College of Technology and Engineering

REGULATIONS
AND
COURSE DESCRIPTION

BACHELOR OF TECHNOLOGY

Mining Engineering

Effective from 2019–20

Maharana Pratap University of Agriculture and Technology, Udaipur (Raj.) – 313 001

VISION OF MINING ENGINEERING DEPARTMENT

- To keep its educational standards same as with the internationally well-known Mining Engineering Departments.
- To educate students to play an active role in industry, satisfying present and future needs of a global society through the development and implementation of revolutionary technologies for the extraction of mineral resources, and construction of underground structures in a socially responsible, economically viable, and environmentally sound manner.

MISSION OF MINING ENGINEERING DEPARTMENT

- To produce skilful and high quality engineers supported by up-to-date curriculum and scientific and industrial research to suit the industry both within the country and abroad
- To educate mining engineers who can follow and utilize the technological developments that may occur during their careers as well as lifelong learning and recognize the needs of an environmentally sensitive society for scientific and eco-friendly mining.
- To support the industry to enhance the techniques for their mining by providing databank, testing facilities, suitable consultancy and training services.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PEO - I

To provide students with sound foundation in science, mathematics, other engineering fundamentals, core mining fundamentals and their field applications.

PEO - II

To develop graduates to able to work with professionals in related fields of mining engineering with special emphasis on planning, execution and monitoring of various mining processes and systems.

PEO - III

To develop the analytical and logical aptitude amongst students to quickly adapt to new work environments, assimilate new information, exposure to cutting edge technology and problem solving.

PEO - IV

To develop the aptitude towards research for problem solving in challenges arises in mining field as well as for pursuing Post Graduate/ Doctoral/ Post Doctoral education and research.

PEO - V

To inculcate self learning, discipline, human values, leadership qualities with good soft skills in students. A graduate must have the basic knowledge of environmental fundamentals, problems, challenges and countering measures with reference to mining.

PROGRAMME OUTCOME (POs)

PO - I

Graduates will demonstrate an ability to apply knowledge of mining engineering, mathematics, probability and statistics as it applies to the field of mining engineering.

PO - II

Graduates will demonstrate in depth knowledge of topics which are critical to surface and underground mining especially mine planning, method of work, drilling systems, blasting, safety, mine environmental engineering and economics. In addition to these, some mine management, mine computing, etc.

PO - III

Graduates will demonstrate the ability to function as a member of engineering and science laboratory teams, as well as on multidisciplinary design teams.

PO - IV

Graduates will demonstrate the ability to learn and work independently to identify and solve mining engineering related problems.

PO - V

Graduates will demonstrate an understanding of professional and ethical responsibilities.

PO - VI

Graduates will posses effective communication skills both orally and in writing.

PO - VII

Graduates will have the confidence and potential to apply engineering solutions in global and social contexts.

PO - VIII

Graduates will be disciplined and will show the capabilities of independent problem solving, self learning and innovation.

PO - IX

Graduates will be truly educated and will have a point of view regarding global scenario of the impact of mining technology on society and especially on environment will demonstrate awareness of contemporary issues at large.

ACADEMIC REGULATIONS
(UNDER-GRADUATE COURSES)

SCHEME OF TEACHING AND EXAMINATION
(Mining Engineering)
First Year B.Tech. (Common for All Branches)

I-SEMESTER

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 111 (BSC)	Mathematics -I	2	1	0	2	1	0	80	0	20
2	ESC	ME 112 (ESC)	Mechanical Engineering	3	0	0	3	0	0	80	0	20
3.	ESC	ME 113 (ESC)	Workshop Practice	0	0	1.5	0	0	3	0	80	20
4	ESC	CE 114 (ESC)	Engineering Drawing	0	0	1.5	0	0	3	0	80	20
			NCC/NSS/NSO/ Yoga/Scout	-	-	-	0	0	2	-	-	-
			Total	**5**	**1**	**3**	**5**	**1**	**8**			
			GROUP I									
5.	BSC	BS 100P (BSC)	Engineering Physics	2	0	1	2	0	2	50	30	20
6.	ESC	CE 100 (ESC)	Engineering Mechanics	2	0	1	2	0	2	50	30	20
7.	ESC	EE 100 (ESC)	Electrical Engineering	3	0	1	3	0	2	50	30	20
8.	HSMC	REE100 (HSM)	Environmental Studies and Disaster Management	2	0	0	2	0	0	80	0	20
			Total	**9**	**0**	**3**	**9**	**0**	**6**			
			GROUP II									
5	BSC	BS 100C (BSC)	Engineering Chemistry	2	0	1	2	0	2	50	30	20
6.	ESC	EC 100 (ESC)	Electronics and Instrumentation	2	0	1	2	0	2	50	30	20
7.	ESC	CS 100 (ESC)	Computer Programming for Problem Solving	0	1	2	0	1	4	0	80	20
8.	HSMC	BS100E (HSM)	Communication Skills and Personality Development	2	0	1	2	0	2	50	30	20
			Total	**6**	**1**	**5**	**6**	**1**	**10**			
			Total Credits	**21**								

Note : 1. NCC/NSS/NSO/YOGA/SCOUT is compulsory non credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

2. The courses BS 100P, CE 100, EE 100, REE 100, BS 100C, EC 100, CS 100 and BS 100E shall be offered in both the semesters. The students will be divided in two groups in I semester itself and shall remain in the same group in II semester as well. However, they have to opt all the eight courses in first year.

SEMESTER - II

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 121 (BSC)	Mathematics -II	2	1	0	2	1	0	80	0	20
2	ESC	CE 122 (ESC)	Civil Engineering	1	0	1	1	0	2	50	30	20
3.	ESC	ME 123 (ESC)	Mechanical Drawing	0	0	1	0	0	2	0	80	20
4	ESC	ME 124 (ESC)	Workshop Technology	2	0	1	2	0	2	50	30	20
			NCC/NSS/NSO/ Yoga/ Scout	-	-	-	0	0	2	-	-	-
			Total	**5**	**1**	**3**	**5**	**1**	**8**			
GROUP I												
5	BSC	BS 100C (BSC)	Engineering Chemistry	2	0	1	2	0	2	50	30	20
6.	ESC	EC 100 (ESC)	Electronics and Instrumentation	2	0	1	2	0	2	50	30	20
7.	ESC	CS 100 (ESC)	Computer Programming for Problem Solving	0	1	2	0	1	4	0	80	20
8.	HSMC	BS100E (HSM)	Communication Skills and Personality Development	2	0	1	2	0	2	50	30	20
			Total	**6**	**1**	**5**	**6**	**1**	**10**			
GROUP II												
5.	BSC	BS 100P (BSC)	Engineering Physics	2	0	1	2	0	2	50	30	20
6.	ESC	CE 100 (ESC)	Engineering Mechanics	2	0	1	2	0	2	50	30	20
7.	ESC	EE 100 (ESC)	Electrical Engineering	3	0	1	3	0	2	50	30	20
8.	HSMC	REE100 (HSM)	Environmental Studies and Disaster Management	2	0	0	2	0	0	80	0	20
			Total	**9**	**0**	**3**	**9**	**0**	**6**			
			Total Credits	**21**								

Note :

1. NCC/NSS/NSO/YOGA/SCOUT is compulsory non credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.
2. Students have to undergo in house practical summer training [Branch Code 239 (PSI)] of 15 days at the end of II semester and will be assessed in III semester.

SECOND YEAR B.Tech.

III-SEMESTER

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 231 (BSC)	Mathematics–III	2	1	0	2	1	0	80	0	20
2	HSMC	BS 232(HSM)	Human Values	2	0	0	2	0	0	80	0	20
3	ESC	CE 233 (ESC)	Strength of Materials	2	0	1	2	0	2	50	30	20
4	PCC	MI234 (PCC)	Mining Geology-I	2	0	1	2	0	2	50	30	20
5	PCC	MI 235 (PCC)	Elements of Mining	2	0	1	2	0	2	50	30	20
6	ESC	EE 236 (ESC)	Electrical Technology	2	0	1	2	0	2	50	30	20
7	PCC	MI 237 (PCC)	Mine Machinery-I	2	0	1	2	0	2	50	30	20
8	PSI	MI 239 (PSI)	Training-I	0	0	1	0	0	0	0	100	0
			NCC/NSS/NSO/ YOGA/SCOUT[1]	-	-	-	0	0	2	-	-	-
			Total Credit	**14**	**1**	**6**	**14**	**1**	**12**			
			G.Total Credits	**21**			**27**					

IV-SEMESTER

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/ week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	BSC	BS 241 (BSC)	Mathematics –IV	2	1	0	2	1	0	80	0	20
2	ESC	CE 242 (ESC)	Fluid Mechanics	2	0	1	2	-	2	50	30	20
3	ESC	ME 243 (ESC)	Mechanical Engineering II	2	0	1	2	-	2	50	30	20
4	PCC	MI 244 (PCC)	Mining Geology II	3	0	1	3	-	2	50	30	20
5	PCC	MI 245 (PCC)	Mine Development	3	0	1	3	-	2	50	30	20
6	PCC	MI 246 (PCC)	Mine Surveying I	3	0	1	3	0	2	50	30	20
7	PCC	MI 247 (PCC)	Rock Mechanics I	3	0	1	3	-	2	50	30	20
8	PCC	MI 248 (PCC)	Mine Computing Lab-I	0	0	1	0	0	2	-	80	20
			NCC/ NSS/ NSO/ YOGA/ SCOUT1	0	0	0	-	-	2	-	-	-
			Total Credit	**18**	**1**	**7**	**18**	**1**	**16**			
			G.Total Credits	**26**			**35**					

[1]NCC/NSS/NSO/YOGA/SCOUT is compulsory non-credit course and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

Note: Students have to undergo a Practical Training-II of 30 days (In house/ Field) at the end of IV Semester for which assessment will be made at the beginning of next semester as MI359 (PSI)

THIRD YEAR B.Tech.

V-SEMESTER

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1	PCC	MI 351 (PCC)	Mine Ventilation	3	0	1	3	0	2	50	30	20
2	PCC	MI 352 (PCC)	Surface Mining	3	0	1	3	0	2	50	30	20
3	PCC	MI 353 (PCC)	Underground Coal Mining	3	0	1	3	0	2	50	30	20
4	PCC	MI 354 (PCC)	Computer Application in Mining	2	0	1	2	0	2	50	30	20
5	PCC	MI 355 (PCC)	Mine Surveying II	2	0	1	2	0	2	50	30	20
6	PEC	MI 356 (PEC)	Professional Elective-I	3	0	0	3	0	0	80	0	20
7	PSI	MI 359 (PSI)	Training –II	0	0	3	0	0	0	0	100	0
			Total credit	**16**	**0**	**8**	**16**		**10**			
			G.Total Credits	**24**			**26**					

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VI- SEMESTER

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PCC	MI 361(PCC)	Underground Mine Environment	3	0	1	3	0	2	50	30	20
2.	PCC	MI 362(PCC)	Dimensional Stone Technology	3	0	1	3	0	2	50	30	20
3.	PCC	MI 363(PCC)	Underground Metalliferrous Mining	3	0	1	3	0	2	50	30	20
4.	PCC	MI 364(PCC)	Mine Machinery II	3	0	1	3	0	2	50	30	20
5.	PCC	MI 365(PCC)	Mine Management	3	1	0	3	1	2	50	30	20
6.	PCC	MI 366(PCC)	Rock Mechanics II	3	0	1	3	0	2	50	30	20
7.	PEC	MI 367(PEC)	Professional Elective-II	3	0	0	3	0	2	50	30	20
			Total credit	**21**	**1**	**5**	**21**	**1**	**14**			
			G.Total Credits	**27**			**36**					

Note: Students have to undergo a Practical Training-III of 30 days (In house/ Field) at the end of VI Semester for which assessment will be made in the next semester as MI 479 (PSI).

FOURTH YEAR B.Tech.

VII-SEMESTER

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PCC	MI 471(PCC)	Mine Legislation and Safety	3	0	0	3	0	0	80	0	20
2.	PCC	MI 472(PCC)	Mine Economics & Financial Management	3	0	0	3	0	0	50	30	20
3.	PCC	MI 473(PCC)	Mineral Processing	2	0	1	2	0	2	50	30	20
4.	PCC	MI 474(PCC)	Environmental Management in Surface Mines	2	0	1	2	0	2	50	30	20
5.	PCC	MI 475(PCC)	Mine Computing Lab -II	0	0	1	0	0	2	0	80	20
6.	PEC	MI 476(PEC)	Professional Elective-III	3	0	0	3	0	0	80	0	20
7.	OE	_478 (OE)*	Open Elective	3/2	0	0/1	3/2	0	0/2	80/50	0/30	20
8.	PSI	MI 479 (PSI)	Training –III	0	0	3	0	0	0	0	100	0
			Total credit	**16/ 15**	**0**	**6**	**16/ 15**	**0**	**6/8**			
			G. Total Credits	**22/21**			**22/23**					

VIII-SEMESTER

S. N.	Cate-gory	Course Code	Course title	Credits			Hrs/week			Marks allotted		
				L	T	P	L	T	P	Th.	Pr.	MT
1.	PSI	MI 481 (PSI)	Seminar	0	0	3				0	100	0
2.	PSI	MI 482 (PSI)	Project**	0	0	15				0	100	0
			Total Credits	**18**								

Note: The student have to take one professional elective course in V^{th}, VI^{th} & VII^{th} from the list given as PE-I, PE-II & PE-III respectively. The list of Open Elective (OE) is given below. However the electives may not be offered if faculty expertise is not available or a minimum of 7 students do not opt for a particular elective.

** Project can be done by the student in house or in industry as the case may be and as per norms and guideline of the college.

Professional Elective - I	
MI 356 (a) (PEC)	Experimental Stress Analysis
MI 356 (b) (PEC)	Numerical Methods
MI 356 (c) (PEC)	Advanced Mineral Exploration
Professional Elective - II	
MI 367 (a) (PEC)	Rock Fragmentation
MI 367 (b) (PEC)	Rock Engineering
MI 367 (c) (PEC)	Advances in Mine Ventilation
Professional Elective - III	
MI 476 (a) (PEC)	Mine Planning and Design
MI 476 (b) (PEC)	Computer Aided Mine Design
MI 476 (c) (PEC)	Maintenance Management
MI 476 (d) (PEC)	Advanced Mineral Processing

*OPEN ELECTIVE

Note: The students have to take one open elective out of the list given below:

Offering Department	Course Code	Course Title	Credit		
			Th.	T	P
Civil Engineering	CE478a (OE)	Urban Waste Management	2	0	1
	CE478b (OE)	Ground Improvement Techniques	2	0	1
Computer Sc. Engg	CS 478 (OE)	Introduction To Cyber Security	3	0	0
Mechanical Engineering	ME 478(a) (OE)	Entrepreneurship And Industrial Management	2	0	1
	ME 478(b) (OE)	Bio Energy System Design	2	0	1
	ME 478(c) (OE)	Energy Conservation And Management	2	0	1
Electronics & Comm. Engg.	EC 478(a)(OE)	Intellectual Property Rights	3	0	0
	EC 478(b) (OE)	E-Commerce	3	0	0
Electrical Engg.	EE 478(a) (OE)	Knowledge Based System	3	0	0
	EE 478(b) (OE)	Advanced Power Converters	3	0	0
	EE 478(c) (OE)	Power Electronics In Renewable Energy Systems	3	0	0
Renewable Energy Engineering	REE 478(OE)	Renewable Energy Technologies	2	0	1
Soil & Water Engineering	SWE 478(OE)	Aerial Photography, RS and GIS	2	0	1
Farm Machinery & Power Engineering	FMP 478(OE)	Machinery For Land Development	2	0	1
Processing & Food Engineering	PFE 478(OE)	Packaging Materials And Methods	2	0	1

COURSE CONTENT

FIRST YEAR B.TECH. (I SEMESTER)

BS 111 MATHEMATICS – I

Cr. Hrs. 3(2+1+0)

	L	T	P
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1 : Expand function in Taylor's and Maclaurin's series.

CO2: Trace the Cartesian and Polar curves.

CO3: Apply the partial differentiation to compute the minima and maxima of functions of two variables.

CO4: Compute areas and volumes by integration.

CO5: Solve linear differential equations of higher order and homogenous differential equations with constant coefficients.

Unit-I

Differential Calculus: Taylor's and Maclaurin's expansions, Asymptotes and Curvature (Cartesian Coordinates only), Curve tracing (Cartesian and standard Polar Curves-Cardioids, Lemniscates of Bernoulli, Limacon, Equiangular Spiral).

Unit-II

Differential Calculus: Partial Differentiation, Euler's Theorem on Homogeneous Functions, Maxima & Minima of Two Independent Variables, Lagrange's Method of Multipliers, Jacobians.

Unit-III

Integral Calculus: Double Integral, Areas & Volumes by Double Integration, Change of Order of Integration, Triple integrals, Beta Function and Gamma Function (Simple Properties), Relation between Beta and Gamma functions.

Unit-IV

Differential Equations: Linear Differential Equations of Higher Order with constant coefficients, Homogeneous Linear Differential Equations with constant coefficient.

Text Books/ References

1. Guar, Y.N. and Koul, *C.L, Engineering Mathematics*, Vols. I & II, Jaipur Publishing House, Jaipur (2013).
2. Babu Ram, *Engineering Mathematics-I*, Pearson Education, India (2011).
3. B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill, India (2012).
4. J.L. Bansal and H.S. Dhami, *Differential Equations*, Vols. I & II, Jaipur Publishing House, Jaipur (2012).
5. M.Ray and Chaturvedi, *A Text Book of Differential Equations*, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati, *Engineering Mathematics*, New Age International (P) Ltd, New Delhi (2012).
7. Gupta C.B., Malik A.K., *Engineering Mathematics –I,* New Age international Publisher.

ME 112 (ESC) MECHANICAL ENGINEERING

Cr. Hrs.	**3(3+0+0)**		
	L	T	P
Credit	3	0	0
Hours	3	0	0

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Apply the principles of conservation of mass, first and second laws of thermodynamics to analyse closed steady state systems and processes involving heat and work interactions.

CO2: Show understanding of concepts of reversibility, entropy and Carnot cycle.

CO3 Demonstrate knowledge of properties of steam and ability to compute them from steam tables and Mollier chart.

CO4: Understand construction and working of steam boilers, steam engines and their specific applications.

CO5: Compute efficiency, power output, etc. of various vapour and gas cycles.

CO6: Demonstrate knowledge about construction and working of IC engines.

Unit - I

Thermodynamics: Thermodynamic properties, closed and open systems, flow and non-flow processes, gas laws, laws of thermodynamics, internal energy. Application of First Law in heating and expansion of gases in non-flow processes only.

Second law of thermodynamics: Kelvin-Planck and Claussius statements. Reversible processes, Carnot cycle, Carnot theorem. Reversed Carnot cycle. Entropy, physical concept of entropy.

Unit - II

Properties of Steam: Difference between gas and vapour, change of phase during constant pressure process. Generation of Steam, triple point and critical point. Internal energy and entropy of steam. Use of steam tables and Mollier chart, heating and expansion of vapour in non-flow processes.

Unit - III

Vapour Power Cycles: Introduction to Carnot Cycle, Rankine cycle and modified Rankine cycle.

Steam Generators: Classification of steam boilers. Cochran, Lancashire, Locomotive and Babcock-Wilcox boilers, Boiler mountings and accessories.

Steam Engines: Introduction to simple and compound steam engines.

Unit - IV

Gas Power Cycles: Introduction. Air Standard efficiency, other engine efficiencies and terms. Otto, diesel and dual cycles. Calculation of efficiency, mean effective pressure and their comparison.

Internal Combustion Engines: Introduction, Classification, terminology and description of IC Engines. Four stroke and two stroke petrol, gas and diesel engines. Comparison of petrol and diesel engines. Simple carburettor.

Text Books/References

1. M. L. Mathur and F. S. Mehta: Thermal Engineering, (Vol. I, SI Edition), Jain Brothers, New Delhi.
2. R. K. Purohit: Foundation of Mechanical Engineering, Scientific Pub. (India), Jodhpur.
3. P.K. Nag: Engineering Thermodynamics, TMH.

ME113 (ESC) WORKSHOP PRACTICE

Cr. Hrs. 1.5(0 + 0 + 1.5)

	L	T	P
Credit	0	0	1.5
Hours	0	0	3

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Demonstrate knowledge of characteristics of various types of woods used in engineering applications.

CO2: Demonstrate knowledge of tools and operations in carpentry work, black smithy, fitting, sheet metal and plumbing works in engineering practice.

CO3 Identify and use measuring instruments in workshop practice and pipe fittings.

CO4: Learn use of tools in the carpentry, fitting, smithy, sheet metal and plumbing shop to make simple jobs.

Carpentry Shop: Acquaintance with types of wood, tools and their uses. Simple exercises involving basic operations like sawing, planning, chiselling, etc. Preparation of simple joints, cross half lap joint, dovetail joint, bridle joint, tenon and mortise joint.

Smithy Shop: Acquaintance with types of tools and their uses. Simple exercises involving basic operations like bending, drawing, punching, shaping, upsetting, and riveting.

Fitting Shop: Acquaintance with tools, measuring and marking tools, precision measuring tools and their uses. Simple exercises involving basic operations like sawing, chipping, filling, drilling, reaming, threading with taps and dies.

Sheet Metal and Plumbing Shop: Demonstration of basic tools, pipe fittings and operations.

Texts books/References:

1. S.K. Hajra Choudhury and A.K. Hajra Choudhury: Elements of Workshop Technology (Vol. I), Media promoters & Publishers Pvt. Ltd., Bombay.

CE 114 (ESC) ENGINEERING DRAWING

Cr. Hrs. 1.5 (0+0+1.5)

	L	T	P
Credit	**0**	**0**	**1.5**
Hours	**0**	**0**	**3**

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

CO1 : Select, Construct and Interpret appropriate drawing scale as per the situation.

CO2 : Draw simple curves like ellipse, cycloid and spiral.

