive action, cutting, ripping and impacts.

UNIT – II Rock Properties:

Rock properties related to excavation process; application of compressive, tensile and tri-axial strengths, index tests and abrasivity, anisotropy, elasticity, porosity, laminations, beddingand jointing in rock fragmentation process.

UNIT – III Rock Cutting Technology:

Mechanism of drilling – rotary, percussive, rotary percussive, mechanics ofrock cutting, theory of single tool rock cutting, crack initiation and propagation, breakage pattern, rock excavation by cutting action – picks, discs, roller cutters, water jet cutting, methods of evaluation of drillability and cut ability index of rocks.

UNIT – IV Rock Cutting Tools:

Rock cutting tool materials, different types, relative applications and their choice,tool shape and size, specific energy consumption, tool wear, effect of operational parameters on tool performance, maintenance and replacement of cutting tools of excavating machines.

UNIT- V Rock Excavating Machines:

Excavating machines, principles, operation, applicability and technical indices of road headers, TBM'S coalface machines and bucket wheel excavators.

Suggested learning resources:

- Introductory Mining Engineering, Hartman, H.L., John Wiley and Sons, New York, 1987.
- Principles of Rock Fragmentation, Clark, G.B., John Wiley and Sons, New York, 1987..
- Diamond Drilling, Chugh, C.P., Oxford-IBH, 1984.

Course Outcomes:

Following are the objectives of this course:

- Have knowledge about mechanism of rock excavation process and different rock fragmentationmethods.
- Know about the influence of different rock properties in rock excavation such as abrasively,lamination and joints etc.
- Acquire knowledge on rock cutting technology
- Understand about different types of cutting tools, their mechanism and application
- Have insight in to rock excavating machines, their application and technical indices of machines.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	RENEWAL ENERGY TECHNOLOGIES
PAPER CODE	:	7601
SUBJECT CODE	:	531
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Learning Objectives:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

Course Content:

UNIT-I: Introduction: World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems.

Unit-II: Solar energy: Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

Unit-III: Wind Energy: Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit-IV: Bio-Energy: Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.

Unit-V: Other Renewable Energy Sources: Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

Reference Books:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press,U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi,2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

Course outcomes:

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

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	INTERNET OF THINGS
PAPER CODE	:	7602
SUBJECT CODE	:	532
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Content:

Unit I - Introduction to Internet of Things

- Define the term "Internet of Things"
- State the technological trends which have led to IoT.
- Describe the impact of IoT on society.

Unit II - Design consideration of IoT

- Enumerate and describe the components of an embedded system.
- Describe the interactions of embedded systems with the physical world.
- Name the core hardware components most commonly used in IoT devices.

Unit III Interfacing by IoT devices

- Describe the interaction between software and hardware in an IoT device.
- Explain the use of networking and basic networking hardware.
- Describe the structure of the Internet.

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Internet of Things	Raj Kamal	McGraw Hill Education; First edition (10March 2017) ISBN 978-9352605224
2	internet of Things: AHands-On Approach	Arsheep Bahge and Vijay Madisetti	Orient Blackswan Private Limited - New Del-hi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	SUMMER INTERNSHIP - II
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	03

SUMMER INTERNSHIP - II

4-6 weeks summer internship after IVth Semester.

It should be undertaken in an Industry only.

Evaluation is based on work done, quality of report, performance in viva-voce, resentation etc.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN MINE SURVEYING (M11)

SEMESTER V

COURSE TITLE	:	MAJOR PROJECT
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	00 (ONE CREDIT WILL BE CARRIED FORWARD TO THE VI SEM. MAJOR PROJECT EVALUATION)

MAJOR PROJECT

It should be based on real/live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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