CO3 : Draw Orthographic projections of points, lines and planes.

CO4 : Draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections.

CO5 : Layout development of solids for practical situations.

CO6 : Draw isometric projections of simple objects.

Introduction and letter writing. Construction and use of plain, diagonal and vernier scale. Methods of drawing ellipse, parabola and hyperbola. Methods of drawing cycloids, spirals. Orthographic projection and projection of points.

Projection of lines, projection of planes, projection of solids. Introduction of prism, pyramid, cylinder and cone.

Section of solids, introduction of intersection of surfaces. Development of plane and curved surface. Isometric projection.

Text Books / Reference

1. N.D. Bhatt. Elementary Engg. Drawing, Rupalee publication, Anand.
2. Lakshmi Narayan and Vaishwanar. A Text Book of Practical Geometry, Jain Brother, New Delhi.
3. R.B. Gupta. A Text Book of Engineering Drawing, SatryPrakashan, New Delhi.
4. Fundamentals of Technical Drawing, Parkinson.

BS 100P (BSC) ENGINEERING PHYSICS

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1: Apply vector calculus approach to problems in electric field and magnetic field.

CO2: Apply laws of physics to simple LRC circuits.

CO3: Learn physics behind various types of lasers and their characteristics.

CO4: Understand the interference and diffraction from wave optics concepts and know its applications.

CO5: Understand polarization of light and its applications.

Unit-I

Electric Field: Line integral of electric field, Potential difference, Field as gradient of potential, Divergence of a vector function, Differential form of Gauss's law, Laplacian, Laplace equations, Curl of a vector function. Gauss's divergence theorem.

Magnetic Field: Curl and Divergence of a magnetic field, Magnetic scalar and vector potential.

Unit-II

Varying Field: Faraday's law-integral and differential form, Self and mutual inductance, Neumann's equation, Charge and discharge of a capacitor through register, Growth and decay of current in LR circuit, Energy stored in electric and magnetic field, Displacement current, Maxwell's equations.

Unit-III

Laser: Coherence, Einstein's coefficient, Spontaneous and stimulated emission, Population inversion, Laser gain (pumping), Spectral narrowing in laser, Coherence length, Ruby and He-Ne laser.

Interference: Division of amplitude, colour of thin films, Newton's ring, Febry-Perot interferometer-principle, operation, determination of wave length and difference in wave length.

Unit-IV

Diffraction: Double slit Fraunhoffer diffraction pattern, Fraunhoffer diffraction by a plane transmission grating, Formation of spectra.

Polarization: Analysis of linearly, circularly and elliptically polarized light (Half wave and quarter wave plates), Optical activity, specific rotations, Laurent's half shade polarimeter and its use for determination of specific rotation of sugar solution.

Practical

1. To find refractive index and dispersive power of material of prism by spectrometer.
2. To find wave length of light by Newton's ring.
3. To find wave length of light by diffraction grating.
4. To find specific rotation of sugar solution by polarimeter.
5. To find wave length of light by Fresnel Biprism.
6. To find frequency of A.C. mains.
7. To determine dielectric constant of liquid using series resonance method.
8. To study charge and discharge of condenser through a resistor (C.R. Circuit).
9. To study LCR resonant circuit, resonance, quality factor and sharpness in (i) series circuit (ii) parallel circuit.

Text Books/References

1. K.K. Tiwari. (1995). Electricity and Magnetism, S. Chand and Company, New Delhi.
2. N. Subrahmanyam and Brijlal. (1993). A Text Book of Optics,

S. Chand and Company, New Delhi.

3. Ahmed and Lal. (1966). Electricity, Magnetism and Electronics, Unitech House, Lucknow.
4. D.S. Mathur. (1993). Mechanics, S. Chand and Company, New Delhi.
5. Gupta and Kumar. (1995). Practical Physics, Pragati Prakashan, Meerut.

CE 100 (ESC) ENGINEERING MECHANICS

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1: Draw free body diagrams and determine the resultant of forces and/or moments.

CO2: Determine the centroid and second moment of area of sections.

CO3: Apply laws of mechanics to determine efficiency of simple machines with consideration of friction.

CO4: Analyse statically determinate planar frames.

CO5: Analyse the motion and calculate trajectory characteristics.

CO6: Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.

(A) STATICS

Unit-I

Introduction of condition of equilibrium: Force, system of force, coplanar forces.

Moment and couples: Moment and parallel forces, Couples, General conditions of equilibrium

Practical Applications: Levers, Crank levers, Steel yards. Sagging chains and toggle joints.

Centre of Gravity: Centre of parallel forces, C.G. in some simple cases, C.G. of Solids.

Moment of Inertia: Moment of inertia, Radius of gyration and perpendicular axis. Determination of moment of inertia of simple sections. Mass of moment of inertia.

Unit-II

Friction: Introduction, Critical angle of friction, Friction on horizontal planes, Friction on inclined planes, Wedge and block, Screw Jack

Machines: Introduction, Effects of friction, Loss of work, Reversible and irreversible machine, Law of machine, Wheel and axle, Differential wheel and axle, Pulley block, Screw jack, Single and double winch crab, Worm and Worm wheel, System of pulleys.

Frames: Statically determinate plane frames, Method of joints, Method of sections.

(B) DYNAMICS

Unit-III

Rectilinear Motion: Motion under gravity, Projectiles equation of the path, Maximum height attained, Time of flight, Horizontal range. Angle of projection, Projectile from a given height, Projectile on an inclined plane, Problems.

Work, Power and Energy: Work, Power, Work done by torque, Energy, Law of conservation.

Unit-IV

Centripetal and centrifugal forces, Laws of motion: Newton's Law of motion and their explanation, Collision of elastic bodies; Impulse and impulsive force, Principle of conservation of momentum, Loss of kinetic energy during impact.

Practical

1. Verification of law of polygon of forces.
2. Verification of principle of moment in case of compound lever.
3. Verification of principle of moment in case of bell crank lever.
4. Determination of reaction in case simply supported beam with or without overhang.
5. To determine coefficient of friction between different surfaces on horizontal plane.
6. To determine coefficient of friction between different surfaces in inclined plane.
7. Study of differential wheel and Axle.
8. Study of single winch crab.
9. Study of worm and worm wheel.

10. Study of Weston's differential pulley block.
11. Determination of mechanical advantage, velocity ratio and efficiency of single winch crab.
12. Determination of mechanical advantage, velocity ratio and efficiency of double winch crab.
13. Determination of mechanical advantage, velocity ratio and efficiency of first system of pulley.
14. Determination of mechanical advantage, velocity ratio and efficiency of second system of pulleys.
15. Determination of mechanical advantage, velocity ratio and efficiency of third system of pulleys.

Text Books / References

1. I.B. Prasad. Engineering Mechanics, Khanna Publisher, New Delhi.
2. R.S. Khurmi. Applied Mechanics, S. Chand & Company Ltd., New Delhi
3. S.B. Junnarkar. Applied Mechanics, Charotar Publishing House, New Delhi.
4. Saluja. Applied Mechanics, SatyaPrakashan, New Delhi.

EE 100 (ESC) ELECTRICAL ENGINEERING

Cr. Hrs.	**4(3+0+1)**		
	L	**T**	**P**
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

CO1 : Proficiency in solving DC network.

CO2 : Know-how of single phase AC circuits

CO3 : Competency in solving three phase balanced AC circuits

CO4 : Dexterity in using basic electrical instruments

CO5 : Comprehension of transformer working principles.

Unit-I

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses.

Kirchoff's law, Delta-star and star-delta conversion, source conversion

Network theorems: Thevenin's, Norton's, superposition, and Maximum Power Transfer theorem.

Unit-II

Single Phase EMF generation, average and effective values of sinusoidal and linear periodic wave forms, instantaneous and average power, power factor, reactive & apparent power, solution of R-L-C, series, parallel, series-parallel circuits, complex representation of impedances, phasor diagram, series and parallel resonance.

Unit-III

Transformer*:* Faraday's laws of Electromagnetic induction, construction and principle operation of single phase transformer, EMF equation, voltage and current relationship and Phasor diagram for ideal transformer.

Fundamentals of DC machines: Working principle, operation and performance of DC machines (Motor and generator)

Unit-IV

Three phase A.C. circuits: Three phase EMF generation, delta and star connection, methods of three phase power measurement; power factor, reactive and apparent power, Series and parallel resonance.

Concept of Three phase induction motor: construction and operation. Basic introduction of single phase induction motor.

Practical

1. To Establish the Voltage-Current Relationship in an Electric Circuit and to Measure the Unknown Resistance by Ammeter-Voltmeter Method (Ohm's Law).
2. Experimentally Verify the Number of Resistance Connected in Series and parallel in an Electric Circuit can be replaced by in Equivalent Resistance without Disturbing the Circuit Condition.
3. Verify Kirchhoff's Current Law and voltage law for a DC Circuit.
4. Verify Superposition Theorem for a DC Circuit.

5. Verify Thevenin's Theorem for a DC Circuit.
6. To Measure Power and power factor in a Single Phase A.C. Series R-L Circuit.
7. Determination of Choke Coil Parameter Resistance (R) and Inductance (L).
8. To Study The Characteristics of an L-C-R Series Circuit.
9. Testing of Single Phase Energy Meter by Direct Loading Method.
10. Determination of Percentage Regulation of a Single Phase Transformer by Direct Loading Method.
11. Determination of Efficiency of a Single Phase Transformer By Direct Loading Method
12. To perform open circuit and short circuit test for single phase transformer
13. To obtain load characteristics of D.C. shunt/series/compound generator
14. To perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent circuit parameters
15. To perform no load & blocked –rotor test on 1 ph. induction motor & to determine the parameters of equivalent circuit.

Text Books / References

1. B.L. Therja. Electrical Technology, S. Chand.
2. M.E. Van Valkenberg. Network analysis, PH.I
3. Soni and Gupta. Introduction to Electrical Network Theory, Dhanpat Rai Publisher.
4. Dr. R.A. Gupta and Dr. Nikhal Gupta. (2002). Fundamentals of electrical & Electronics Engineering, JPH.
5. H.P. Tiwari. (2002). Electrical & Electronics Engineering, College Book Centre, Jaipur.
6. J. B. Gupta. (2002). Fundamentals of Electrical & Electronics. S.K. Kataria and Sons. Dehli.

REE 100(HSM)
ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Cr. Hrs. 2 (2+0+ 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

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

CO1 : Develop an understanding of different natural resources including renewable resources.

CO2 : Realize the importance of ecosystem and biodiversity for maintaining ecological balance.

CO3 : Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.

CO4 : Demonstrate an appreciation for need for sustainable development and role of science.

CO5 : Aware of important acts and laws in respect of environment.

Unit-I

Environmental Studies: Definition, scope and importance. Natural Resources: Renewable and non-renewable resources and associated problems.

Forest resources: Use and over-exploitation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects. Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.

Unit-II

Ecosystems: Concept, Structure and function. Energy flow in an ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the various ecosystems.

Biodiversity and its conservation: Introduction, definition, genetic species & ecosystem diversity and biogeographical classification of India.

Value of biodiversity: Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation.

Unit-III

Environmental Pollution: Definition, cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Social Issues and the Environment: Urban problems related to energy; Water conservation, rain water harvesting, watershed management.

Environmental ethics: Issues and possible solutions; Wasteland reclamation, Consumerism and waste products. Environment Protection Act.

Issues involved in enforcement of environmental legislation. Public awareness, Human Population and the Environment: population growth, Family Welfare Programme.

Environment and human health: Human Rights, Value Education, HIV/AIDS, Women and Child Welfare.

Role of Information Technology in Environment and human health.

Unit-IV

Natural Disasters: Meaning and nature, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, accidents.

Disaster Management: Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Armed forces in disaster response; Disaster response; Police and other organizations.

Text Books / References

1. Agarwal K.C., Environmental Biology, Nidi Publications, Bikaner, 2001.
2. Bharucha Erach. 2005. Text Book of Environmental Studies for Undergraduate Courses, University Grants Commission, University Press, Hyderabad.
3. Chary Manohar and Jaya Ram Reddy. 2004. Principles of Environmental Studies, BS Publishers, Hyderabad.
4. Chaudhary, B.L. and Jitendra Pandey: Environmental Studies, Apex Publishing House, Udaipur, 2005
5. Climate Change.1995: Adaptation and mitigation of climate change-Scientific Technical Analysis Cambridge University Press, Cambridge.
6. Gupta P.K. 2004, Methods in Environmental Analysis – Water. Soil and Air. Agro bios, Jodhpur.
7. Husain Majid. 2013, Environment and Ecology: Biodiversity, Climate Change and Disaster Management, online book.
8. Jhadav, H. & Bhosale, V.M.: Environmental Protection & Laws, Himalaya Pub. House, Delhi
9. Kaul S.N., Ashuthosh Gautam. 2002. Water and Waste Water Analysis, Days Publishing House, Delhi.
10. Rao, M.N. and A.K. Datta, Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
11. Sharma J.P. 2003, Introduction to Environment Science, Lakshmi Publications.

12. Sharma, B.K., Environmental Chemistry, Goel Publishing House, Meerut

13. Sharma, R.K. & Sharma, G. 2005, Natural Disaster, APH Publishing Corporation, New Delhi.

14. Singh Pratap, N.S. Rathore and A.N. Mathur: Environmental Studies, Himanshu Publications, Udaipur, 2004.

15. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno Science Publications.

BS 100C (BSC) ENGINEERING CHEMISTRY

Cr.Hrs. 3(2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1 : Demonstrate knowledge of science behind common impurities in water and methods to treat them.

CO2 : Describe the purpose and operational steps of key water treatment processes used to improve water quality including: Coagulation, Sedimentation, Filtration, Disinfection, Corrosion Control, Taste and Odour Control.

CO3 : Know the methods to determine the calorific value of fuels, perform flue gas analysis and combustion analysis.

CO4 : Apply the science for understanding corrosion and its prevention.

CO5 : Apply the knowledge of Kinetics of Reactions.

Unit- I

Sources of water: Common impurities, requisites of drinking water in municipal water supply. Purification of water, sterilization, break point chlorination. Hardness, determination of hardness by Complexometric

(EDTA) method, degree of hardness, Boiler troubles, carry over corrosion, Sludge and scale formation. Caustic embrittlement, cause of boiler troubles and their prevention.

Unit- II

Classification of fuels: Solid fuels, Proximate and Ultimate analysis of coal, significance of constituents, theoretical method for calculation of Gross and net calorific values. Liquid fuels- Petroleum origin, Refining of Petroleum, knocking, octane number, anti knocking agents . Flue gas analysis by Orsat Apparatus, Calculations based on combustion.

Unit- III

Corrosion and its control: Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion.

Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit- IV

Chemical Kinetics: Order and Molecularity of reaction, first and second order reaction, Derivation of equations for first and second order reaction, determination of order of reaction, Energy of activation and Arrhenius equations, Numerical of first and second order reactions.

Practical

1. Determination of viscosity of a liquid.
2. Estimation of free chlorine in a water sample.
3. Determination of temporary and permanent hardness by EDTA method.
4. Determination of Copper Sulphate iodometrically.
5. Estimation of Potassium dichromate iodometrically.
6. Determination of purity of Ferrous Ammonium Sulphate (Mohr's Salt) using Potassium Permanganate.
7. Estimation of available chlorine in Bleaching Powder sample.
8. Analysis of Brass.
9. Determination of Strength of Ferrous Ammonium Sulphate (FAS) using Potassium Ferricyanide as an external indicator.
10. Analysis of Common Salt.

Text Books / References

1. Jain and Jain. Engineering Chemistry, Dhanpat Rai Publishing Company(P) Ltd., New Delhi.
2. Jain and Gupta. A Text Book of Engineering Chemistry,Jaipur Publishing House,Jaipur
3. B.K. Sharma. Engg. Chemistry(General), Krishna Prakashan Media (P) Ltd., Merrut.
4. S.S. Dara. A Text Book of Engineering Chemistry, S.Chand & Co., New Delhi.
5. M.M. Uppal. A Text Book of Engineering Chemistry,Khanna Publishers, New Delhi.
6. S.S. Dara. A Text Book on Experiments and Calculations in Engg.Chem.

   S.Chand & Co., New Delhi.
7. Ameta and Yasmin. Practical Engineering Chemistry, Himanshu Publications, New Delhi

EC100 (ESC) ELECTRONICS AND INSTRUMENTATION

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Unit-I

Passive Components: Construction and characteristics of various types of resistors, capacitors & inductors for electronic circuits, color coding of resistors. Semiconductor Devices: Basic theory of semiconductors, constructions and characteristics of PN diode, Zener diode, photodiode, LED, BJT & JFET.

Unit-II

Bipolar Junction Transistor: Introduction to BJT biasing circuits, Basic concept of class-A, class-B, class-AB, class-C amplifiers.

Power supply: Rectifier circuits and filters. Concept of voltage regulators, Zener diode voltage regulators, Transistor series regulator.

Unit-III

Feedback & Oscilloscopes: Concept of positive and negative feedback. Introduction to Oscilloscope.Barkhausen criteria. Working principle of RC- phase shift, Wien bridge, Hartley, Colpitts and Crystal Oscilloscopes.

Unit-IV

Transducers: Active and Passive transducers. Working principle of Thermocouple, LVDT, Strain Gauge and Tacho Generator. Instrumentation: Introduction to data acquisition system. Working principle of Electronic Multimeter, Cathode Ray Oscilloscope, Digital Storage Oscilloscope and Spectrum Analyzer.

Practical

1. Identification and testing of different types of passive and active electronic components: Resistors, Capacitors, Inductors, Diodes, Transistors.
2. Plot the V-I characteristics in forward and reverse bias mode for (a) PN junction diode (b) ZENER diode and find the cut- in and breakdown voltage respectively.
3. Plot the V-I characteristics of LED diode in forward bias mode and find the glow voltage.
4. Determine the R.M.S value of output voltage and check the waveform on CRO for:

   (a) Half wave rectifier with and without filter.

   (b) Full wave centre tapped rectifier with and without filter.

   (c) Full wave bridge rectifier with and without filter.
5. Plot the input and output characteristics for two configurations of transistors:

   (a) NPN/PNP transistor in CE configuration.

   (b) NPN/PNP transistor in CB configuration.
6. Determine both theoretically and practically the frequency of oscillation for R-C Phase shift Oscilloscope.
7. Determine the output voltage of an amplifier: (a) with feedback (b) without feedback.

8 . Study and perform basic measurement of Digital Multi Meter.

9 . Study and perform basic measurement of Cathode Ray Oscilloscope/ Digital Storage Oscilloscope.

10 . Study of Spectrum Analyzer and perform basic measurements.

NOTE: *The actual number of experiments may be more than the above mentioned list.*

Text Books / References

1. Millman and Halkias. Integrated electronics: Mc Grew Hill

2. W.D Cooper. Electronics Instrumentation and Measurement : PHI

3. M.L.Gupta. Electrical Engineering Materials

4. Melvin,o Principles of Electronics

5. John D. Ryder. Electronics Fundamentals

CS100 (ESC)
COMPUTER PROGRAMMING FOR PROBLEM SOLVING

Cr. Hrs. 3 (0+1+2)

	L	T	P
Credit	**0**	**1**	**2**
Hours	**0**	**1**	**4**

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

CO1 : Design, implement, test, debug, and document programs in C using conditional branching and iteration.

CO2 : To use arrays, understand how to write and use functions, how the stack is used to implement function calls, and parameter passing options

CO3 : Implement recursion functions & use of pointers and structures to formulate programs.

CO4 : To be able to create, read and write to/from files and to write simple searching and sorting algorithms

Unit-I

Introduction to Programming, Algorithm, Flowchart, Arithmetic expressions and precedence: The Character set, constants, variables and keywords, data types, Type Conversion, Hierarchy of Operations, Conditional Branching: The if Statement, if-else Statement, Nested if-else, Ladder if-else, The Conditional Operators. Loops: While Loop, do-while loop, for Loop, Nesting of Loops, Multiple Initializations in for Loop, break Statement, continue Statement, Decisions using switch, Go to Keyword, finding roots of an equations.

Unit-II

Arrays: Array Initialization, Bounds Checking, One and Two Dimensional Arrays, Memory Map of a 2-Dimensional Array, Strings: String Functions- strlen( ), strcpy( ), strcat( ), strcmp( ), Two-Dimensional Array of Characters. Function: Function Declaration and Prototypes, Parameter passing in functions: Call by Value and Call by Reference, Passing Array Elements to a Function, Passing an entire Array to a Function.

Unit-III

Recursion: Recursion such as Finding Factorial, Fibonacci series, Ackerman function etc. Structures: Declaring a Structure, Array of Structures. Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures.

Unit-IV

File handling: Create, open, insert, update, search and display operations. Basic Algorithms: Searching: linear & binary, Basic Sorting Algorithms (Bubble, Quick sort and Merge sort), Notion of linked list.

Text books / References

1. "Let us C", Yashwant Kanetkar, Allied Publishers.
2. "The C programming language", Kernighan and Ritchie, Prentice Hall of India.
3. "Programming in ANSI C", E. Balaguruswamy, Tata McGraw Hill.

BS100E (HSM)

COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT

Cr. Hrs. 3 (2 + 0 +1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, students will be able to:

CO1 : Understand basic grammar principles, and apply them to synthesise and transform sentences and identify common errors in writing.

CO2 : Demonstrate enhanced communicative ability in English, and develop sensitivity to cultural differences in communication .

CO3 : Write structured paragraphs and essays, CVs, letters and professional emails .

CO4 : Understand their personality type, develop leadership qualities and time-management techniques.

CO5 : Understand the process and types of communication and the barriers to effective communication.

CO6 : Show improved vocabulary and pronunciation.

CO7 : Practice skills required for oral presentations, group discussions and interviews.

Unit-I

Sentence and its types, Parts of Speech, Articles, Tenses, Concord, Modals, Narration and Voice

Unit-II

Nissim Ezekiel: Goodbye Party for Miss Pushpa T.S. – Poem (Introduction to Indianisms and Difference between Indian English and Standard English)

George Orwell: Politics and the English Language – Essay (Writing process and what constitutes good or bad writing; rules of writing for effective communication)

Unit-III

C.V and Resume Writing, Letter Writing, E-mail Writing, Paragraph Writing (Topic sentence, inductive and deductive logic), Essay Writing (Narrative, Descriptive, Expository and Persuasive).

Unit-IV

Personality Traits (Big Five Model), *Skills of a Good Leader,* Effective Time Management Techniques, Communication: Process and Types (Verbal/Non-Verbal/Para-Verbal, Intrapersonal/Interpersonal, Upward/ Downward/Horizontal/Diagonal), Barriers to Effective Communication.

Practical (Language Lab)

Phonetics, Group Discussions, Mock Interviews, Presentations, Vocabulary Building (Synonyms, Antonyms, One-Word Substitutes, Idioms and Phrases), Listening Comprehension, Everyday Conversations.

Text books / References

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan. 2007
3. High School English Grammar and Composition. Wren and Martin. S. Chand. 2018
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
7. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
8. The Ultimate Book of Common Errors. Terry O'Brien. Rupa Publications. 2015.
9. Technical Writing for Engineers and Scientists. Barry J. Rosenberg. Addison-Wesley Professional. 2005.
10. Spoken English: A Manual of Speech and Phonetics. R.K. Bansal & J.B. Harrison. Orient Longman. 2013.

11. English Phonetics & Phonology: A Practical Course. P. Roach. Cambridge University Press, London. 2010.

12. Handbook of the International Phonetic Association: A Guide to the Use of the International Phonetic Alphabet. Cambridge University Press.

13. Communicating Your Way to Success: The Success Stories. Dale Carnegie. Manjul Publishing House. 2018.

14. Talk like TED: The Public-Speaking Secrets of the World's Top Minds. Carmine Gallo. St. Martin's Press. 2014.

15. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Gopalaswamy Ramesh and Mahadevan Ramesh. Pearson Education. 2013.

FIRST YEAR B.TECH. (II SEMESTER)

BS121 (BSC) MATHEMATICS – II

Cr. Hrs. 3(2+1+0)

	L	T	P
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1 : Show knowledge of vector calculus and its applications in engineering.

CO2 : Solve second order differential equations for application in their field of engineering.

CO3 : Solve partial differential equations of first order and higher orders (with constant coefficients).

CO4 : Solve simultaneous equations by matrix methods.

CO5 : Determine eigenvalues and eigenvectors.

CO6 : Diagonalise a matrix and invert a matrix.

Unit-I

Vectors Calculus: Scalar and Vector field, Differentiation of vector functions, Gradient, Divergence, Curl and Differential Operator, Integration of vector functions, Line, Surface and volume Integrals, Green's Theorem in a Plane, Gauss's and Stoke's Theorem (without proof) and their Applications.

Unit-II

Differential Equations: Second Order Ordinary Differential Equations with Variables Coefficients, Exact Forms, Part of Complimentary Function is known, Change of Dependent Variable, Change of Independent Variable, Normal Forms, Method of Variation of Parameter.

Unit-III

Partial Differential Equations: Formation of partial differential equations, Partial Differential Equations of First Order, Lagrange's Form, Standard Forms Higher order linear partial differential equations with constant coefficients.

Unit-IV

Matrices: Rank of a matrix, Inverse of a matrix by elementary transformations, Consistency and Solution of simultaneous linear equations, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), Diagonalization of matrix.

Text Books / References

1. Guar, Y.N. and Koul, C.L.(2013), *Engineering Mathematics,* Vols I and ll, Jaipur Publishing house.
2. Bansal, J.L. and Dhami, H.S.(2012), *Differential Equation* Vols I and ll, Jaipur Publishing house.
3. Babu Ram (2011), *Engineering Mathematics –I* , Pearson Education India.
4. B. V. Ramana (2012), *Heigher Engineering Mathematics*, Tata McGrew Hill, India.
5. M. Ray and Chaturvedi*, A text book of Differential Equation*, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati (2012), *Engineering Mathematics*, New Age International (p) Ltd., New Delhi.
7. Gupta C.B., Malik A.K., *Engineering Mathematics –II,* New Age international Publisher.

CE 122 (ESC) CIVIL ENGINEERING

Cr. Hrs. 2(1+0+1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

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

CO1: Demonstrate knowledge of various surveying methods.

CO2: Conduct a compass survey.

CO3: Conduct levelling survey and be able to do RL calculations.

CO4: Demonstrate knowledge of properties of various building materials.

CO5: Plot work profile.

(A) SURVEYING AND LEVELING

Unit-I

Principle and purpose of plane surveying.

Introduction of Chain Surveying: Instrument for chaining, Direct & indirect ranging. Introduction of laser based distance measurement.

Compass Surveying: True & Magnetic meridian, whole circle bearing & quadrantal bearing system, construction & use of Prismatic & Surveyor Compass, Local attraction.

Introduction of plane table Surveying: Accessories and working operation.

Unit-II

Level and leveling: Definition of various terms used in leveling. Types of Bench mark and their uses. Construction and use of Dumpy level, Leveling staves. Temporary adjustment of Dumpy level. Simple, differential leveling, fly leveling, longitudinal and cross sectioning, plotting of profile leveling. Determination of level by line of collimation and rise and fall method, Arithmetical checks. Level book and record keeping, leveling difficulties and errors in leveling.

(B) BUILDING MATERIAL

Unit-III

Stones: Different types, properties of good building stones, common testing of stones, Dressing of stones and use of stones in construction.

Bricks: Types, raw materials, identification, composition. Properties and uses of ordinary bricks, fire resistant and chemical resistant bricks.

Limes: Definition, sources of lime, slaking of lime, ISI classification of lime.

Unit-IV

Cement: Chemical composition, types of cement, properties, uses and tests on cement.

Mortars: Proportioning, properties of ingredients and use of lime, cement and gauge mortars.

Cement Concrete: Ingredients, common proportions, properties of fresh hardened concrete, Water cement ratio, curing and compaction of concrete.

Timber: Properties of good quality timber. Decay and preservation of timber.

Practical

1. Study of accessories used in measurement of distances.
2. Ranging Direct and indirect and use of chain and tape.
3. Study of prismatic compass and taking bearings..
4. Study of Dumpy level, temporary adjustment and R.L. calculations.

5. Simply and differential leveling operation, record in level book, practice for staff reading line of collimation and Rise and fall method calculations.
6. Longitudinal sectioning.
7. Cross sectioning.
8. Fly leveling operation.
9. Plotting of working profile.
10. Introduction of laser based distance measurement.
11. Properties of good quality bricks.
12. Properties of good quality stone.
13. Properties of good quality timber.
14. Physical test of cement.

Text Books / References

1. S.C. Rangwala. Engineering Materials, Charotar Book Stall, Anand.
2. B.C. Punmiya. Surveying & Field Work (Vol. I), Laxmi Publications, New Delhi.
3. Kanetkar T. P., 'Surveying and leveling', Vol. I & II.
4. Duggal S. K., 'Text book-Surveying', Vol. I & II.

ME123 (ESC) MECHANICAL DRAWING

Cr. Hrs.	**1(0+0+1)**			
	W	**L**	**T**	**P**
Credit		**0**	**0**	**1**
Hours		**0**	**0**	**2**

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Demonstrate knowledge of conventional representation employed in machine drawing.

CO2: Make detailed drawings of simple machine parts in first/third angle projection by proper choice of sectioned views as per need.

CO3: Read, interpret and visualize machine parts from a given drawing.

CO4: Demonstrate knowledge of riveted, welded, threaded and screwed joints and fastenings.

Introduction, conventional representation of different materials used in machine drawing, Introduction to BIS codes.

Orthographic Projection: First and third angle methods of projection. Preparation of working drawing from models and isometric views. Drawing of missing views.

Dimensioning: Different methods of dimensioning.

Sectional Views: Concept of sectioning. Revolved and oblique section. Sectional drawing of simple machine parts

Riveted and Welded Joints: Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints.

Screw Fastenings: Nomenclature, thread profiles, multistart threads, left and right hand threads. Square headed and hexagonal nuts and bolts. Conventional representation of threads. Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts.

Different types of joints: Knuckle joint, cotter joint and universal joint.

Text Books / References

1. N. D. Bhatt. Machine Drawing, Charotar Book Stall, Anand.
2. V. Laxminarayan and ML Mathur. A Text Book of Machine Drawing, Jain Brothers, New Delhi.
3. P. S. Gill. Machine Drawing, S. K. Kataria & Sons, New Delhi.

ME124 (ESC) WORKSHOP TECHNOLOGY

Cr. Hrs. 3(2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Understand welding principles, equipment and tools of arc-, gas and resistance welding, brazing and soldering.

CO2: Describe construction, operations and tools of lathe, shaper and drilling machines.

CO3: Understand basic hot and cold forming operations.

CO4: Demonstrate knowledge of types of patterns, cores, moulding sands and tools.

CO5: Understand sand, permanent mould and investments castings and casting defects.

Unit-I

Welding: Introduction to types of welding. Principle of electric arc welding, welding tools and safety devices, welding positions, welding joints, types of welds, Resistance welding. Oxyacetylene gas welding, types of flames. Soldering and Brazing.

Unit-II

Lathes: Constructional details of centre lathe. Main operations and tools used on centre lathes.

Shaper: Types of shapers. Constructional details of standard shaper, shaper tools and main operations.

Unit-III

Drilling Machines: Types of drilling machines. Constructional details of pillar type and radial drilling machines. Main operations. Twist drills, drill angles and sizes.

Forming: Basic descriptions and applications of hot and cold working processes, forging, bending, shearing, drawing and forming operations.

Measurement and Inspection: Classification of measuring instruments, linear and angular measurement, comparators.

Unit-IV

Foundry & Casting Practices: Introduction, types of patterns, Mouldings, moulding materials, cores, moulding tools and equipments. Moulding sands, properties of moulding sands. Casting defects. Casting methods: Permanent mould casting, investment casting.

Practical

Practical exercises on welding, pattern making, foundry and machining operations.

Text Books / References

1. Mathur Mehta and Tiwari: Elements of Mechanical Engineering, Jain Brothers, New Delhi.
2. S.K. Hajra Choudhury and A.K. Hajra Choudhury: Elements of Workshop Technology (Vol. I and II), Media promoters & Publishers Pvt. Ltd., Bombay.

SECOND YEAR B. TECH. (III SEMESTER)

BS231 (BSC) MATHEMATICS – III

Cr. Hrs. 3 (2 + 1 + 0)

	L	T	P
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1: Understand Finite differences, various difference operators and their relationships, factorial notation.

CO2: Use numerical methods in modern scientific computing.

CO3: Find the Inverse Laplace Transform by Partial Fractions.

CO4: Use the Laplace Transform to solve differential equation with constant coefficients.

CO5: Numerically integrate any function by Trapezoidal and Simpson's rule.

Unit-I

Interpolation: Finite differences, various difference operators and their relationships, factorial notation, Interpolation with equal intervals, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula for unequal intervals.

Unit-II

Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae.

Numerical Differentiation: Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.

Unit-III

Numerical Integration: Numerical integration by Trapezoidal, Simpson's rule.

Numerical Solutions of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.

Unit-IV

Laplace Transform: Laplace transforms of elementary functions, Basic properties of Laplace transform, Initial value theorem, final value theorem and convolution property of Laplace transform, Inverse Laplace transforms, Applications of Laplace transform to solve ordinary differential equations.

Text Book/ References

1. H.C. Saxena, *Text Book of Finite Differences and Numerical Analysis*, S. Chand and Co.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering computation*, New Age International (P) Ltd.
3. N.P. Bali and Manish Goyal, *A Text book of Engineering Mathematics*, Laxmi Publication Pvt. Ltd., New Delhi (VII Edition).
4. S.P. Goyal and A.K. Goyal, *Integral Transforms*, Jaipur Publishing House, Jaipur.
5. Bansal, Bhargava, *Numerical Analysis*, JPH, Jaipur.

BS 232 (HSM) HUMAN VALUES

Cr. Hrs. 2 (2+0+0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

Course Outcomes: At the end of the course, the students will be able to:

CO1: Distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.

CO2: Engage in a process of self-reflection and know what they 'really want to be' in their life and profession

CO3: Understand the meaning of happiness and prosperity for a human being.

CO4: Understand harmony at all the levels of human living, and live accordingly.

CO5: Apply the understanding of harmony in existence in their profession, develop commitment and courage to act in order to lead an ethical life

Unit-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for value education; Self Exploration - content and process; 'Natural Acceptance' and Experiential Validation; Continuous Happiness and

Prosperity with respect to Human Aspirations; Method to fulfil human aspirations: understanding and living in harmony at various levels

Unit-II

Understanding Harmony in the Human Beings and their Relationships - Harmony in Myself, Family and Society

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha; Understanding the Body as an instrument of 'I' ,Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Swasthya;

Understanding harmony in the Family; Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman);

Understanding harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family

Unit-III

Understanding Harmony in Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature; Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all pervasive Space; Holistic perception of harmony at all levels of existence

Unit-IV

Implications of the above - Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, and develop appropriate technologies and management models; Strategy for transition from the present state to Universal Human Order at the level of individual and society.

Note: In each unit, relevant practice exercises and case studies to be taken up. Mode of conduct should be through group discussions.

Text Books/ References

Textbook:

R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2009. ISBN: 978-9-350-62091-5.

Other reference books

1. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Annie Leonard, 2010, The Story of Stuff, Free Press
4. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
5. R. Subramanian, Professional Ethics includes Human Values, Oxford Univ. Press.
6. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
7. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
8. A Nagraj, 1998, Jeevan Vidya: Ek Parichay, Divya Path Sansthan, Amarkantak.
9. A N Tripathy, 2003, Human Values, New Age International Publishers.
10. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co.
13. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

CE 233 (ESC) STRENGTH OF MATERIAL

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1: Analyze behavior of materials under simple stress and strains

CO2: Analyze behavior of materials under compound stress and strains

CO3: Analysis of stress and strains by various methods, stresses in thin cylinder and special shells

CO4: Plot SFD and BMD of beams under various loading and determine shearing and bending stresses

CO5: Analyze various shafts under torque

CO6: Analyze and design columns using different formulae

Unit-I

Fundamentals: Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagrams, mechanical properties of materials, elasticity and plasticity. Shear stress and strain, pure shear, complementary shear. Poison's ratio, volumetric strain, bulk modulus of elasticity. Elastic constants and relation between elastic modulie.

Linear elasticity and Hooke's law. Temperature stresses and effects. Stress and strain in axially loaded members.

Unit-II

Analysis of Stress and Strain: Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr's circle representation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke's law for plain stress.

Stresses in thin cylinder and special shells subjected to internal & external pressures.

Unit-III

Beam under Flexural Loads: Bending moment and shear force, relation between load, Shear force and bending moment. Bending moment and shear force diagrams for simply supported, Cantilever and overhang beams under static loading of different types viz. point loads, Uniformly distributed loads, linearly varying loads, Pure bending. Theory

of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of Rectangular, Circular and I-section. Shear formula, effect of shear strain.

Unit-IV

Torsion: Torsion of solid and hollow circular shafts. Non-uniform torsion.

Columns: Buckling and stability, critical load. Euler's theory for initially straight column with different end conditions, equivalent length, Limitation of Eulor's formula. Rankine's formula. Column under eccentric loading. Secant, Perry's and Indian standard Formulae.

Practical

1. Study of Universal Testing Machine, its part and functions.
2. Operation of U.T.M, fixing of specimen for different testing.
3. Tensile test on mild steel specimen to failure and computing, Stresses, % elongation, Contraction etc.
4. Compression test on timber.
5. Compression test on mild steel.
6. Compression test on concrete cube.
7. Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.
8. Determination of toughness by Izod test for wood, Aluminum & Brass.
9. Study of torsion testing machine.
10. Performance of torsion test on circular shaft specimen.
11. Bending test on wooden beam and determination of modulus of rupture.
12. Deflection test on wooden beam.

Text Books/References

1. Junarkar S.B. and Shah H.J., 'Mechanics of Structures' Vol.-I Charoter Publishing, Anand.
2. PunmiaB.C., 'Strength of Materials and Mechanics of Structures', Vol-I, Standard Publisher distributors, New Delhi.
3. Fedinard L., 'Strength of Materials', Singer& Andrew Pytel'.
4. Fenner, 'Mechanics of Solids'.
5. Davis H. E, Trophell, G.E. &Hanck, G.F.W., 'The Testing of Engineering Materials', McGraw Hill.
6. Timoshenko, S.P. & Young, D.H., 'Strength of Materials', East West Press Limited.

MI 234 (PCC) MINING GEOLOGY - I

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Understand the basic knowledge of Physical geology, Fundamentals of Diastrophism, Petrology, Mineralogy, Exploration and reserve estimation as outcome of this course, which is highly beneficial for the mining engineers in the industry.

Unit – I

Introduction and importance of geology in Mining: Evolution, age, origin and interior of the earth; Physio-graphic features of India; Geological Time Scale.

Physical Geology: Geological processes- weathering, erosion, transportation and deposition; Geological work done by wind, river, lake, glacier, underground water and sea.

Unit - II

Petrology: Definition of rock, formation, crystallization, texture, structure and classification of igneous rocks; Definition of sedimentary rocks, formation, texture, structure and classification; Definition of metamorphic rock, metamorphism, agents responsible for metamorphism, texture, structure and classification.

Unit – III

Mineralogy: Definition of mineral, identification by physical, chemical and optical properties; Classification of rock forming minerals; Description of mineral families. i.e. feldspar group, mica group, pyroxene group, amphibole group.

Exploration: Geological, geophysical, geo-chemical and remote sensing methods. Geological factors consider for excavation viz. rock related factors, structures, seismicity; sub surface drains and influence of ground water flow systems on rock excavations.

Unit- IV

Sampling and Reserves Estimation: Definition of sampling, methods and importance in mining; Mine sample reduction; Quality control; Total Quality; Definition of reserve, classification and estimation by conventional and geo-statistical techniques.

Diastrophism: Slow and rapid earth movements; Earthquakes causes and effects; Seismic belts, Interior of earth; plate tectonics.

Practical

1. Minerals under handspecimen.
2. Rocks under handspecimen.
3. Geomorphic & Crystal models models.
4. Geological Time-Scale.
5. Geological succession of India and available minerals.
6. Geological succession of Rajasthan and available minerals.
7. Geologic maps and sections.
8. Plotting Indian geological formations & mineral deposits.
9. Plotting of earthquake/ seismic belts of India
10. Plotting of Physiographic maps of India
11. Plotting of structure/ tectonic map of India
12. Minerals under microscope
13. Rocks under microscope.
14. Exercises related to ore reserve estimation.
15. Preparation of assay plan.

Text Books/References

1. Mukherjee P.K., A Textbook of Geology, The World Press Pvt.Ltd Calcutta.
2. Tyrell G.W.,The Principles of Petrology, B.I.Publications Pvt. Ltd
3. H.H.Read ,Textbook of Mineralogy Oxford University Press. Delhi
4. Haung G.N., Petrology
5. Pettijohn F.J.,Sedimentary Rocks, C.B.S.Publishers & Distributors
6. Turner & Verhoogen, Igneous Petrology, McGraw Hill Inc.
7. Miyashiro, Metamorphic Petrology
8. Winkler, Metamorphic Petrology, McGraw Hill Inc.
9. Holmes, Principles of Physical Geology, E.L.B.S.

MI 235 (PCC) ELEMENTS OF MINING

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Understand the fundamentals of exploratory drilling and various blasting techniques for underground and opencast mines which can be put in practice later in the concerned mining industries. As deep underground mining is inevitable in near future, students must play on active role in participating in various activities like arrangement for support etc.

Unit – I

Mineral resources of Rajasthan, India and World; Mining of important economic minerals in India; Various terms used in mining; Introduction and comparison of underground and surface mining. Introduction to unit operations.

Unit – II

Prospecting and Exploration: Reconnaissance; principles and methods of prospecting - pit, shaft, trench and boreholes; Methods of Exploration, Selection of sites for boreholes; Surface layout of boring; Details of equipment, Borehole logging; Maintenance of records; Deflection of boreholes; Difficulties in boring; Fishing tools and their uses; Methods of exploratory drilling for oil; Interpretation of borehole data.

Unit – III

Supports and Reinforcement: Examination of roof; Materials for support: Timber, masonry, concrete and steel supports; Storage, preservation and fire proofing of timber; Objectives and limitations of supports under different conditions; Rigid and yielding types of supports, Strata bolting; Roof stitching; Recovery of falls; Shotcreting, cable bolting.

Unit – IV

Explosives: Classification and comparative properties of explosive; Blasting devices; General application and uses; Blasting theory; Safety considerations.

Blasting system: Electric and non -electric methods; Delay blasting techniques; Priming; Charge distribution; Mechanisms of rock blasting; Blasting with cut and solid blasting, Introduction to SMS, PMS, Emulsion and Heavy ANFO.

Practical

1. Mapping of different mineral resources of (i) Rajasthan (ii) India and (iii) world.
2. Illustration of Mining Terminology.
3. Various types of fishing tools used in exploratory boring for mineral and oil.
4. Bore-hole logging and interpretation of bore hole data and numerical problems related to it.
5. Working of the Sylvester prop withdrawal system.
6. Design and use of the friction props.
7. Design and use of the hydraulic props
8. Various types of roof bolts, roof stitching and different wooden supports & their application in mines.
9. To feed the bore hole data in computer software and to take results related with the formation and quantum of mineral resources.
10. Selection of various types of blasting accessories used in mines and designing of explosive magazines
11. PMS Plants with various capacities for surface mines.
12. SMS Plants with various capacities for surface mines
13. Charging problem
14. Study of portable magazine
15. Study of exploder

Text Books/References

1. C.P. Chugh, High Technology in Drilling and Exploration. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
2. C.P. Chugh, Diamond Drilling. Pub: Oxford & IBH Publisher.
3. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons.
4. Dr.Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, TO5036, USA.
5. R.D. Singh, Principles & Practices of Modern Coal Mining Pub:- New Age International Pvt.Ltd. New Delhi.
6. Dr. Calvin Konya; “Rock Blasting and Overbreak Control” Precision Blasting Services, Montville, Ohio.

EE236 (ESC) ELECTRICAL TECHNOLOGY

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Understand principles of operations and performance characteristics of DC machines.

CO2: Determine regulation efficiency of transformers.

CO3: Understand operating principle and performance characteristics of alternators.

CO4: Understand principles of operations and performance characteristics of induction and synchronous motors.

Unit-I

D.C. Machines: Characteristics curves of d.c. generators and motors, application of motors for different uses, starting and speed control of motors.

Unit-II

Transformers: Phasor diagram and equivalent circuits, regulation efficiency and their determination. Open circuit, short circuit and Sumpner's test.

Stepper motors, Servo motors, Brushless DC motors

Unit-III

Induction Motors: Polyphase induction motors – starters, equivalent circuit, effect of rotor resistance, torque-slip curves, speed control by rotor resistance, pole changing and cascading, use in industry. Single phase induction motor – starting methods.

Unit-IV

Alternators: Elementary idea of armature winding. Calculation of induced e.m.f., factors affecting generating e.m.f. Open circuit, short circuit and load characteristics. Voltage regulation and its determination by synchronous impedance methods. Synchronising.

Synchronous Motors: Methods of starting. Power angle characteristics of cylindrical rotor machine, operation of synchronous motor as a condenser and as a reactor. Applications in industries.

Practical

Lab practical will be as per the theory syllabus.

Text Books/References

1. Nagrath and Kothari: Electrical Machines, Tata McGraw-Hill Publishing Company Ltd, New Delhi.
2. Ashfaq Hussain: Fundamentals of Electrical Engineering,

MI 237 (PCC) MINE MACHINERY – I

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Understand air compressor used in mining and distribution of compressed air. It will give the knowledge of wire ropes and its usage in winding and production purposes. Understand mechanics of various drilling system. Knowledge about various machineries for underground coal mining and surface mining makes student confident. To get knowledge about pumping operation & maintenance

Unit – I

Compressed Air: Air Compressors; types, construction, installation & maintenance; Transmission and distribution of compressed air; Calculations of main parameters; Comparison of compressed air with other forms of power.

Wire ropes: Wire ropes used in mines- types and their construction, installation, maintenance and tests; Rope splicing and change of ropes; rope capels and process of capping.

Unit – II

Machinery for underground mining: Loaders: SDL, LHD, LPDT; Cutter loaders: SERDS, DERDS, Coal Plough, Continuous miner, Road headers. Cable bolting machine.

Open pit Machinery: Dozers; Front end loaders; Power shovels: Rope and hydraulic, Back hoes, Draglines; Dumpers, Coal haulers; Motor graders; Scrappers; Rippers; Bucket wheel excavators; Spreaders; Re-claimers; Continuous surface miner.

Unit – III

Drills for blasting: Introduction to drilling systems; Mechanics of percussive, rotary and rotary-percussive drilling; Different types of drills: compressed & hydraulic, diesel and electric drills; Jack hammers, drill jumbos and blast hole drills; Drill accessories and their working; Types of drill steels, bits and their uses.

Maintenance: Preventative and predictive maintenance; Condition monitoring; Workshops. Automation and remote control of mining equipment.

Unit – IV

Pumps and Pumping: Principal types, construction, operation and characteristics; Calculation of size and efficiency; Installation, operation care and maintenance; Frictional resistance; Installation in shafts and roadways; Damage due to corrosion and abrasion, and precaution; Cleaning and replacement of pipes; location and design of mine sumps.

Practical

1. Transmission and distribution of compressed air for surface and underground mines with pressure losses and remedial measures.
2. DERDS used in coal mines.
3. Hydraulic, rope and back hoe types of loading machines and their selection criteria.
4. Application of bucket wheel excavators in coal mines.
5. Constructional features and working aspects for dragline.
6. Constructional features and working aspects for bucket wheel excavator.
7. Design and application of rope capples.
8. Constructional features and working aspects for L.H.D. & S.D.L.
9. Planning and scheduling of maintenance of machinery used in mines.
10. Design of mine sumps and their selection of site in mines.
11. Hydraulic drills.
12. Constructional aspect of Jackhammer and its maintenance.
13. Different types of drill bits used in drilling and their selection criteria.

14. Turbine pump with constructional details and characteristic curves.
15. Design of mine pump with its installation, care and maintenance.

Text Books/References

1. Dr. G.B. Mishra, Surface Mining Pub:Dhanbad Publisher, Dhanbad.
2. Amitosh Dey, Heavy Earth Moving Machinery. Available at Geeta book store, Dhanbad.
3. M.A. Ramlu, Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
4. Karelin, Mine Transport. Pub:- Orient Longmans Ltd. New Delhi.
5. M. A. Ramlu; "Mine Hoisting" Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. C. P. Chug; "High Technology in Drilling and Exploration" Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Cummins & Givens; "SME Mining Engineering Handbook, Vol. I & II" A.I.M.M.New-York
8. R.D. Singh, Principles & Practices of Modern Coal Mining Pub:-New Age International Pvt.Ltd. New Delhi

BS241 (BSC) : MATHEMATICS-IV

Cr. Hrs.	**3 (2 +1+ 0)**		
	L	**T**	**P**
Credit	**2**	**1**	**0**
Hours	**2**	**1**	**0**

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

CO1: Demonstrate proficiency in solving Fourier Series.

CO2: Solve Algebraic and Transcendental Equation.

CO3: Solve Wave equation and Laplace's equations.

CO4: Show competence in Statistics, Correlation and regression.

Unit-I

Fourier Series: Fourier series, even and odd functions; Half range series; Change of interval; Exponential form of Fourier series; Harmonic analysis.

Unit-II

Roots of Nonlinear (Algebraic and Transcendental) Equations: Bisection method, False position method, Newton Raphson method; Convergence of False position and Newton Raphson method. Complex roots of polynomials by Bairstow's method.

Unit-III

Partial Differential Equations: Classifications of partial differential equations; Method of separation of variables to solve Heat equation, Wave equation and Laplace's equations.

Unit-IV

Statistics: Correlation and regression; Principle of least square method and curve fitting.

Probability Distribution Functions: Random variable; Mathematical expectations; Moment generating functions; Discrete and continuous distribution functions; Binomial, Poisson and Normal distributions.

Reference:

1. J.L. Bansal and H.S. Dhami, *Differential Equations (Vols.-II)*, Jaipur Publishing House, Jaipur (2005).
2. N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics (VII Edition), Laxmi Publication Pvt. Ltd., New Delhi.
3. S.C. Gupta and V.K. Kapoor, Mathematical Statistics, Sultan Chand & Sons, New Delhi.

CE 242 (ESC) FLUID MECHANICS

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Learn properties of fluid, pressure, Equation of fluid flow, Applications of equations of fluid flow, losses in pipes flow, channel sections etc.

Unit-I

Hydrostatics: Fluid Properties, Measurement of liquid pressure. Pascal's law fluid pressure on plane and curved stationery surface, Centre of pressure, Principal applications (preliminary) in simple gales and tanks.

Unit-II

Fluid motion: type and patterns, velocity and acceleration of fluid, continuity equation, elementary concept of velocity potential. Stream function and flow nets. Euler's equation of motion, integration of Euler's equation to give Bernoulli's equation for compressible and incompressible fluids, applications of Bernoulli's equation.

Unit-III

Impulse momentum equation: introduction, force on pipe bends. Flow through sharp edged orifices, flow through mouth pieces (steady flow condition).

Discharge measurement in pipes and open channels: venturimeter, orificemeter. Nozzle and pitot tube (steady flow condition). Flow over weirs, and notches (steady flow condition).

Unit-IV

Flow through pipes: various types, velocity distribution, loss of head due to friction, minor losses, hydraulic gradient, pipes in series and parallel.

Open Channel Flow: Various types, flow equations, geometrical properties of sections, Most economical section.

Practicals

1. Study and use of pressure gauge.
2. Study & use of manometer.
3. Determination of C_C for orifices.
4. Determination of C_V for orifices.
5. Determination of C_d for orifices.
6. Calibration of a Venturimeter.
7. Calibration of V notch.
8. Calibration of Rectangular notch.
9. Determination of friction for pipe.
10. Velocity distribution in channel cross section.
11. Field visit.
12. Field visit.
13. Revision.
14. Revision.

Taxt book

1. Jadish Lal, Hydraulics, Metropolitan Book Co. Pvt. Ltd., Delhi-(1986)
2. Modi P.N. and Seth, S.M. – Hydraulic and Fluid Mechanics, Standard Book House, Delhi-6 (1995)
3. R.K. Bansal, Fluid Mechanics & Machine,

ME243 (ESC) MECHANICAL ENGINEERING-II

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes: Upon completion of this course the students will be able to:

CO1: Demonstrate knowledge of characteristics of power transmission drives with flexible connectors and gears and application forelementary calculations.

CO2: Solve simple balancing problems of rotating and reciprocating masses.

CO3 Describe brakes, dynamometers, bearings, couplings and lubrication methods.

CO4: Explain the sources and types of vibrations encountered in machines.

CO5: Describe the construction and operation of high pressure steam boilers, turbines and condensers.

CO6: Explain various cycles of refrigeration and basic concepts of air-conditioning.

CO7: Demonstrate knowledge of performance characteristics of water turbines and centrifugal pumps required for selection of proper machine.

Unit - I

Transmission of Power: Belts, ropes and chains, length of belts, tension in belts, centrifugal tension and maximum power transmitted by belts. Spur gear nomenclature, involute and cycloidal profiles, helical, bevel and worm gears. Gear trains.

Brakes and Dynamometers: Band brake, block, band and block brake. Single and multiple disc clutches. Transmission and absorption type dynamometers.

Unit - II

Balancing: Balancing of rotating masses in single and multiple planes. Partial primary and secondary balancing of reciprocating masses.

Vibrations: Free, longitudinal, transverse and torsional vibrations, Critical speed.

Bearings and Couplings: Main types of bearings and coupling. Antifriction bearings.

Lubrication: Laws of friction for dry and lubricated surfaces, Methods of lubrication of bearings.

Unit - III

Steam Boilers: High pressure boilers of natural and forced circulation type, La Mont, Benson, Loeffler, Velox Boilers.

Steam Turbines: Expansion of steam through nozzles with and without friction. Throat pressure for maximum discharge. Working of impulse and reaction turbines. Compounding. Velocity diagrams. Governing of turbines. Emergency governing.

Condensers: Types, classification and details. Vacuum efficiency. Cooling towers and spray pounds.

Unit - IV

Gas Turbines: Basic principles, simple gas turbine cycle, applications of gas turbines.

Refrigeration and Air Conditioning: Bell-Colleman refrigerator. Vapour compression and absorption refrigerators. Psychrometric Chart. Introduction to comfort air-conditioning.

Water Turbines: Classification and characteristics of various water turbines, governing of turbines. Problem of cavitation. Selection of turbine for hydropower plants.

Centrifugal Pumps: Classification, characteristics of centrifugal pumps. Selection of pumps.

Practicals

Study of gears, brakes and dynamometers. Study of various types of clutches and antifriction bearings. Study of critical speed of shaft. Study

of air compressors. Study of high pressure boilers and condensors. Study of steam and gas turbines. Study and experiments on refrigeration systems. Study of air conditioner.

Text Books/References

1. M. L. Mathur and F. S. Mehta: Thermal Engineering, (Vol. I & II, SI Edition), Jain Brothers, New Delhi.
2. R. K. Purohit: Thermal Engineering,
3. R. S. Khurmi and J. K. Gupta: Theory of Machines, Eurasia Publishing House (Pvt.) Ltd., New Delhi.
4. P. L. Ballaney: Theory of Machines, Khanna Publishers, Delhi

MI 244 (PCC) MINING GEOLOGY - II

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Understand the procedures of geological mapping, assaying, sampling, prospecting and exploration. Also it will give the understanding of structural features of rocks, stratigraphy important metallic, non-metallic and fuel minerals of India.

Unit- I

Structural Geology: Structural features of rocks, attitude of rocks; Folds and faults- definition, mechanism, classification, recognition and impact in mining; Joints, definition, classification and impact in mining; Unconformities, outlier and in-lier. Stereographic plotting of geological features.

Unit- II

Stratigraphy: Introduction, standard stratigraphic scale, principle of stratigraphic correlation; Geology of India in brief; Review of major geological formations of minerals of India. Geology of Rajasthan with emphasis on economic importance; Precambrian stratigraphy of Rajasthan.

Geological Mapping: Definition of map, scale of map, types, map symbols; Surface and underground geological mapping. Computer based geological data plotting and preparation of map.

Unit- III

Assaying: Wet and dry methods, spectro-photometry, flame photometry and atomic absorption spectro-photometry.

Economic Geology: Definition of ore, gangue, tenore and grade and classification of mineral deposits; Study of occurrence, shape, form, size, mineral composition and texture of various process generated mineral deposits; Controls of localization of mineral deposits.

Unit- IV

Engineering Geology and Hydrogeology: Criteria of site selection for shaft, incline, tunnels, dams and wells; Introduction to hydrogeology and its impact on mining.

Study of important metallic, non-metallic and fuel minerals of India: Their geographical distribution, mode of occurrence, economic importance giving emphasis on occurrences in Rajasthan. Metallic minerals i.e. Lead, Zinc, Copper, Iron, Nickel, Gold, Aluminum, Manganese, Tungsten, Uranium; Non-Metallic minerals i.e. Limestone, Talc, Rock-Phosphate, Gypsum, Kyanite, Marble, Granite, Sandstone, Garnet, Corundum, Diamond, Fluorite, Quartz, Feldspar, Calcite, Topaz, Kyanite, Olivine; Fuel minerals i.e. Coal, lignite and Petroleum. Definition, composition, properties, origin, theories of migration of petroleum, structural features of coal seams; Fuel mineral resources of Rajasthan.

Practical

1. Structural models under hand specimen.
2. Metallic minerals under hand specimen.
3. Non-metallic economic minerals under hand specimen.
4. Plotting of geological section along given section line in the given geologic map.
5. Stereo-net plotting of ore body planes with the help of dip and strike data obtained by borehole drilling.
6. Construction of Clinometers and Brunton compass.
7. Determination of volumetric joint count.
8. Calculation of T/W ratio for dams (T= pressure of reservoir water tends to displace the dam horizontally & W = the weight of the dam which acts downwards and tends to key the dam in position, R= resultant forces)

9. Find the width of ore body with the help of outcrop observations in the following topographic conditions:

a. On horizontal ground b. Slope of ground opposite to the dip of the ore body.

c. Ground slopping in the same direction as dip of the ore body.

10. Find out inclination and slope of ore body with the help of three-point method.

11. Determination of apparent dip of ore body from true-dip with the help of stereo-net.

12. Ore body outcrop compilition in given geologic map.

13. Determination of resistivity of ground/ sub surface rocks with the help of resistivity meter.

14. Plotting of geologic sections with the help of surface geological plan of the area.

15. Interpretation of the satellite imagery.

16. Plotting of symbols in geologic map.

Text Books/References

1. Billings M.P, Structural Geology, Prentice Hall of India Pvt. Ltd New Delhi

2. Krishnan M.S, Geology of India & Burma, C.B.S.Publishers & DistributorsDelhi.

3. Ravindra Kumar, Fundamentals of Historical Geology & Stratigraphy of India, Wiley Eastern Pvt Ltd New Delhi.

4. Rogers J.J.W, Precambrian Geology of India, Oxford University Press

5. Lemon R.R, Principles of stratigraphy, Meril publishing Co.London.

6. Weller J.M, Stratigraphic principles and Practice, Universal Bookstall Delhi

7 John G.Ramsay, Folding and fracturing of rocks, McGraw Hill Book Co.

8 Ragan, Structural geology: An Introduction to the Geometrical Techniques, John Wiley & Son's.

9 Bolton T, Geological Maps, their solution and Interpretations, Cambrige Uni.Press

10 S.Sinha Roy, Geology of Rajasthan, Geological Society of India, Bangalore.

11 Krishnaswamy, India's mineral resources, Oxford Pub

MI 245 (PCC) MINE DEVELOPMENT

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Understand the fundamentals of shaft sinking, making entries, structures, raises and galleries in underground coal and metal mines. As deep underground mining is inevitable in near future, students must play on active role in participating in various activities like arrangement for sinking, ventilation, lighting etc.

Unit – I

Introduction to primary and secondary mine development.

Mine Entries: Choice, location and size of mine entries- shafts, inclines, declines and adits; their merits and applicability.

Mine Structures: Construction and layouts of structures - Shaft insets, ore and waste bins, skip-pockets, engine chambers, ore passes, chutes, garages, grizzlies and sumps.

Unit – II

Shaft Sinking: Conventional methods; Preparatory arrangement; Drilling, blasting, loading and hoisting of muck; Lining, ventilation, drainage and lighting; Sinking through loose, fractured, flowing and water bearing ground; Widening and deepening of shafts; Shaft boring; staple shaft.

Unit – III

Drifting: Conventional methods, different types of drilling patterns, blasting, loading, transport of muck, support, ventilation, drainage and lighting; Drifting through loose, fractured, flowing and water bearing ground; Drifting by road headers and tunnel boring machines. Cross-measure drifts and laterals.

Unit – IV

Stope Development: Conventional methods of raising and winzing; Modern methods of Raising - Raise climbers, Long hole raising and Raise borers; Slot preparation

Practical

1. Design a drift taking into consideration different options available for given set of conditions.
2. Tunnel boring machine used in India and Abroad & various application parameters.
3. Ordinary method of shaft sinking.
4. Piling methods of shaft sinking and their applicability
5. Drop shaft methods of shaft sinking and their applicability
6. Designing the Cementation method of shaft sinking.
7. Designing the Freezing method of shaft sinking for watery conditions.
8. Alimak raise climber and procedure of driving a raise by it.
9. VCR method (drop shaft) of raising in hard rock and fracture zone.
10. Procedure of shaft deepening in a working mine upto 300mts depth.
11. Shaft widening for raising the daily production from 1500 tonnes to 5000 tonnes in metal mines.
12. Modern tunneling techniques.
13. Raise borers
14. Cast iron tubbing - English & German tubbing
15. Various types of mine structures

Text Books/References

1. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons.
2. Cummins & Givens, SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. New-York.
3. Ray Lowrie; “SME Mining Reference Handbook” SME Publication 2002.
4. William A. Hustrulid, Rechard Bullock; “Underground Mining Methods” SME Publication.

MI 246 (PCC) MINE SURVEYING – I

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Acquire sufficient knowledge on conducting mine surveys like traversing, tacheometric survey and curve setting levelling etc using latest instruments like theodolite, level etc. This also provides elementary excursuses using this knowledge for data generation, preparation of mine plans in the mining industry.

Unit – I

Theodolite: Various types; Principles of construction; Temporary and permanent adjustments; Measurement of horizontal angles; Tubular and trough compass.

Traversing: Theodolite traversing; Closing error and its adjustment; Calculation of coordinates; Problems in traverse surveying; Area of closed traverse; Omitted measurements and their calculations.

Unit – II

Tacheometric Surveying: Principles; Types of tacheometer; Additive and multiplying constants; Tangential tacheometry; Anallactic lens; General procedure for field work; Degree of accuracy.

Unit – III

Curve Ranging: Definition; Elements of curves; Degree of curvature; Different methods of setting out curves (apex accessible and apex inaccessible); Underground curve laying.

Unit – IV

Levelling: Shaft plumbing and measurement of depth of shaft; Subsidence survey; Underground levelling and grading, Giving and maintaining direction & gradient for inclined shaft, slopes, levels and tunnels; Maintaining alignment.

Contouring: Definitions; Characteristics of contours; Tacheometric Contouring - Fieldwork, Interpolation of contours; Plotting and interpretation of contours.

Practical

1. Constructional details of vernier theodolites & its temporary adjustments.
2. Measurement of horizontal angle with the help of vernier theodolite
3. Traversing of given area with the help of vernier theodolite and its plotting with co-ordinate method.
4. Constructional details of microptic theodolites & its temporary adjustments
5. Measurement of horizontal angle with the help of microptic theodolite
6. Traversing of given area with the help of microptic theodolite and its plotting with co-ordinate method
7. Determination of tacheometric constants.
8. Determine the height of inaccessible points, distance between two inaccessible points with tacheometer.
9. Exercise on tacheometric contouring and plotting of contour map for flat area.
10. Exercise on tacheometric contouring and plotting of contour map for hilly area
11. To prepare topographic map by co-ordinate plotting of given area at a scale of 1:1000, 1:2000 as per mining regulation.
12. G.T. sheet and its application.
13. Elements of a curve and design a curve for underground roadways meeting at an angle of 90, 120,150 degree etc.
14. Use of theodolite in maintaining the gradient of drivage, laying of drainage system
15. Transferring of T. I. points level to B. M.

Text Books/References

1. Dr. B. C. Punmia, Surveying Vol. I & II, Pub: Laxmi Publication New-Delhi
2. T. P. Kanetkar, Surveying & Levelling, Vol I & II, Geeta book store Dhanbad.
3. Mc Adam; “Colliery Surveying”
4. Holland; Surveying Vol. I & II

MI 247 (PCC) ROCK MECHANICS-I

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Study various aspects of rock properties, fundamentals of stress and strain, ground control problems in underground and opencast mines with a better understandings of scope for application of various numerical methods.

Unit -I

Status of Rock Mechanics: Role and status of rock mechanics in mining engineering; Definitions & terms used in Rock Mechanics.

Stresses and Strains: Stresses in two and three dimensions; Stress tensors; Principal stresses; Stress invariants; Displacements and strains; Stress- Strain relations; Equilibrium and compatibility equations.

Unit -II

Geological Investigation of Rock mass: Classification, identification and survey of joints; Basic geological description of rock mass; Graphical representation of joint systems; Geophysical investigation of rock mass; Rock mass classification- RQD, RSR, RMR, Q-system

Physical Properties & Rock Indices: Specific gravity, hardness, porosity, moisture content, permeability, swell index, slake durability, thermal conductivity, point load strength index, protodyakonov strength index, impact strength index.

Unit -III

Mechanical Properties of Rocks: Compressive, tensile and shear strengths; Modulus of elasticity; Poisson's ratio and tri-axial strength; Field and laboratory determination.

Determination of in-situ strength and in situ stresses – methods and instrumentation.

Unit -IV

Theories of rock failure. Elastic and time dependent properties of rocks, Dynamic properties, Post-failure phenomenon;

Soil Mechanics: Classification of soils; Strength, consolidation and seepage of soils; Stability of waste dumps, factors affecting, monitoring and control measures.

Practical

1. Preparation of core samples as per ISRM standards.
2. Determination of compressive strength and point load index of given rock samples.
3. Measurement of Schmidt rebound hardness and its application.
4. Determination of slake durability index of given rock samples.
5. Determination of elastic properties of given rock samples.
6. Determination of tensile strength of given rock samples of by Brazilian test
7. Determination of shear strength and triaxial properties of rock
8. Measurement of core recovery and RQD from the various data collected.
9. Determination of RMR of given field data
10. Determination of Protodykonov index of given rocks
11. Determination of impact strength index
12. Determination of Schmidt hammer rebound number of various rocks.
13. Determination of moisture contents of various rocks.
14. Measurement of insitu stress with Flatjack
15. Determination of triaxial properties of various compositions of spoil dumps.

Text Books/References

1. Obert & Duall, Rock Mechanics and design of structures in rock. Pub: John Willey & Sons
2. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company
3. B.S. Verma, Elements of Mechanics of Mining Ground. Pub. Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
4. Vutukuri & lama, Handbook of Mechanical properties of rock Vol.I&II. Pub: Transtech, Germany
5. Syd.S.Peng, Coal Mine Ground Control. Pub: John Willey & Sons
6. J.C. Jeager & NGW Cook, Fundamentals of Rock Mechanics. Pub: Chapman & hall, Londaon
7. Charles Jaeger, Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London
8. J.Hudson and Harrison, Introduction to rock mechanics, Pub: Elsevier Science Ltd

MI 248 (PCC) MINE COMPUTING LABORATORY –I

Cr.Hrs. 1 (0+0+1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**2**

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

Understand various computer basic and relevant preparation in further applications in mining such as ore body modeling and reserve estimation of mining deposits. It also aimed to learn the basics and applicability about various mining software language and to inculcate the skill for small mining application software**.**

Practical

1. Exercises related to Word processing: MS Word and Preparation of technical report.
2. Exercises related to Word processing: MS Excel.
3. Exercises related to Word processing: Powerpoint.
4. Exercises related to Acrobat reader.
5. Introduction to software packages related to mining.
6. Introduction to Datamine software.
7. Introduction to ore body modeling with Datamine software.

Practical based on 'C' language:

8. Programs related to calculate explosive quantity and powder factor.
9. Program to determine distances and reduced levels of various points in tacheometry.
10. Program to determine co-ordinates of surface mine survey.
11. Program related to calculation of area of closed traverse.
12. Program to calculate bucket capacity of a excavator for given production parameters.
13. Program based on drill parameters: rate of penetration, drilling rate etc.
14. Program related to contouring.
15. Program related to trigonometry.

MI 351 (PCC) MINE VENTILATION

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Understand the ventilation requirements for ground mines including knowledge about gases, heat, humidity and flow of air, selection of mine fans, ventilation planning, ventilation surveying etc. For any underground mine, ventilation officer is a statutory post as per Indian Mining Law. This course facilitates the required knowledge to perform the duties of ventilation planning effectively.

Unit - I

Mine Gases: Occurrence, properties, detection, measurement and monitoring; Methane layering; Methane drainage.

Heat and Humidity: Heat load Sources and thermal environment, Effect and control of heat and humidity in mines; Conditions of comfort; Cooling power of mine air; Air conditioning.

Unit - II

Air Flow in Mine Workings: Standards of ventilation; Reynold's number; Laminar and turbulent flow; Pressure losses due to friction and shock resistances; Pressure across the mine; Equivalent orifice of the mine; Resistances in series and parallel; Air quantity requirements; Leakages; Homotropal and Antitropal ventilation; Central and boundary ventilation. Network analysis.

Unit - III

Natural Ventilation: Mechanism; Estimation and measurement of natural ventilation pressure; Characteristic curves.

Mechanical Ventilation: Centrifugal and axial flow fans- Construction, pressure developed, characteristic curves, series and parallel operations; Installation and testing; Forcing and exhaust ventilation; Fan drifts and evasees; Reversal of air flow.

Auxiliary Ventilation: Longitudinal air curtains and brattices; Forcing, exhausting and forcing cum exhausting ventilation systems; Dust

extraction; Auxiliary fans- Types, construction, characteristics, location and installation; Air ducts; Risk of re-circulation.

Unit - IV

Ventilation Devices: Stopping, doors, air locks, air crossings and regulators; Regulators and boosters for the regulation of air flow- Construction, location and installation and their effect on the air flow in the panel and the entire mine; Risk of re-circulation; Controlled re-circulation for ventilating extensive mine workings.

Ventilation Survey: Purpose, instruments, procedure, tabulation and calculation, Preparation and interpretation of ventilation plans, ventilation planning, ventilation network.

Practical

1. Different gases found in coalmines, metal mines and their permitted limits as per the mining regulations. Effect of these gases when found in excess.
2. Various types of Methanometers used in mines and their selection criteria.
3. Various types of CO-detectors used in mines and their selection criteria
4. Measurement of relative humidity with the help of various types of hygrometer.
5. To find the effect of heat, humidity and air velocity with the help of Kata-thermometer.
6. Various air circuits with resistance in series and parallel.
7. Calculation for the installation of main ventilation fan and its reversal arrangement.
8. Design the evasee of ventilation fan in different working conditions.
9. Designing auxiliary ventilation system and their comparative performance.
10. Measurement of air velocity with the help of anemometer, velometer etc, measurement of temperature, pressure etc.
11. To prepare complete ventilation plan and indicating air direction and other ventilation devices as per the regulation in various colour codes.
12. Air conditioning problem.
13. Ventilation survey problem.
14. Auxiliary fan problem.
15. Networking problems

Text Books/References

1. G.B. Mishra, Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. L.C. Kaku, Numerical Problems on Mine Ventilation. Pub: Punam Publisher
3. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
4. Mutmansky & Weng, Mine ventilation & Air conditioning. Pub: John Willey & Sons
5. Prof. S. P. Banerjee; "Mine Ventilation" Lovely Prakashan, Dhanbad.

MI 352 (PCC) SURFACE MINING

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Understanding of various techniques of surface mining including operation and maintenance of associated machinery as outcome of this course. Also the students will learn about the advanced drilling and blasting operations in surface mining. Acquire knowledge of lighting, drainage and placer mining methods.

Unit - I

Applicability: Applicability and limitations of surface mining.

Basic Parameters: Size of mine area ; Pit depth; Annual production and life of mine; Bench height, width and slope, Pit slope; Cut-off grade; Stripping ratio.

Opening of Benches: Opening of deposits-Trench, Ramp; Width and slope of entry trenches; Driving of entry and opening trenches; Formation of benches.

Unit - II

Overburden Removal: Systems of overburden removal and disposal; Overcasting, haulage and combination methods.

Layouts: Basic layouts for flat, horizontal, inclined and steep deposits; Strip mining layouts; Layout for hilly deposits. Management of layouts (Pushback operation for rearrangement of existing layouts).

Unit – III

Blast hole drilling: Drilling concepts - Operation and performance, Selection of Drills; Control of dust.

Blasting: Choice of explosive; Blast round design - Hole diameter and length; Burden, spacing, sub-grade and stemming length; Column charge configuration, Mode and points of initiation; Sequence of blasting and delay interval; Blast hole deviation, Inclined hole blasting; Fragmentation monitoring; Blast design for casting; Secondary blasting; Blasting hazards - noise, ground vibration, fly rock, dust & air over pressure and their remedial measures.

Unit - IV

Optimization of shovel: Sumper combination; Computerized truck dispatch system; Stock piling and blending; Haul road design, construction and safety measures.

Special Mining Situations: Mining over old underground workings; Placer mining: hydraulicking, dredging, dump leaching; Deep sea mining. Steep angle conveyor, high angle conveyor, in pit crushing and conveying, highwall mining.

Lighting: Various lighting arrangements.

Drainage: Assessment of water make; Drains, sumps and pumping systems; Pre-drainage through diversion channels and boreholes.

Practical

1. Designing an approach road/ramp to open a deposit by surface mining.
2. Various techniques used in over cast from cost benefit point of view.
3. Designing various layouts for hilly deposits of vein and bedded forms.
4 Designing various types of layouts for deposits below the general ground level.
5 Designing of various types of layouts for placer deposits.
6 Designing a deposit by opencast mining, which has been partially excavated by underground mining.
7 Performance and choice of drilling equipment in surface mine working.

8 Designing the blast hole charging, taking into consideration various parameters.

9 Measurement of blasting vibrations with Blastmate series III equipment and its analysis.

10 Prediction of nuisances due to blasting and their controlling measures.

11 Design problem for opencast mine-Coal

12 Design problem for opencast mine-Lime stone

13 Blending problem solution for rock phosphate

14 Optimization of shovel dumper combination.

15 Open cast drainage problems.

Text Books/References

1. Dr. G.B. Mishra, Surface Mining Pub: Dhanbad Publisher, Dhanbad..
2. Howard, L. Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
3. Surface Mining Handbook.
4. Dr. Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A. Balkema Publisher Old post Road, Brook field, VTO5036, USA.

MI 353 (PCC) UNDERGROUND COAL MINING

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Understand various coal mining methods and stowing arrangement. Take challenge of producing coal on vary difficult geomining conditions at deeper horizons with special emphasis on the latest experimental trails conducted in Indian coalfield. Also the students will learn about the advanced mining methods of coal mining.

Unit - I

Stratified deposits-their origin and distribution; Characteristic of roofs, floors and associated rocks.

Factors influencing choice of methods; Classification of mining systems-their relative merits and application.

Global and Indian Status: Global and Indian status of different under ground coal mining methods. Trend of change in technology of mining coal vis-vis demand.

Filling Arrangements: Fill materials; Methods of filling- Gravity, pneumatic, mechanical and hydraulic; Procurement of fill material on surface; Transport to bunker; Transport to face area; Filling installations and operations in face area.

Unit - II

Division of mine area: District and level system, concept of uni and bi-lateral panels, order of extraction, size of panel.

Bord and Pillar Method: Development - different methods and layout using LHD, SDL, Mechanical loader with shuttle car; Cutting, drilling, blasting, loading and transportation; Support, ventilation, drainage and lighting, manpower; Depillaring - different methods and layout; Simultaneous development and depillaring; Mechanised B&P development and depillaring by continuous miner.

Unit - III

Long wall Method: Advancing and retreating methods - Length of face and daily advance, Size of panel, Development of panel with multi-heading and single heading gates; Extraction of panel - by drilling, blasting & loading and by Continuous mining; Support; Ventilation, drainage, lighting and signaling in extraction.

Room & pillar, Shortwall, comparison amongst B&P, Longwall, R & P and Shortwall mining methods.

Unit - IV

Hydraulic Mining: The concept; Layout of workings on district and level systems; Winning of panels; Pillar methods (square pillars, rectangular pillars and long pillars)

In-situ Gasification: The concept and chemistry; Methods- using underground excavations, and using vertical or directionally drilled boreholes from surface;

Mining of coal under difficult Situations: Steeply inclined seams; Thin seams, Thick seams, Contiguous seams, seams prone to outburst and bumps; Horizon Mining; Blasting gallery method, Sublevel and integral caving method.

Mining of seams prone to fire and spontaneous combustion, Mining of seams in the vicinity of water bodies and structures.

Practical

1. General outline of Indian coal sector, with location, organization, production, problem related details.
2. Bord and pillar method of mining with caving technique.
3. Bord and pillar method of mining with stowing technique.
4. Various layouts of longwall advancing method and its suitability in Indian conditions
5. Designing longwall retreating method for a coal seam of thickness 2.4m and dipping at 1in 15.
6. Application of powered support in longwall mining.
7. Blasting gallery technique for excavation of coal deposits.
8. Various filling materials and their comparative properties and application.
9. Sand collection techniques at the river sides.
10. U/g Gasification of coal
11. Exercise on simultaneous development and depillaring.
12. Various depillaring techniques
13. Problems of Thick seam mining.
14. Problems of horizon mining.
15. Problems of hydraulic mining.

Text Books/References

1. R.D. Singh, Principles & Practices of Modern Coal Mining Pub:- New Age International Pvt.Ltd. New Delhi
2. T.N. Singh, Underground winning of coal. Pub: Oxford & IBH, New Delhi
3. Singh & Dhar, Thick Seam Mining, Pub: : Oxford & IBH, New-Delhi

4. Samir Kumar Das, Modern coal mining. Geeta book store, Dhanbad.
5. Prof. J. G. Singh; “Underground Coal Mining Method” Braj-Kalp Publisher, Varansi
6. William A. Hustrulid, Rechard Bullock; “Underground Mining Methods” SME Publication
7. MSHA; “Underground Coal Mine Blasting” ISEE Publication Cleveland, Ohio

MI 354 (PCC) COMPUTER APPLICATION IN MINING

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Understand various computer applications in mining such as ore body modeling and reserve estimation of mining deposits based on exploration data, open pit designing, underground designing, operational simulation, empirical method, Logical flow diagram for different mining activities.

Unit – I

Importance of computer application in mining, Different areas of application. Introduction to Computers and hardware for application in mining industry. Programming with ‘C’ computer language for mining related problems.

Unit - II

Basic Introduction for application of Computers in areas of:

Exploration: Data generation, collection and analysis through computers for exploration and reserve estimation

Surface Mining: Bench geometry design, Haul road design, Drainage, Waste dump design and monitoring.

Mine Planning & Design: Introduction of mine planning concept through mining software. Introduction to numerical methods in Mining.

Unit - III

Basic Introduction for application of Computers in areas of:

Environmental Engineering: Basic concept of data generation, collection and analysis through computers for environment management. Relevant software application

Mine Surveying: Introduction to mapping, Estimation of area and volume, Preparation of plans & sections, Tonnage/ Volume calculation for contractual billing and relevant software application.

Project Monitoring: Systems & tools of monitoring of different mining operations, data collection, analysis and online monitoring. Inventory control and management.

Unit - IV

Mining Software:

Mine Planning Software: Basic introduction, salient features, planning by different mining software like DATAMINE, SURPAC

Software for various applications: Basic introduction, salient features and application of software like BLASTWARE, FRAGLYST, GALENA, FLAC/ FLAC3D, VENT.

Application of artificial neural network (ANN) in solving Mining problems, HEMM Simulators, Application of Artificial Intelligence and Automation in mining.

The detailed Syllabi of the subject will be announced at the beginning of the session every year, in light of the continuous changing nature of the subject and its application in the mining industry.

Practical

1. Computer programming for mining problem with C/C++.
2. Introduction to different hardware application related to mining.
3. Introduction to Mine planning by DATAMINE
4. Introduction to Mine planning SURPAC
5. Introduction to BLASTWARE software.
6. Calculation of production tonnage of an opencast mine for contractual billing with Total station & Datamine
7. Introduction of "VENT" software of simulation of ventilation network of a mine.
8. Introduction to "FRAGLYST 2.0" software.

9. Introduction to "BIMPS" software.
10. Introduction to “Pattern Analyser” software.
11. Introduction to “Flyrock Predictor” software.
12. Introduction to "FLAC/ FLAC 3D software
13. Introduction to “N-Fold” software.
14. Introduction to “GALENA” software related to slope stability.
15. Introduction to “Solid works” software

Text Books/References

1. Sukumar Bandopadhyay; “Application of the Computers and Operation Research in the Mineral Industry” Proceedings of the 30th international Symposium SME Publication 2002
2. Manuals of different softwares

MI 355 (PCC) MINE SURVEYING – II

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Acquire sufficient knowledge on conducting mine surveys using latest instruments and this also provides elementary excursuses using total station, GPS, GIS, data generation, preparation of mine plans in the mining industry. Also the students will learn about the advanced knowledge about co-relation, stope surveying triangulation in mining.

Unit - I

Correlation: Methods of correlation of surface and underground surveys - Through mine openings; Correlation by magnetic needle; Precautions and accuracy.

Surveying for tunnels and open pits.

Unit - II

Triangulation Surveying: Definition; Reconnaissance; Selection of signals and stations; Triangulation system with primary, secondary and tertiary orders; Measurement of base line and angles; Booking of observations; Auxiliary stations; Satellite stations; Computation; Calculation of coordinates; Errors and their distribution and plotting.

Unit - III

Stope and face surveying: Theodolite in stope surveying; Tape triangulation; Traversing; Radiation and other methods.

Plans and Sections: Legal requirements as to mine plans in India and symbols used; Preparation and preservation of plans and section; Enlargement of plans; Use of ediograph, pantograph and planimeter.

Errors: Sources, classification, propagation and growth; Treatment of non-systematic errors by the method of least squares; Probable errors; Most probable value; Probable error and weight; Limits of errors in drift surveys.

Unit - IV

Photogrammetry and Aerial Surveying: Terrestrial photogrammetry; Photo-theodolite & its construction; Method of field work and plotting from horizontal photographs with determination of elevations; Elementary perspective as applied to aerial photographic surveying.

Field Astronomy: Important definitions; Determination of Azimuth by observation of star and Gyroscope

Application of laser in surveying: Electronic distance measuring equipment: Total station, GPS, DGPS, 3D Laser Scanner, Application of drone in mining.

Practical

1. Various methods of correlation and its practical applicability assuming the underground mining conditions.
2. Gyroscope and its use in correlation.
3. Measurement of Base-line for triangulation survey in difficult ground conditions.
4. Triangulation of a hilly terrain.
5. Various stope surveying methods.
6. Planimeter and calculation of areas with its help.
7. Determination of elevation from aerial photographs.

8. Determination of azimuth by observation star at equal altitude.
9. Problems on dip-strike, bore-hole, faults & drifts.
10. Exercise with the help of EDM, Total station.
11. Exercise with the help of GPS, and other latest instruments
12. Exercise of triangulation in flat & large area.
13. Study and problem with Pentograph.
14. Preparation and preservation of plans
15. Problems related to errors.

Text Books/References

1. Dr.B.C.Punmia, Surveying Vol. I,II & III, Pub: Laxmi Publication New-Delhi
2. Kanetkar, Surveying & Levelling, Vol I & II, Geeta book store Dhanbad.
3. D.K. Jain, Mine Surveyors Competency Examination, Geeta book store, Dhanbad.
4. Winiberg, Metalliferous Mine Surveying

MI 361 (PCC) UNDERGROUND MINE ENVIRONMENT

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Acquire knowledge on various issues of mine environmental engineering including assessment and control of hazard due to mine fires, inundations, mine dust etc and can be able to apply the concepts of hazards and control measures in the world mining**.**

Unit -I

Fires: Classification of fires; Causes, detection, monitoring and control of surface and underground fires; Preventive measures; Fire fighting and inertization; Monitoring of atmosphere behind sealed- off areas; Reopening of sealed- off areas; Case histories.

Spontaneous Heating: Mechanism, causes, detection, monitoring and control of spontaneous heating in underground mines, on surface and in coal stacks and dumps; Incubation period; Preventive measures.

Unit -II

Explosions: Types, causes and mechanism of firedamp and coal dust explosions; Preventive measures; Water spraying - Stone dusting, stone-dust and water barriers; Investigations after an explosion; Case histories.

Unit -III

Mine Rescue and Recovery work: Different types of rescue equipment; Test on rescue apparatus; Rescue stations; Recovery and first-aid appliances; Training of personnel and organization of rescue station; Rescue and recovery work in connection with mine fire, explosions and other conditions. Safety chamber

Unit -IV

Mine Inundation: Causes; Precautionary measures; Precautions to be taken while approaching old workings; Burnside boring apparatus;

Design and construction of water dams; Recovery of flooded mines; Dewatering of old working; Water blast: dangers and precautions.

Mine Illumination system: Flame safety lamps and electric lamps; Construction, examination, testing and maintenance; Underground lighting from mains; Illumination survey; Conventional and photographic methods. Recent advances in Mining cap lamp

Practical

1. Monitoring of sealed off areas and goaf fires.
2. Soda ash fire extinguishers and its application
3. Co_2 snow fire extinguishers and its application
4. Dry chemical fire extinguishers and its application
5. Reasons of spontaneous heating, its preventive measures in underground and at surface.
6. Designing of stone dust barrier & water barrier in underground mines
7. Exercise with self contained breathing apparatus
8. Exercise with Filter type breathing apparatus
9. Designing of rescue stations for different conditions
10. Exercise on resuscitation.
11. Design of water dams with their locations in mines.
12. Burnside boring apparatus and its application.
13. Mechanism of coal dust explosions
14. Mechanism of firedamp
15. Water blast: dangers and precautions

Text Books/References

1. G.B. Mishra, Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. Donald Mitchell; “Mine Fires, Prevention, Detection fighting” ISEE Publication Cleveland, Ohio
3. Ramlu M. R.; “Mine Fires, Explosion, Recovery & Inundation”, Dhanbad Publisher, Dhanbad
4. David Stone; “Minefill 2001” Proceedings of the International Symposium on Mining with Backfill” SME Publication 2001

MI 362 (PCC) DIMENSIONAL STONE TECHNOLOGY

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Acquire knowledge to excavate blocks of marble, granite, sandstone etc. Students get a benefit of detailed understanding of various techniques of dimensional stone mining including diamond wire saw, blind cut technique etc. Also get the benefit of processing techniques such as gang saws, automatic tiling plant, multiwire machine for slab making etc. and environmental impact due to mining and processing activities.

Unit -I

Resources of Marble, Granite, Slate, Sandstone and Limestone as Dimensional stones in India vis a vis world, uses, marketing, export.

Geological, mineralogical and physico-mechanical properties of dimensional stones; Criteria for selection of dimensional stone deposit. Procedure for obtaining mining lease and preparation of project proposal.

Unit -II

Mining: Conventional mining of Sandstone, Limestone, Marble and Granite; Recent developments- wire saw including blind cut technique, chainsaw, belt saw, hydraulic splitting, flame jet cutting, water channeling etc; Blasting techniques in dimensional stone mines: various types of explosives used, controlled blasting for providing horizontal & vertical cut; Splitting by swelling material.

Unit -III

Insitu splitting technique used in compact limestone (Kota stone) for utilization of waste as dimensional stone. Various types of loaders, cranes and hydraulic excavator used in dimensional stone mines; Quarry layouts. Hole making technique using hole-finder and laser beam. Application and development of diamond tools, formation of stone block and their handling.

Unit -IV

Processing: Dressing- Mono block dresser; Sawing- gang saws, circular saws; Preparation and mounting of blades/discs and segments;

slab repair by resin Polishing - Manual, Mechanical; Various types of polishing machines; Abrasives- type, use and selection, shaping; Tile preparation; Automatic tiling plant, slurry handling and treatment including water supply; Multiwire technology.

Environmental impacts of mining and processing of dimensional stones; Secondary use of quarried land and waste of the industry; Land reclamation.

Practical

1. Marble & Granite deposits, types and potentials: Indian and Global scenario
2. Flowsheet of marble processing plant.
3. Determination of physico-mechanical properties of various marbles and granites.
4. Wire saw, Chain saw & and Belt saw its operational observation at nearby mines.
5. Various methods of splitting of rock and its application.
6. Gang saw and its operations for determination of rate of cutting for various dimensional stone.
7. Various types of cranes used in dimensional stone mining and processing & their applicability
8. Various abrasives used in dimensional stone processing and their application.
9. Jet flame technique for granite mining & observation in nearby industry.
10. Blind cut and its comparison to other method.
11. Design a mechanised marble quarry in hilly terrain for 200m X 200m lease area.
12. Design a mechanized granite quarry for flat terrain deposit in a 9 hectares lease area.
13. Design a mechanized flaggy lime stone (Kota stone) quarry for flat deposit of 150m X 150m lease area.
14. Impact of various types of diamond beads in wire saw operation
15. Impact of various types of diamond segment in gang saw operation

Text Books/References

1. Rathore S. S., Bhardwaj G. S., Jain S. C; "Dimensional Stone Technology" Himanshu Publication New Delhi
2. Rathore S. S., Laxminarayana V.; "Safety and Technology in Marble Mining and Processing in New Millennium" Proc. Of National Workshop held March 10-11 200 Udaipur
3. Rathore S. S., Gupta Y. C., Parmar R. L.; "Recent Development in Machinery and Equipment for Dimensional Stone Mining" held Dec. 13-14, 2003 at Udaipur.
4. India Stones, Business Magazine on Indian Stone Industry, Pub. ICONZ Communications, 203, Mahaveer Residency, 15 Main J. P. Nagar, 5th phase, Bangalore

MI 363 (PCC) UNDERGROUND METALLIFEROUS MINING

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Develop opportunity to learn almost all the variants of 'underground Metal Mining Technologies which can help in selection of suitable metal mining technologies vis-à-vis Geological condition of the deposit in the field / Mining industry.

Unit – I

Metalliferous Mining in India and World: Historical development; Trend of mining non-coal deposit in India during the last ten years; Geographical distribution of important economic non-coal mineral in India.

Overview of various stoping Methods: Factors influencing selection of stoping methods; Classification of different stoping methods. Stope layouts and stope preparation work for different stoping methods.

Unit - II

Open stoping methods: Stull mining; Breast stoping; Room and Pillar; Sub-level; Shrinkage; Blast hole; VCR stoping and their variations.

Unit - III

Supported stoping methods: Post pillar; Cut and fill and their variations; Square set; Different types of support used.

Unit - IV

Caving stoping methods: Top slicing; Sub-level caving; Block caving and their variations.

Stoping of superimposed veins and parallel ore bodies; Combined methods; Extraction of underground pillar.

Special method of mining for deep deposit and difficult mining conditions. Ore mining by Leaching.

Practical

1. Various terms, factors influencing selection of method of work and classification of underground methods.
2. Designing sub-level stoping for an ore body width varying 10-15 mts.
3. Application of blast hole stoping and its comparison with sub-level open stoping.
4. Cut and fill methods used in different Indian deposits.
5. Application of Vertical crater retreat method of mining in moderate strength of wall rocks.
6. Sub-level caving and block caving methods for deeper deposits.
7. Square-set stoping for excavation of manganese ore deposit.
8. Application of leaching technique in ore mining.
9. Stoping techniques used in excavation of gold deposit at deeper depth.
10. Designing an under ground metalliferous mine on given geological physico-mechanical properties of rock.
11. Design of Post pillar method
12. Design of Shrinkage method.
13. Problem for mining for greater depth.
14. Design of block caving.
15. Design Sub level top slicing

Text Books/References

1. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
2. Cummins & Givens, SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. New-York
3. Ramlu et al, Computer in mineral industry. Pub: Oxford & IBH, New-Delhi
4. W.A. Hustrulid, Underground mining methods handbook, Pub: Society of mining engineers of the American Institute of Mining Metallurgical and Petroleum Engineers, Inc. New-York

MI 364 (PCC) MINE MACHINERY – II

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Learn the latest trends in mine mechanization including transportation arrangements in mines, principal types and their operations and also various types of haulage and transport used in mining industry. Understand mechanism of aerial ropeway and various layouts for mineral handling.

Unit – I

Winding: Winding system-Drum & friction winding ; Mechanical and electrical braking; Ward Leonard control; Automatic winding; Winding drums- types, their construction and duty cycles; Detaching hooks, cages, skips, suspension gear, rigid and rope guides; Methods of counterbalancing loads; Multi rope winding, Winding from different horizons. Shaft fittings and head gear design.

Design calculation for different types of winding systems; Safety devices- depth indicators, over speed and overwind preventors, keps, slow banking and other safety devices.

Unit - II

Transport: Track and trackless; Mine cars; Haulage track-its laying and maintenance; Gauge selection; Mine tubs and cars-their constructional details and attachment. Low profile dumpers and shuttle cars, their construction, operation and maintenance.

Rope Haulage: Different types- their construction, operation, maintenance and design calculations. Slushers, scrapers etc.

Unit - III

Mine Locomotives: Diesel, battery and electric trolley wire types- their construction, operation and application; Calculations for locomotive haulage; Man riding systems in underground mines; Mono rails; Underground loco shed layout.

Conveyor Haulage: Different types, their construction, installation, maintenance and design calculations; Steep angle belt conveyor, Armoured face conveyor.

Unit - IV

Aerial Ropeway: Different types, their construction, installation, operation and maintenance, their layouts including rope tensioning arrangement; Loading, unloading and angle stations.

Mineral Handling: Layouts of pit-top and pit-bottom; Details of banking; Mineral handling and screening equipment; Creepers; Tipplers; Layouts of railway siding of mines; Storage bunker. Pit bottom installations and circuit with cage and skip systems.

Practical

1. Process of changing of winding rope and its requirement as per regulation.
2. Designing direct rope haulage system in moderately dipping coal seam.
3. Endless rope haulage and its designing aspects.
4. Application of Mono cable and Bi-cable rope way & its designing parameters.
5. Diesel locomotives and comparative application.
6. Battery locomotives and comparative application.
7. Trolley wire locomotives and comparative application.
8. Suspension gear arrangement of the shaft.
9. Different types of winding system and their comparative application.

10. Application of various types of detaching hooks.
11. Various types of guides in winding.
12. Belt conveyors with their design parameters used in mines.
13. Pit-top layout with shaft for handling 3000 tonnes production per day.
14. Designing of various pit-bottom layouts.
15. Application of creeper and tippler in mineral handling.

Text Books/References

1. M.A. Ramlu, Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
2. Kerelin, Mine Transport. Pub:- Orient Longmans Ltd. New Delhi.

MI 365 (PCC) MINE MANAGEMENT

Cr.Hrs. 4 (3+1+0)

	L	T	P
Credit	**3**	**1**	**0**
Hours	**3**	**1**	**0**

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

Understand the market dynamics namely, demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures. Also, Gain an insight into how production functions are carried out to achieve least cost combination of inputs and cost analysis. Students will be able to solve or optimize the system through understanding of network analysis and project monitoring.

Unit – I

Management: Principles of Scientific Management; Organization, Planning and control. Forms of Business Organization: Private and public enterprises with special reference to mining of minerals. Basic Principles of Trade unionism, Trade union activities w.r.t. mining in India, Major trade union bodies.

Disputes: Types of disputes between contractors and owners, between workers and owners; Methods of avoiding and resolving disputes.

Unit – II

Network Analysis: CPM, PERT and Work scheduling.

Work Study: Time and motion study; Methods of improving productivity; Improving working environment, welfare measures, incentives and penalties.

Unit – III

Inventory: Systems of inventory control; Methods of minimizing inventory.

Purchasing and Tendering: Purchase procedures in public sector; Preparation of tender documents; Tender completion formalities; Consideration of bids and finalization of purchase order.

Project Monitoring: Monitoring techniques; Management Information Systems (MIS).

Unit – IV

System Engineering: Concept of reliability; Reliability of simple system; Maintainability and availability, linear programming, transportation and assignment problems; Inventory models; Queuing theory; Basics of simulation.

Text Books/References

1. Banga & Sharma: Engineering Economics and Industrial Organisation. Pub: Khana Publishers, New-Delhi
2. V.L. Mote, Samuel Paul and G.S. Gupta. Managerial Economics, Concepts and Cases.
3. Memoria & Agarwal, Industrial Organisation, Pub: M/S jain Brothers, Delhi.
4 Khana, O.P., A text book of Work Study. Pub: M/S Dhanpatrai & Sons, Delhi.
5. Jain, S.P. Industrial & Labour laws. Pub: M/s Dhanpatrai & Sons, Delhi

MI 366 (PCC) ROCK MECHANICS - II

Cr.Hrs. 4 (3+0+1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

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

Study various aspects of ground control problems in underground and opencast mines with a better understandings of subsidence, slope, rock burst and caving in the mine. Also provide understanding of deformation and its measurement. Also provide model studies in geomechanics

Unit – I

Stress State: Stress distribution around narrow and wide openings (single and multiple).

Rock reinforcement: Introduction to local and mass support system, Design of support systems in shafts, systematic supports in headings, junctions, depillaring areas, gates, long wall faces and stopes; bolting; Shot-creating & guniting. Cable bolting, filling & pillar as mass support system, pressure on supports.

Unit – II

Deformation and related instrumentation: Measurement of rock movements and interpretation of data; Load cells, convergence recorders, bore hole extensometers and borehole cameras.

Insitu and induced stresses and their measurement. Basics of numerical methods in geomechanics with applications.

Unit – III

Subsidence: Mechanics of surface subsidence; Factors affecting subsidence; Sub-critical, critical and super-critical widths of extraction; Discontinuous and continuous subsidence; monitoring, prediction, control and management of subsidence.

Rock Bursts: Rock bursts and bumps; Mechanism of occurrence, prediction and control.

Design of shaft pillar, Tunnels and Caverns.

Unit – IV

Caving: Mechanics of caving; Cavability of rocks; Caving height

Slopes: Types of slope failure; Analysis of slope failure; Factors affecting slope stability; Drainage and reinforcement of slopes; Monitoring of slopes, Slope stability radar.

Practical

1. Bore hole extensometer and measurement of displacement with its help.
2. Measurement of strain by tape extensometer.
3. Load cell and measurement of convergence.
4. Flat jack method and measurement of insitu stress.
5. Determination of ground vibrations with seismograph, and its effect on designing slopes.

6. Factors influencing the stability of slope. Design for maintaining of slope in adverse conditions.
7. Mechanics of caving in metalliferous mine.
8. Mechanism of subsidence and factors influencing it.
9. Mechanism of rock burst and bumps and factors influencing it
10. Design of shaft pillar in hard and soft strata conditions.
11. Shotcreting method of support - principle, application etc.
12. Design of support system.
13. Application of cable bolting
14. Application of numerical methods in geomechanics
15. Study of Slope Stability Radar

Text Books/References

1. Obert & Duall, Rock Mechanics and design of structures in rock. Pub: John Willey & Sons.
2. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company.
3. B.S. Verma, Elements of Mechanics of Mining Ground. Pub. Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
4. Vutukuri & lama, Handbook of Mechanical properties of rock Vol.I&II. Pub: Transtech, Germany.
5. S.S.Peng, Coal Mine Ground Control. Pub: John Willey & Sons.
6. J.C. Jeager & NGW Cook, Fundamentals of Rock Mechanics. Pub: Chapman & hall, London.
7. Charles Jaeger, Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London.
8. B. Singh, Mine Subsidence.
9. Z.T. Bieniawski, Rock Mechanics Design in Mining and Tunneling, Pub: A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands.
10. Hoek E. and Brown, E.T. Underground excavations in Rock, Institutions of Mining and Metallurgy, London.
11. Brown, E.T., Rock characterization, testing and monitoring – ISRM suggested method, Pergamon Press, Oxford.
12. William A. Hustrulid (Editor), Slope Stability in Surface Mining.
13. Hoek and Bray, Rock slope Engineering, Taylor & Francis.

MI 471 (PCC) MINE LEGISLATION AND SAFETY

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Learn state and central laws related to mining. This course gives an opportunity for the students to understand the statutory requirement for coal/metal mining by opencast/underground methods. Also Student will be able to work better as safety officials in mining projects with detailed knowledge in safety management, accident approaches.

Unit – I

General Principles of Mining Laws. Post Independence trend of changes.

Principal provisions of the Mines and Minerals (Development and Regulation) Act 2015; Mineral Concession Rules 1960; Mineral Concession and Development Rules 1988; New Mineral Policy 2019.

Unit – II

The Mines Act 1952 with upto date amendments.

The Mines Rules 1955 with upto date amendments.

Coal Mines Regulation 2017 with upto date amendments.

Metalliferous Mines Regulations 1961 with upto date amendments.

Unit – III

Principal provisions of mines rescue rules 1985, pit head and bath rules, crèche rules, the mine vocational training rules 1966, explosive rules (related to mines); Indian Electricity rules 1956 applicable to mines and oil fields.

Principal provisions of industrial dispute Act, workmen's compensation Act, payment of wages Act and minimum wages Act.

Important technical circulars issued by DGMS.

Unit – IV

Accidents, Health and Safety: Classification of accidents- statistics causes, accident data analysis and prevention of accidents; Costs of accidents; Major accidents enquiry reports; Health of workmen and Comfort conditions; Occupational diseases-their causes, nature and prevention.

Signaling: Safety regulations and different signaling systems in mines.

Text Books/References

1. P.Seshagiri Rao, Law of Mines & Minerals. Pub: Asia Law House, Hyderabad.
2. Rakesh & Prasad, Legislation in Indian Mines Vol. I & II. Pub: Mrs. Asha Lata Varanasi
3. Classified Mine Circulars Issued by DGMS (Compiled)
4. Relevant Act, Rules and Regulations, Published by Govt. of India

MI 472 (PCC) MINE ECONOMICS AND FINANCIAL MANAGEMENT

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Understand various issues related to finance /Accounts starting from project planning stage presentation of account, balance sheet etc as outcome of the course. Also develop proficiency in financial analysis & cost analysis of a mining project.

Unit - I

Introduction: Economic importance of the mining industry; mining economy; risky nature of the mining industry; the state and the mining industry; Marketing and export of minerals; National mineral policy.

Loss of mineral in Mining: Classification and incorporation of losses, coefficient of recovery of mineral extraction; Dilution and recovery.

Unit - II

Mine examination and Valuation: Examination and report on mines/mineral properties; valuation of mines/mineral properties; present value and its computation; ore value and profitability of mining; recoverable value.

Cost of Mining: Capital and operating cost, factor affecting operating cost, method of estimating future costs; computation of cost of development and stoping operation.

UNIT - III

Financial Management: Finance function and objectives of a firm. Generally accepted accounting principles (GAAP); Scope of financial management.

Financial Statements: Nature and limitations of financial statements. Interpretation of financial statements. Uni-variate and multivariate ratio analysis. Limitation of ratio analysis.

Cost analysis: Various cost concept; Cost-Volume-Profit analysis; Break-even analysis; Cost indifference point. Decision making with the cost data. Cost and budgetary control.

Unit - IV

Financial Analysis: Revenue and mining costs; Taxes and royalties; Net Present Value (NPV); Internal Rate of Return (IRR); Effect of inflation on NPV of a project; Sensitivity analysis.

Capital-its importance, various forms, formation and processes of formation; Raising capital.

Mine accountancy and book keeping.

International investment and trade in mineral materials and products.

Text Books/References

1. Park, A text book of Mine Valuation.
2. W.A. Hustrulid, Underground Mining Methods Handbook.
3. Rendu, An Introduction to Geo-statistical Methods of Mineral Evaluation.
4. R.T. Deshmukh, Mine Economics.

MI 473 (PCC) MINERAL PROCESSING

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Get opportunity to know various techniques of mineral processing including theory, application and limitation. Understand the flow sheets of various metal ores, coal washing etc.

Unit - I

Scope, object and limitations of Mineral Dressing; Role of microscopic study.

Communition and Liberation: Theory and practice of crushing & grinding; Conventional units used-their fields of application and limitation.

Sizing and Classification: Laws of setting of solids in fluid; Laboratory methods of sizing and interpretation of sizing data; Industrial sizing by screens; Types of classifiers; Classification as means of sizing by screens.

Unit - II

Gravity concentration Methods: Jigging, Flowing film concentration like spirals and shaking table; Heavy Media separation: Theory, applications and limitations of each method; Introductory Froth Flotation, principles underlying flotation, reagents, flotation machines; Flotation of sulphides, oxides and non-metals.

Unit - III

Electrical Methods of Concentration: Electrostatic and magnetic methods, their principles of operation, fields of application and limitations.

Dewatering and drying: Thickening, filtration and drying.

Coal washing: Coal washability, crushing, sizing and cleaning of coal.

Unit - IV

Sampling: Importance and methods used in ore-dressing.

Simplified Flow Sheets: Beneficiation of coal and simple ores of copper, lead, zinc, Iron and manganese with reference to Indian deposits.

Practical

1. Jaw crushers and their comparison.
2. Roll crushers and their comparison.
3. Gyratory crushers and their comparison.
4. The ball mill and its application.
5. Various types of classifiers.
6. Determination of various sized product with sieve shaker.
7. Concept and apparatus of froth flotation.
8. Process of thickening & filtration.
9. Wilfrey table
10. Filter press
11. Laboratory jig.
12. Flowsheet of lead-zinc ore (Zawar).
13. Flowsheet of copper ore (Khetri).
14. Flowsheet of Gold, Iron ore, Manganese ore,
15. Flowsheet of coal washing.

Text Books/References

1. M.A. Gaudin, Principles of Mineral Dressing, Pub: Mcgraw-hill Inc
2. S.K.Jain, Mineral Processing, CBS Publishers & Distributors P Ltd.
3. D.V. Subba Rao, Mineral Processing, CRC Press.
4. H.G. Vijendra, Hand book on mineral dressing. Pub: Vikas Publishing House, 576, Masjid Road, Jangpura New-Delhi 110014

MI 474 (PCC)
ENVIRONMENTAL MANAGEMENT IN SURFACE MINES

Cr.Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Understand various issues related to environmental management of mines such as preparation of EIA and EMP, Mine closure planning, laws related to mine environment etc.

Unit - I

Man and Mine Environment: Changes of social environment caused by mining; Socio-economic factors; Occupational health hazards due to mine dust, poor lighting and ventilation, noise and vibration, trace elements, radioactive emission, Impact of surface subsidence.

Unit - II

Air and Water pollution: Sources, ill effects, measurement and monitoring, standards; Preventive and mitigating measures.

Dust in mines: Dangers, formation, prevention and suppression; Dust sampling apparatus, their construction and applications.

Noise and Vibration: Sources, ill effect, measurement and monitoring, standards; Preventive and mitigating measures.

Unit - III

Acid Mine Drainage: Sources, mechanism of formation and ill effects; Preventive and mitigating measures.

Land Reclamation: Re-vegetation and restoration methodologies; Plant species selection; Case studies of coal and metalliferous mine dumps/spoils.

Unit - IV

Environmental Management: Factors to be considered, EIA, EMP preparation, Mine Closure Planning.

Environmental laws and acts: Main provisions of Environmental Protection Act 1986, EIA notification 2006 and important Circulars issued by MoEF, Forest Conservation Act 1980 and Forest Conservation Rules 1981 related with the Mining.

Practical

1. Occupational health hazards and their remedial measures.
2. Standards for water, air, noise, dust etc. and their impact when found in excess.
3. Measurement of dust contents with the help of dust sampler.
4. Measurement of dust by instruments used in mines.
5. Sound level meter and measurement of noise level produced by various mining machineries.
6. Measurement of vibration with the help of Blastmate series III seismograph.

7. Reclamation of dumps for mechanized opencast mines.
8. Preparation of EMP of mines, collection of various fields' data and their evaluation.
9. Measurement of vibrations produced in mines by seismograph.
10. Measurement of pH value of water samples collected from mine discharge and analyzing its adverse effects.
11. Gravimetric dust sampler.
12. Preparation of EIA.
13. Sound level measurement.
14. Problem for Acid mine drainage.
15. Case study of reclamation and valley filling.

Text Books/References

1. Dr. B.B. Dhar, Environmental Management of Mining Operations. Pub.
2. Proceeding of the National & International Seminars/Symposium organized in concern with mine environment.
3. Rekha Ghosh, D. S. Chatterjee; "Environmental Geology" Capital Publishing Co. New Delhi.
4. David Stone; "Minefill 2001" Proceedings of the International Symposium on Mining with Backfill" SME Publication 2001.

MI 475 (PCC) MINE COMPUTING LAB – II

Cr.Hrs. 1 (0+0+1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**2**

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

Develop programs to solve various mining problems related to opencast/ underground mines such as pillar design problem, subsidence predicting support system, optimum blast design etc.

1. Programs related with strain and stress analysis of rocks.

2. Slope stability analysis and simulation.
3. Pillar design problem for underground mines.
4. Design of mine opening.
5. Subsidence prediction of underground coal mines.
6. Detailed planning by Datamine/ Surpac software of massive deposit.
7. Detailed planning by Datamine/ Surpac software of vein type deposit.
8. Computer analysis of data collected during survey camp.
9. Design an optimum blast for lime stone quarry.
10. Design of a pumping system for a u/g mine.
11. Design of support system in U/G mining.
12. Design of stope with various field conditions.
13. To prepare a program for designing a drift for metalliferous mining.
14. Optimization of Shovel-Dumper operation.
15. Design of mine ventilation system

    (a) Calculation of air quantity

    (b) Equivalent resistance of mines.

    (c) Calculation of relative humidity etc.

Professional Elective Course (PEC) -1

MI 356 (PEC) (a) EXPERIMENTAL STRESS ANALYSIS

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Study various aspects of ground control problems in underground and opencast mines with better understandings of non destruction testing, photo-elasticity, two dimensional stress analysis. Also provide model studies in strain gages and their application to experimental stress analysis and research design and field problems.

Unit - I

Importance of experimental methods, similitude laws and design of experiments, some simple measuring instruments.

Unit - II

Bagg's deformeter, Strain gauges-principles and applications, Mechanical, optical and electrical strain gauges; semi-conductor strain gauges; strain recording instruments.

Unit - III

Photo-elasticity-two dimensional stress analysis, principles and applications, Moirs techniques, three dimensional stress analysis.

Unit - IV

Non-destructive testing, Brittle coatings, Some application of experimental stress analysis and research, design and field problems.

Text Books/References

1. Obert & Duall, Rock Mechanics and design of structures in rock. Pub: John Willey & Sons
2. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company
3. Vutukuri & lama, Handbook of Mechanical properties of rock Vol.I&II. Pub: Transtech, Germany
4. Syd.S.Peng, Coal Mine Ground Control. Pub: John Willey & Sons
5. J.C. Jeager & NGW Cook, Fundamentals of Rock Mechanics. Pub: Chapman & hall, London

6. Charles Jaeger, Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London
7. Manual on Rock Mechanics, Prepared by Central Soil & Materials Research Station, New Delhi, Add: Central Board of Irrigation and power Malcha Marg, Chanakyapuri, New-Delhi- 110021

MI 356 (PEC) (b) NUMERICAL METHODS

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Understand the finite element method and boundary element method and their practical application in solving, planning and monitoring various mining problems.

Unit - I

Introduction to Elastic Rock Models: Fundamentals; Elastic, homogenous isotropic, non linear elastic and elasto-plastic models.

Unit - II

Finite Element Method- the concept, formation of mesh elements and finite difference patterns solution; Discretization and element configuration; Element stiffness, assemblage and solution.

Unit - III

Boundary element method: The concept, discretization, different methods of solution for isotropic and infinite media.

Unit - IV

Practical application of above methods.

Text Books/References

1. Charles Jeager, Rock Mechanics & Engineering, Pub: Cambridge Univ. Press, London
2. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company
3. Z.T. Bieniawski, Rock Mechanics Design in Mining and Tunneling, Pub: A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands.
4. L.U. Hy. Numerical Modeling of Rock fracture process under mechanics loading, Lulea Uni. of Technology.

MI 356 (c) (PEC) ADVANCED MINERAL EXPLORATION

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Understand about airborne surveying and satellite data applications for search, explore, validate and plan the different types of mineral deposits.

Unit- I

Basic Principles of Remote Sensing, Remote Sensing Platforms, Sensors and Space Program.

Electromagnetic Radiation (EMR) and their characteristics with relevance to remote sensing, satellite orbits and Measurement strategies, atmospheric effects in remote sensing data sets, spectral reflectance properties of earth's surface features.

Unit- II

Aerial remote sensing: Cameras, films and their characteristics, multi-band photography and its advantages. Principles of photo processing, Elements of photogrammetry, Elements of GIS and GPS.

Unit- III

Digital Image Processing, statistical techniques adopted on remotely sensed data, Analysis, Image classification.

Application of GPR in Mining: Various types, antennas types, softwares used for GPR data interpretation.

Unit- IV

Digital Elevation Modeling, Resources mapping and monitoring, Data integrity and spatial up scaling for process studies, Land use, Drainage analysis, Rock identification, Terrain interpretation, Mineral exploration, Geo-environmental application Forestry.

Text Books/References

1 T.S. Chouhan and K.M. Joshi. Applied Remote sensing and photo interpretation, Vigyan Prakashan Jodhpur. (1996)

2 T.M. Lillesand and K.W. Kiefer. Remote sensing and image interpretation, John Wiley and Sons, 1992.

3 F.F. Sabbins. Remote sensing-Principles and Interpretation, W.H. Freeman & Co., San Fransico, USA (1987)

Professional Elective Course (PEC) - 2

MI 367 (PEC) (a) ROCK FRAGMENTATION

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Understand the procedures of advanced drilling and blasting operations in surface and underground mining. Also it will give the understanding of important aspects of detaching the rock from insitu and proper fragmentation for ease in loading & transportation with minimum damage to environment by reducing noise, vibration and flyrock.

Unit - I

Present status of drilling and blasting practices in India and abroad: Methods of drilling; Different types of machines; Hydraulic drills; Long hole drilling; Novel methods of drilling; Choice of drills.

Unit - II

Mechanics of drilling; Variables in drilling; Drillability of rocks.

Study of bit life, cost of drilling, hole diameter, pull down weight, joints etc. in relation to BHD and rock characteristic; Trouble shooting; Diagnosis of problems in drilling.

Unit - III

Emerging trends in explosives, initiating system and blasting techniques; Mechanics of blasting, Blast round design & influence of controllable and non controllable parameters on blasting, Fragmentation assessment and monitoring, Instrumentation and software application for design of blast round, monitoring and assessment of rock fragmentation; Deep hole blasting, Hot hole blasting, Stemming plug.

Unit - IV

Blasting damages – Micro and macro level damages due to blasting; Ground vibrations, flyrock and air over pressure; Wall control, Blast casting; Demolition blasting, Nuclear blasting; Destress blasting; Safety during blasting.

Text Books/References

1. Dr.Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, VTO5036, USA.
2. C.P. Chugh, High Technology in Drilling and Exploration, Pub: Oxford & IBH, New Delhi.

MI 367 (PEC) (b) ROCK ENGINEERING

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Study various aspects of ground control problems in underground and opencast mines with a better understanding of subsidence, slope, rock burst and caving in the mine. Also provide understanding of deformation and its measurement.

Unit - I

Slope design: Basics mechanics of rock and spoil slope failures; Parameters for stability analysis; Design of slopes; Reinforcement of rock slopes and monitoring of slopes.

Unit - II

Design of mine excavations like drifts, shafts and stopes; Pillar design; Theories of roof failures of small and large excavations; Cavability of ore and stratified deposit.

Mining subsidence, bumps and rock burst, destressing to control rock bursts.

Unit - III

Drillability of rocks; Mechanics of rotary and percussive drilling; Design of drills; Drill bits for optimum penetration; Parameters affecting rate of penetration; Effect of flushing medium on drill performance.

Unit - IV

Rock reinforcement; Estimation of support requirements of underground excavation.

Mechanics of rock breakage in blasting; Influence of rock properties; Controlling damage.

Text Books/References

1. Dr.Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, VTO5036, USA.
2. Obert & Duall, Rock Mechanics and design of structures in rock. Pub: John Willey & Sons.
3. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company.

MI 367 (PEC) (c) ADVANCES IN MINE VENTILATION

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Acquire the advanced knowledge of the ventilation requirements for underground mines including knowledge about ventilation planning, ventilation surveying and related systems. For any underground mine, ventilation officer is a statutory post as per Indian Mining Law. This course facilitates the required knowledge to perform the duties of ventilation effectively.

Unit - I

Advanced treatment of Air flow in Mines: Thermodynamics considerations; Instrumentation and monitoring in mine ventilation and air conditioning.

Unit - II

Planning and design of mine ventilation systems, network theory and analysis by digital computer, heat flow from rocks. Mine heat load calculation. Design of refrigeration and air conditioning systems in mines. Degasification of coal mines.

Unit – III

Leakage, re-circulation and reversal of air flow.

Methane drainage- control and case studies.

Network analysis- controlled flow models by CPM.

Unit – IV

Natural splitting problems by Hardy-Cross and other techniques.

Environmental monitoring and automatic control systems.

Text Books/References

1. G.B. Mishra, Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. L.C. Kaku, Numerical Problems on Mine Ventilation. Pub: Punam Publisher.
3. Mutmansky & Weng, Mine ventilation & Air conditioning. Pub: John Willey & Sons

Professional Elective Course (PEC) -3

MI 476 (a) (PEC) MINE PLANNING AND DESIGN

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Better understanding of the challenges in planning surface mining project is also an outcome of this course. Student can be able to plan extraction methods for metal mining by underground techniques as outcome of this course. Also, underground coal mining is supposed to produce 80% of coal demand and the student can get opportunity to be specialist in planning for such underground coal mining projects as outcome of this course.

Unit - I

Feasibility study: Its function and preparation of feasibility report and DPR for metallic and non-metallic minerals.

Minerals inventory and ore reserves.

Unit - II

Different types of underground mining methods as per the organizational and technical parameters.

Determination of size of mine, life of mine and production rates.

Design for mining the mineral deposits by open-pit mining, under ground mining and the combination of both; The ultimate open pit profile based on physical and economical parameters; Optimum pit design.

Unit - III

Division of underground mine into parts, levels and panels; Determination of level interval; Size of long wall faces.

Stope design-the basic concepts.

Different planning stages- micro and macro planning, Project scheduling.

Unit - IV

Basics of geostatistics and quality control, Optimisation of facility location.

Computer applications; Information systems; Information technology.

Design for mining mineral deposits by underground mining.

Production planning: Selection of machines; Haul road design; Optimum load haul system; Optimum blast design.

Text Books/References

1. W.Hustrulid & Kuchta, Open Pit Mine Planning and Design Vol & I. Pub: A.A. Balkema
2. W.A. Hustrulid, Underground Mining Methods Handbook
3. Cummins and Gievens; SME Handbook.Pub: Society of Mining Engineers of the American Institute of Mining , Metallurgical, and Petroleum Engineers, Inc New York.
4. Bhattacharya, A., Principles of Mine Planning, Allied Publishers.

MI 476 (PEC) (b) COMPUTER AIDED MINE DESIGN

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Provide opportunity for better understanding of the challenges in planning surface and underground mining projects by emphasizing on computer graphics and related computer added mine design. Student can be able to plan extraction methods by optimum production planning and scheduling.

Unit - I

Computer Graphics: Display devices- Refresh Cathode- Ray tubes, Random-Scan and Raster scan monitors, color CRT monitors, three dimensional monitors; hard copy devices; interactive input devices; display processors; graphic software.

Unit - II

Output primitives: Points and lines; DDA and Bresenham's line algorithms; Antialiasing lines; Line command; Fill areas; Bresenham's algorithm for drawing circle and eclipse; other curves; Different attributes to output primitives; Interactive picture-construction techniques.

Unit - III

Two dimensional transformation: Translation, scaling and rotation; Matrix representation; Composite transformation; Concatenation properties; Mirroring, reflection, windowing and clipping; viewport.

Unit - IV

Optimization of location of Mining facilities: Application of O & M techniques in mining: Mathematical programming: Queing theory, Replacement theory, Optimal production planning and scheduling, Optimization of mine field, mine capacity and other mining parameters.

Text Books/References

1. W.Hustrulid & Kuchta, Open Pit Mine Planning and Design Vol & I. Pub: A.A. Balkema
2. Banga & Sharma: Engineering Economics and Industrial Organisation. Pub: Khana Publishers, New-Delhi
3. Sukumar Bandopadhyay; "Application of the Computers and Operation Research in the Mineral Industry" Proceedings of the 30th International Symposium SME Publication 2002

MI 476 (PEC) (c) MAINTENANCE MANAGEMENT

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Acquire the proper knowledge for maintenance of various mining machinery by through failure analysis, classification of maintenance systems, cost management of maintenance and decision models for maintenance planning.

Unit - I

Introduction: General objectives, Functions; Organization and administration of maintenance systems; Requirements, Concepts and structure of suitable organizations for maintenance systems.

Failure Analysis: Analysis for source identification, classification land selectivity of failure; Statistical and reliability concepts and models for failure analysis.

Unit - II

Classification of maintenance systems: Basis and models for various maintenance systems.

Cost management for maintenance: Cost estimates- recording, summarizing and distributing cost data, maintenance budget.

Unit - III

Decision models for maintenance planning: Operation and control, optimum level of maintenance; replacement aspects of breakdown and preventive types, group and individual types, obsolete facility, deteriorating and completely failing facilities, replacement vs. reconditioning, economics of overhaul, addition replacement model-additive damage case, zero memory case, partially observed situation, planning horizon procedure. Spare planning and control: static spares, insurance spares with and without salvage value, low moving spares; man power planning-crew size, allocation etc. stand by machines; economical and operational aspects; scheduling planning of activities, monitoring and updating, resource allocation, Assigning priorities.

Unit - IV

Other relevant topics: Work measurement for maintenance, maintenance control indices, maintenance service contract, preventive maintenance management-guidelines, procedure, general management of lubrication system, organizing preventive maintenance program using vibration signature analysis-some basic ideas, management of records for maintenance, computerization of maintenance activities, major plant shut-down procedures.

Text Books/References

1. Higging L.T. Morrow L.C. Maintenance Engineering Handbook, McGraw Hill (1977).
2. Newbrought B.T., Effective maintenance management, McGraw Hill (1967).

MI 476 (d) (PEC) ADVANCED MINERAL PROCESSING

Cr.Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

Acquire the advanced knowledge of various basic and advanced techniques of mineral processing including theory, application and limitation.

Unit - I

Fluid-particle mechanics, Terminal settling velocity, Equal settling particle, Hindared settling, Types of classifiers: hydraulic, mechanical etc. and their performance characteristics, Classifiers efficiency, Selectivity index, Dense medium separation: no material used for suspensions, Separatory vessels and their relative merits and demerits. Hydrocyclone ; mechanism of separation, concepts of DSO.

Unit - II

Flocculation and thickening. Design features of thickners, flowing-flow concentration, wilfley and other types of tabling operation, Vannars and their application. Jigging: mechanism, cycle, variables in operation etc. Baum, Harz and other types of Jigs.

Unit - III

Dewatering and drying. Filtration: pressure and suction filters, their relative merits and demerits, filter and filtration cycle, rate of drying. Compartment, rotary and other types of dryer and their operational features.

Unit - IV

Magnetic separation, Paramagnetic and diamagnetic substances. Industrial magnetic separators and their performance criteria. Electrical separation of minerals; Electrostatic and electrodynamic methods, Plate and roll type separators. Factor affecting the design of high tension roll separators. Electrostatic precipitation. Single and two stage separations. Operational features of ESMS such as cottrell precipitator.

Text Books/References

1. M.A. Gaudin, Principles of Mineral Dressing, Pub: Mcgraw-hill Inc
2. S.K.Jain, Mineral Processing, CBS Publishers & Distributors P Ltd.
3. D.V. Subba Rao, Mineral Processing, CRC Press.
4. H.G. Vijendra, Hand book on mineral dressing. Pub: Vikas Publishing House, 576, Masjid Road, Jangpura New-Delhi 110014

****OPEN ELECTIVE**

Note: The students have to take one open elective out of the list given except the subjects offered by their own branch.

CE 478a (OE) URBAN WASTE MANAGEMENT

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1: Demonstrate knowledge of Problems & National & global scenario of solid waste management.

CO2: Demonstrate knowledge of solid waste seperation, collections, transfer and transport.

CO3: Analysis of solid waste & chemical characteristic of refuse.

CO4: Understand composting and incineration.

CO5: Understand sanitary land filling.

CO6: Monitor effects of solid waste on environment.

Unit -I

General: Problems associated with Solid Waste Disposal. National & global scenario of solid waste management.

Generation of Solid Waste: Objectives of solid waste management, Classification of solid waste. Activities associated with generation of solid waste, quantity of waste generation, factors affecting solid waste generation.

Unit -II

Types of Solid Waste: Sources of solid waste. Food & biodegradable waste, recyclable waste. hazardous waste.

Waste Collections, Transfer and Transport: Storage of waste at source & source separation of waste. Primary collection of waste, secondary storage of waste. Waste storage depot. Transportation of waste.

Unit-III

Analysis of Solid Waste: Need for physio-chemical analysis of municipal solid waste. Physical characteristic of refuse : specific weight & category analysis.

Chemical Characteristic of Refuse: Determination of moisture content, volatile solid, pH, carbon, nitrogen, phosphorus, potassium & calorific value.

Composting & incineration, their advantages & disadvantages.

Unit-IV

Sanitary Land Filling: Introduction, approach to design of sanitary land filling. Typical component of land-fill cover. Various guide lines for design of land-fill. Trench of municipal solid waste disposal. Environmental quality monitoring at land-fill site. Recommendation for problems of municipal solid waste.

Practical: As per theory syllabus.

Suggested Books & References

1. G. Techobanogious, H. Theisen & R. Blassen, 'Solid Waste Engineering, Principles and Management Issues', McGraw Hills, Book Co. New York.
2. C.L. Mentell, 'Solid Waste Management, 'John Whely, New York.
3. Bhide & Sundrashen, 'Solid Waste Management in Developing Countries'.

CE 478b (OE) GROUND IMPROVEMENT TECHNIQUES

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

CO1: Ground Improvement Techniques & Methods of soil stabilization.

CO2: Understand soil cements stabilization.

CO3: Stabilize dune sand by lime fly ash.

CO4: Demonstrate knowledge of Soil Bituminous stabilization and Thermal stabilization.

CO5: Understand Granular column and soil reinforcement.

CO6: Demonstrate knowledge of Dynamic compaction.

Unit -I

Ground Improvement Techniques: Shallow and deep techniques. Soil stabilization; Purpose, mechanical mixing of different types of soils, grading land plasticity charcteristics,.

Soil Lime Stabilisation: Base exchange, Pozzolinic reaction, curing, Types of soils, stabilised, density, effect on consistency properties. Effect of lime on liquid limit, plastic limit, plasticity index and shrinkage limit. Relationship of strength with curing period & density.

Unit -II

Soil Cement Stabilisation: Soil cement stabilisation, Mechanism of soil cement stabilisation. Various theories; Modified soil cement & plastic soil cement. Effect of density, curing period and surface area on strength.

Soil Fly-Ash Stabilisation: Soil-lime fly ash stabilisation, principles of pozzolanic reaction. Proportions used in practice. Stabilisation of dune sand by lime fly ash.

Unit-III

Soil Bituminous Stabilisation: Soil bituminous stabilization Intimate mix theory & plug theory. Effect of mixing, moisture, aerating, density & compaction.

Thermal Stabilisation: Theory of thermal stabilisation, Electroosmotic drainage. Double layers, 'Ke' electro osmotic coefficient of permeating, Full scale field test, Electro osmotic chemical hardening Field construction methods and equipment.

Dynamic compaction of soil Equipments used, tests performed in field, Pre compression and Vertical Drains.

Unit -IV

Granular Columns: Methods of construction, bearing capacity of composite soil. Empirical methods/charts, Theory of determination of settlement of composite soil. Vibro-flotation &vibro-compaction.

Soil Reinforcement: Geosynthetics, Geomembrane,

Practicals : As per theory syllabus.

Suggested Books & References

1. Purushotham, P. Raj, 'Ground improvement Techniques'.
2. Venkaramiah, C., 'Ground Improvement'.
3. Madhav, M.R., 'Development in Reinforcement of Ground and Slopes'.

CS 478 (OE) CSE INTRODUCTION TO CYBER SECURITY

Cr. Hrs. 3 (3 + 0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

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

CO1: Describe and analyze the term ethics related to cyber security.

CO2: Evaluate designs related to ethical hacking, penetration testing, privacy and security of system.

CO3: Analyse and compare symmetric-key encryption public-key encryption schemes based on different security models

CO4: Identify issues to protect digital assets in compliance with cyberwarfare.

Prerequisite: Prior knowledge of using open source operating system, shell programming, open source security tools and ability to design a cryptosystem is desirable.

Unit – I

Introduction to Ethics: the field of ethics, how it differs from either law or religion, why it is still necessary when we have both law and religion; The Ethical Frameworks: introduction to three stances applied to thinking about ethics: virtue ethics, utilitarianism, and deontological ethics.

Unit – II

The Ethical Hacker: Introduction to the notion of ethical hacking, the hacker code and the particular problem of penetration testing; The Problem of Privacy: What is privacy?, how is it different from security?, ethical issues related to privacy.

Unit – III

Cryptography Techniques: Plain Text and Cipher text, Substitution techniques, Transposition techniques, Encryption & decryption, Computer-based Symmetric key Cryptography Algorithms: Algorithms types and modes, overview of symmetric key cryptography, data encryption standards (DES), Advance encryption standards (AES), Shannon's theory of confusion and diffusion. Computer- based Asymmetric key Cryptographic Algorithms: RSA algorithms, MD5 Digital Signature.

Unit – IV

The Problem of Surveillance: Introduction to surveillance, types of surveillance, surveillance practices; The Problem of Piracy: the problem of piracy and intellectual property theft.

Problem of Cyberwarfare: What is cyberwarfare?, the players involved, ethics of cyberwarfare; The Way Forward: some thoughts about what a Code of Ethics contains and what it means to practice professionalism in one's craft, future of cyber security, introduction to some ethical issues.

Text Books/References

1. "Cybersecurity Ethics: An Introduction", Mary Manjikian, Taylor & Francis Group.
2. "Cybersecurity and Cyberwar: What everyone needs to know", P. W. Singer and Allan Friedman, Oxford University Press.
3. "Cryptography and Network Security", Atul Kahate, Tata McGraw-Hill Publishing Company Ltd.
4. "Cryptography and Network Security", William Stallings, Pearson Asia.

ME478(a) (OE)
ENTREPRENEURSHIP AND INDUSTRIAL MANAGEMENT

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes: Upon completion of this course the students will be familiar with:

CO1: Selection and development of a small or medium business idea

CO2: Make and Implement project proposals and reports to hunt for venture capital etc.

CO3: Market competition and innovation in products and processes.

CO4: Develop managerial skills to achieve goals, & Plan and implement projects applying management techniques.

CO5: Understand social responsibility as a modern management concept.

Unit-I

Entrepreneurship: Definition and Meaning; Characteristics of Entrepreneurship/Traits of an Entrepreneur; Functions of Entrepreneurship - Job Creation, Innovation, Inspiration, Economic Development; Types of Entrepreneurship, Entrepreneurship and Intrapreneurship, Entrepreneurship Strategy

The Business Plan: Creating and Starting the Venture: The Marketing Plan, The Financial Plan, Sources of Capital; Legal Issues for the Entrepreneur: Patents, Trademarks, Copyrights, Trade Secrets, Licensing, Product Safety and Liability, Insurance; Contracts, Advertising, Supply Chain Management, Retail & FDI

Proposals & risks: Project Report Preparation (Feasibility, Cost Estimation, CVP Analysis, Detailed Project Report, Concept of Risk and decision making, Risk Management-SWOT etc

Unit-II

Entrepreneurship and Innovation: The Innovation Concept, Importance of Innovation for Entrepreneurship, Source of Innovation for Opportunities, The Innovation Process, Product life cycle, new product development process, mortality curve, Creativity and innovation in product modification/ development

Entrepreneurship and Economic Development: Role of Entrepreneurship in Modern Economy, Managers Vs Entrepreneurship**:** Characteristic of Managers, Characteristic of Entrepreneurs, Similarities and differences between Managers and Entrepreneurs

Unit-III

Industry, Commerce and Business: Types of ownership in the organization- Definition, characteristics, Merits & Demerits; Single ownership, Partnership, Cooperative Organizations, Joint Stock Companies, Government owned, Differences between Management and Administration, Leadership Models.

Industry Size & Current schemes: Micro, Small, Medium- Industry; Registration Process, Current Promotional Schemes for new Enterprise

Unit-IV

Function of Management: Planning- Types of Planning - Strategic Plan, Tactical Plan and Operation Plan; Organizing- Definition and Meaning, Types of Organizing; Staffing- Definition and Meaning, Types of Staffing – Internal & External, The Basic Steps in the Staffing

Process; Directing (Leading)- Definition and Meaning; Controlling- Definition and Meaning, Relationship between Planning and Controlling.

Social Responsibility: Social Obligation, Social Responsiveness and Social Responsibility, Managerial Ethics

Practical: As per theory

Text Books/References

1. Entrepreneurship Development and Management, A. K. Singh, Jain Book Agency (JBA) publishes, New Delhi
2. Small Scale Industries and Entrepreneurship, Vasant Desai, Himalaya 2008
3. Industrial Engineering and Management, O.P.Khanna, Dhanpat Rai and Sons, Delhi
4. Industrial Management and Entrepreneurship, V. K. Sharma, Scientific Publishers, New Delhi.
5. Entrepreneurship, Roy Rajeev, Oxford Latest Edition.

ME478(b) (OE) BIO-ENERGY SYSTEMS DESIGN

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes: Upon completion of this course the students will be familiar with:

CO1: Classifybioenergy fuels and their conversion technologies.

CO2: Describe the knowledge for operation of biomass gasifier, biomass pyrolysis and biogas plant.

CO3: Design system for biomass gasification, pyrolysis and biogas production.

CO4: Demonstrateproduction of biodiesel and bioethanol, and their application power generation and transportation.

CO5: Demonstrate socio-economic aspects and cost-economics analysis of biomass conversion technologies.

Unit–I

Introduction: Introduction to bio-energy from, classification of biomass as fuel – Agro based, Forest, residue. Bio-energy systems/Conversion devices – Incinerators, gasifiers, digestors.Design objectives for sustainable bio-energy systems.Bio-mass bricketing machine.

Biomass conversion processes: Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion.

Unit–II

Bio-mass Combustion: Basics of combustion, Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit–III

Bio-mass Gasification: Working principle, Gasifiers – Fixed bed system – Downdraft and updraft gasifiers,Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Bio-mass Pyrolysis: Pyrolysis – types, slow, fast; Manufacture of charcoal: methods -yields and application; Manufacture of pyrolytic oils and gases, yields and applications.

Unit–IV

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status, Design and constructional features; Biomass resources and their classification for biogas.

Review of mechanical Design: Materials of Construction, corrosion damage, testing and inspection.

System modelling: Basics and its mathematical model, Use of Software in system design. Economicsanalysis of bio-energy systems.

Practical: As per theory

Text books/ References

1. Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction: Practical Design and Theory, Academic Press, Elsevier, 2018.

2. John Rezaiyan, Nicholas P. Cheremisinoff, Gasification Technologies, Taylor & Francis, 2005.
3. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
4. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
5. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
6. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

ME478(c) (OE) ENERGY CONSERVATION AND MANAGEMENT

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcomes: Upon completion of this course the students will be familiar with:

CO1: To understand the basic knowledge ofdifferent terms & principles of energyconservation,audit and management

CO2: To understand efficient heat utilization, saving andrecovery in different thermal system

CO3: To prepare energy audit report fordifferent energy conservation instances

CO4: To Evaluate the energy saving &conservation in different mechanical utilities

Unit-I

Energy Scenario: Commercial and Non-Commercial Energy, Primary Energy Resources, Commercial Energy Production, Final Energy Consumption, Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy and

Environment: Air Pollution, Climate Change, Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features.

Unit-II

Energy Management & Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple pay back period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs.

Unit-III

Energy Monitoring and Targeting: Defining monitoring & targeting, Elements of monitoring & targeting, Data and information-analysis, Techniques -energy consumption, Production, Cumulative sum of differences (CUSUM).

Global Environmental Concerns: United Nations Framework Convention on Climate Change (UNFCC), Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon Fund (PCF), Sustainable Development.

Unit-IV

Energy Efficiency in Thermal Utilities and systems: Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas, Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, Condensate and flash steam recovery system, identifying opportunities for energy savings, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace, hot air generators, Feed water treatment, blow down, energy conservation opportunities, Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation, Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, Steam utilization, Performance

assessment more details, installation, Temperature control, draft control, waste heat recovery. Forging furnace heat balance, Thermic fluid heaters, super critical boilers, Thermo-compressor, steam pipe insulation, condensate pumping, steam dryers

Cogeneration: Definition, need, application, advantages, classification, saving potentials. Heat balance, steam turbine efficiency, tri-generation, micro turbine. Heat Exchangers: Types, networking, pinch analysis, multiple effect evaporators, condensers, distillation column, etc. Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential. Insulation and Refractories: Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss. Cold insulation. Heating, ventilation, air conditioning (HVAC) and Refrigeration System: Factors affecting Refrigeration and Air conditioning system performance and savings Opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system and saving potential, heat pumps and their applications, section on ventilation system, ice bank system, and performance assessment of window and split room air conditioners, Star labeled pumps, cold storage refrigeration, and humidification system.

Practical: As per theory.

Text Books/References

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press.
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press.
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4.
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication.
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation dited byE J Wilson and D Gerard, Blackwell Publishing.
6. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994.

EC 478(a) (OE) INTELLECTUAL PROPERTY RIGHTS

Cr. Hrs. 3(3+0+ 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcomes: The student will be able to

CO1: Understand the concept of Intellectual Property Rights and Patents.

CO2: Understand the concept of Trademark and its related Statutory authorities.

CO3: Apprehend the idea of Copyright and registerability of a design.

CO4: Understand International IPR, Case laws and World intellectual property organization.

Unit-I

Introduction: Concept of IPR, Historical development , kinds of IPR, brief description of patent, trademark, copyright ,industrial design, importance of IPR, IPR authorities.

Patents: Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.

Unit-II

Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration, licensing in trademark.

Unit-III

Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright ,term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies

Industrial design: The design act-2000, registerability of a design, procedure of registration of a design, piracy of a registered design, Case law on designs.

Unit-IV

International IPR & case laws: World intellectual property organization, WCT, WPPT, TRIPS, Copyright societies, international IPR dispute resolution mechanism. Case laws.

Text Books/References

1 Law Relating to Intellectual property, fourth edition by B.L.Wadehra . Universal law publishing co. pvt. Ltd, 2007.

2 Intellectual property: Patents, copyright, trademarks and allied rights. Fifth edition by W.R. Cornish. Sweet & Maxwell publisher, 2003.

3 Law and practice of intellectual property in India by Vikas Vashishth, 2006.

4 Patents, copyrights, trademarks and design by B L Wadhera, 2014.

5 Dr. B. L. Wadhera, "Intellectual Property Law Handbook". Universal Law Publishing 2002.

EC 478 (b) (OE) E-COMMERCE

Cr. Hrs. 3(3+0+ 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcomes: The student will be able to

CO1: Understand the concept of Electronic Commerce and its need.

CO2: Understand the idea of Network Infrastructure for E- Commerce.

CO3: Apprehend the notion of security issues on web and importance of Firewall.

CO4: Understand Electronic Payments, SET protocol and E- Commerce Law.

Unit-I

Introduction: Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models

Unit-II

Network Infrastructure for E- Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, and FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device.

Unit-III

Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

Unit-IV

Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda

Text Books/References

1 Goel, Ritendra "E-commerce", New Age International,2007.

2 Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison- Wesley. 1996.

3 Vinod Kumar Garg and Venkita krishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI 2004.

EE 478(a) (OE) KNOWLEDGE BASED SYSTEM

Cr. Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome :

CO1: Know-how of Artificial neural networks.

CO2: Proficiency in learning techniques of artificial neural networks.

CO3: Know-how of fuzzy control techniques.

CO4: Capability to Adaptive Fuzzy control design.

Unit I

Artificial Neural Networks: Neural Networks- an overview, Introduction to Artificial Neural Networks (ANN), Historical Development of Neural Networks, Biological Neural Networks, Comparison Between Artificial and Biological Neural Network. Basic Building Blocks of ANN: Network Architecture, , Activation Function.

Unit II

Fundamental Models of Artificial Neural Networks: Introduction, McCulloch-Pitts Neuron Model. Learning Rules: Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule (Widrow-Hoff Rule or Least Mean Square (LMS) Rule), Back Propagation Rule.

Unit III

Fuzzy Logic: Fuzzy logic concepts and application areas, classical and fuzzy Sets, fuzzy relation and membership functions, fuzzification and defuzzification methods, fuzzy rule base system.

Unit IV

Neural Network and Fuzzy Logic application in load forecasting, fault detection, economic load dispatch, voltage and reactive power control, load flow and electric drive control.

Text Books/References

1. S N Sivanandanm, S Sumathi and S N Deepa. Introduction to Neural Networks Using MATLAB- Tata McGraw- Hill Publishing Company Limited.
2. J.M. Zurada. Introduction of artificial neural systems - Jaico Publication House.
3. D. Driankov, H. Hellendoorn and M Rein frank. An introduction to fuzzy control - Narosa Publication House, 2nd reprint.

EE 478 (b) (OE) ADVANCED POWER CONVERTERS

Cr. Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome :

CO1: Competency in Single-Switch Isolated Converters design**.**

CO2: Proficiency in Dynamic Analysis of DC-DC Converters

CO3: Know-how of resonant converter.

CO4: Know-how of Multilevel Converters**.**

Unit I

Single-Switch Isolated Converters: Requirement for isolation in the switch-mode converters, Forward and flyback converters, Push-Pull Converters Power circuit and steady-state analysis,.

Unit II

Dynamic Analysis of DC-DC Converters: Formulation of dynamic equation of buck and boost converters, averaged circuit models, linearization technique, small-signal model and converter transfer functions.

Unit III

Resonant Converters: Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits-Resonant switches. Concept of Zero voltage switching.

Unit IV

Multilevel Converters: Basic concept, classifications, working principle, applications.

Text Books/References

1. Switched Mode Power Conversion, Course Notes, CCE, IISc, 2004.
2. Issa Batarseh, 'Power Electronic Circuits', John Wiley, 2004.
3. Philip T Krein,' Elements of Power Electronics ',Oxford Press.
4. Fundamentals of Power Electronics – Robert Erickson and Dragon Maksivimovic,
5. Springer Publications. Power Electronics–IssaBatarseh- John Wiely
6. Elements of Power Electronics- Philip T.Krein – Oxford University Press.

EE 478(c) (OE)
POWER ELECTRONICS IN RENEWABLE ENERGY SYSTEMS

Cr. Hrs. 3 (3+0+0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome :

CO1: Learning of Basics Renewable Energy Systems.

CO2: Proficiency in Dynamic modelling of Power Electronics converter.

CO3: Know-how of power electronics in Wind Power Plants.

CO4: Know-how of power electronics in Solar PV.

Unit I

Basics Renewable Energy Systems: Modern power electronics technology for the integration of renewable energy sources. challenges for grid integration,energy needs of India and energy consumption patterns, worldwide potentials of these sources.

Unit II

Power electronics converters: Various topologies of power electronics converters (PECs), power electronics converters (PEC) classifications, Dynamic modelling of Power Electronics converter

Unit Ill

Power electronics in Wind Power Plants: Grid interconnection requirements for wind farms, integration issues, operational issues, grid integration issues in India, wind power integration standards, super grid strategy, Applications of PEC in wind power plants, Modern PEC in wind power plants.

Unit IV

Solar Photo Voltaic (PV) Technology: Solar cell characteristics, parameters of solar cell and its equivalent circuit, PV Module and arrays, perturb and observe maximum power point tracking (MPPT) technique, components of PV system, design of a standalone PV system. solar constant, solar radiation at the earth's surface, solar radiation geometry, solar radiation measurements, estimation of average solar radiation. Solar Thermal Systems: Types of collectors, collection systems and efficiency.

Text Books/References

1. Wind power plants and projects developments, Joshua Earnest and T Wizelius, PHI, New Delhi, 2011.
2. Handbook of renewable energy technology, World Scientific, Siongapore, 2011.

REE 478(OE); RENEWABLE ENERGY TECHNOLOGIES

Cr. Hrs. 3 (2+0+1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

This course is undertaken to introduce basic aspects of renewable energy supply presenting fundamental characteristics of the resource base (solar, wind energy, bio energy, etc.) and principles of related technical systems (photovoltaic, wind, biomass power generation, etc.). In a further step an economic analysis of supply technologies will be undertaken. Students will learn to acquire a basic understanding of issues related to renewable energy supply systems.

Unit I

Conventional and Alternative Energy Sources: Effect on environment of fossilfuels, nuclear energy and hydroelectric power. Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization.

Unit II

Solar Energy: Solar thermal and Photovoltaic System for power generation. Flat platecollectors & Focusingcollectors. Solar water and air heaters, solar distillation, solar cooker, drying of materials, application in industries.

Unit III

Wind Energy: Nature and potential, wind mill types, their merits and demerit. Wind farms. Brief description of geothermal energy, ocean thermal energy, tidal and wave energy.

Unit IV

Biomass: Nature and potential, different bio conversion techniques, biogas, biodiesel. Power generation from biomass (gasification &dendro thermal) and fuel cell technology.

Practical

1. To study solar drying system.
2. To study solar water heating system.

3. To study box type solar cooker.
4. To study solar distillation system.
5. To study different biogas plants.
6. To study wind energy conversion systems.
7. To study downdraft biomass gasifier for thermal application.

Suggested Readings

1. G.D. Rai. Non Conventional Energy Sources, 2013, Khanna Publishers.
2. Twidell, J., & Weir, T. (2015). *Renewable energy resources*. Routledge.
3. Basu, Prabir. *Biomass gasification and pyrolysis: practical design and theory*. Academic press, 2010.
4. Rathore N. S., Kurchania A. K., Panwar N. L.;Non Conventional Energy Sources, Himanshu Publications, 2000.

SWE478(OE) AERIAL PHOTOGRAPHY, RS and GIS

Cr. Hrs. 3 (2 +0+ 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

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

Familiarize with aerial photographs and its interpretation. Developing skill of use of various hardware and software in use of satellite data, GPS technology. Development of resource mapping and planning studies using RS and GIS.

Unit I

Aerial photography: Aerial photograph, their classification, map v/s aerial photograph, photogrammetry and its application. Elements of aerial photo interpretation, aerial photo interpretation and its use.

Unit II

Remote sensing: Definition, electromagnetic radiations,Interactions with the Atmosphere,Passive v/s Active Sensing, Characteristics of Images, Satellite and Sensors-Satellite Characteristics, Resolution, Multi-spectral Scanning, Thermal Imaging, Satellite missions, microwave sensing, Image Analysis- Visual interpretation, Digital image processing, image, Enhancement and Classification.

Unit III

GIS: Definition, basic components, data types- spatial, non- spatial, GIS data modeling, vector and raster representation, GIS data base management, GIS data file management.

Unit IV

GIS data input and editing: Data input methods, scanning, digitization, GPS data, data editing, errors and data reduction, Data analysis- format conversion, spatial measurement, overlay analysis and data output.

Practical

1. Study of aerial photographs under mirror stereoscope.
2. Preparation of stereo model of aerial photograph.
3. Land use/cover studies through aerial photograph.
4. Use of optical scanners and digitizers. U
5. Use of GPS in mapping and GIS data input, satellite data product.
6. Familiarization with image processing and GIS software's and their applications.

Suggested Readings

1. K.K. Rampal. (1999) Hand Book of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi.
2. M. A. Reddy (2002) Remote Sensing and Geographical Information Systems, B.S. Publications, Hyderabad.
3. Lillisand and Kiefer (1987) Remote sensing and Image Interpretation, John Weiley and sons.

FMP 478(OE) : MACHINERY FOR LAND DEVELOPMENT

Cr. Hrs. 3 (2 +0 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will have the knowledge of different earth moving machineries used for land development operation.

Unit-I

Land leveling: Criteria for land leveling, plane profile and inspection, engineering fundamentals related to earth-moving machinery.

Unit-II

Earth moving and excavation machines classification and application of bulldozers, advantage and disadvantage, straight and angle bulldozers, moving earth with bulldozers and estimation of output of a bulldozer numerical problems.

Land clearing equipments, Power shovel: Construction and operation of power shovel size selection of power shovel factors affecting the output of a power shovel.

Unit-III

Scraper: Types, construction and operation of scrapers, size of the scraper, cycle time production rates of scrapers, numerical problems, load-growth curve and estimation of output of a scraper.

Dragline: Types of dragline, size basic parts and operation of a dragline, output of a dragline, estimation of output, effect of different factors on output, numerical problems.

Clam shell: Basic parts and operation of a clam shell, application, size and output of a clam shell.

Motor grader: Construction and operation of motor grader, application, basic adjustment parameters of major grader, output of motor grader,

Unit-IV

Trenching machines: types, construction and operation of wheel and ladder type trenching machines, selection of suitable equipment for excavating trenches and production rates of trenching machines.

Practical

1. Study of various components of bulldozers
2. Study of various components of Scraper:
3. Study of various components of Dragline
4. Study of various components of Clam shell
5. Study of various components of Scraper: Motor grader
6. Study of various components of Scraper: Trenching machines

Suggested Readings

1. R.L. Peurifoy. Construction, Planning, Equipment and Methods.
2. Mahesh Verma. Construction equipment and its planning and application.
3. Jagman Singh. Heavy construction, planning, equipment and methods.
4. A.M. Michael. Irrigation theory and practices.

PFE 478(OE) : PACKAGING MATERIALS AND METHODS

Cr. Hrs. 3 (2 +0+ 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will be able to acquaint with various packaging materials, various aspects of packaging methods and technology.

Unit-I

Factors affecting package material, Packaging, requirement, importance and scope, frame work of packaging strategy, environmental considerations, Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging.

Unit-II

Different types of packaging materials, their key properties and applications, metal cans, plastic packaging, different types of polymers used in packaging and their barrier properties. Manufacture of plastic packaging materials; glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, modification of barrier properties and characteristics of paper/ boards.

Unit-III

Labeling on packages, shrink and cling packaging, vacuum and gas packaging; active packaging, factors affecting the choice of packaging materials, disposal and recycle of packaging waste, printing and labeling; lamination.

Unit-IV

Package testing, testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper, glass containers, metal containers.

Practical

1. Identification of different types of packaging materials.
2. Determination of tensile / compressive strength of given material/package.
3. Vacuum packaging of agricultural produces.
4. Determination of tearing strength of paper board.
5. Measurement of thickness of packaging materials.
6. To perform grease-resistance test in plastic pouches.
7. Determination of bursting strength of packaging material.
8. Determination of water-vapour transmission rate.
9. Shrink wrapping of various horticultural produce.
10. Testing of chemical resistance of packaging materials.
11. Determination of drop test of food package and visit to relevant industries.

Suggested Readings

1. Coles R., McDowell D. and Kirwan, M.J. 2003. Food Packaging Technology, Blackwell Publishing Co.
2. Gosby, N.T. 2001. Food Packaging Materials, Applied Science Publication.
3. John, P.J. 2008. A Handbook on Food Packaging, Narendra Publishing House,
4. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials, Tata McGraw Hill.
5. Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide,Narendra Publishing House.
6. Robertson, G. L. 2005. Food Packaging: Principles and Practice, Second Edition, Taylor and Francis Pub.