



SIR PADAMPAT SINGHANIA UNIVERSITY

Udaipur

SCHOOL OF ENGINEERING

**Course Curriculum of 4-Year B. Tech. Programme
in
Mining Engineering
(Batch - 2018-22)**

Credit Structure

B. Tech. Core		B. Tech. Elective	
Category	Credits	Category	Credits
Departmental Core Subjects	118	Departmental Electives	12
Humanities & Basic Sciences Subjects	36	Open Electives	13
Management Subjects	02		
Total	156	Total	25
Grand Total			181

Distribution of Total Credits and Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact hours/week
1	I	21	25
2	II	22	27
3	III	24	29
4	IV	26	30
5	V	25	29
6	VI	23	28
7	VII	27	29
8	VIII	13	17
Total		181	--

Course Structure: B. Tech. 2018-22

Semester-I

S. No	Course Code	Course Title	L	T	P	Credit(s)
1	CE-151	Engineering Mechanics	3	1	0	4
2	ME-151	Engineering Drawing & Computer Aided Drafting	0	1	1	2
3	ME-152	Manufacturing Practice	0	0	1	1
4	HU-153	Professional Communication-I	2	0	0	2
5	CH-154	Chemistry – I	3	0	1	4
6	MA-151	Mathematics – I	3	1	0	4
7	PH-151	Physics – I	3	0	1	4
Total Credits						21
8	EP-199	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						25

Semester– II

S. No	Course Code	Course Title	L	T	P	Credit(s)
1	CS-152	Introduction to Computers & Programming	2	0	2	4
2	EC-152	Basics of Electrical & Electronics Engineering	3	0	1	4
3	HU-154	Professional Communication - II	1	1	0	2
4	CH-155	Chemistry - II	3	0	1	4
5	MA-152	Mathematics - II	3	1	0	4
6	PH-152	Physics - II	3	0	1	4
Total Credits						22
7	EP-199	Endeavour Project (Beyond the Syllabus)				3
Total Contact hours/week						27

Semester – III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-253	Mining Geology - I	3	0	1	4
2	MN-254	Elements of Mining	3	0	0	3
3	CE-251	Solid Mechanics	3	1	1	5
4	ME-256	Thermal Engineering	3	0	1	4
5	ME-257	Solid Modeling Lab	0	0	2	2
6	HU-251	Business & Technical Communication	1	1	0	2
7	MA-251	Mathematics - III	3	1	0	4
Total Credits						24
8	EP-299	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						29

Semester - IV

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-261	Mining Geology - II	3	0	1	4
2	MN-262	Mine Machinery – I	3	0	0	3
3	MN-263	Mine Development	3	0	0	3
4	CE-255	Surveying - I	3	0	1	4
5	ME-269	Fluid Mechanics & Hydraulic Machinery	3	1	1	5
6	ME-270	Theory of Machines	3	1	1	5
7	XX-XXX	Open Elective - I	X	X	0	2
Total Credits						26
8	EP-299	Endeavour Project(Beyond the Syllabus)				3
Total Contact hours/week						30

Semester – V

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-351	Strata Control	3	0	0	3
2	MN-352	Surface Mining	3	0	0	3
3	MN-353	Mine Machinery – II	3	0	0	3
4	MN-354	Computer Application in Mining	3	1	0	4
5	MN-355	Mine Computation Lab	0	0	2	2
6	CE-356	Surveying – II	3	0	1	4
7	EE-359	Theory of Electrical Machines	3	1	0	4
8	XX-XXX	Open Elective – II	X	X	0	2
Total Credits						25
9	EP-399	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						29

Semester - VI

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-361	Underground Coal Mining	3	0	0	3
2	MN-362	Underground Metal Mining	3	0	1	4
3	MN-363	Mine Ventilation & Environment	3	0	1	4
4	MN-364	Underground Mine Hazards	3	0	0	3
5	CE-366	Rock Mechanics	3	0	1	4
6	ME-367	Numerical Computation Lab	0	0	2	2
7	MN-3XX	Departmental Elective - I	3	0	0	3
Total Credits						23
8	EP-399	Endeavour Project(Beyond the Syllabus)				3
Total Contact hours/week						28

Semester – VII

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-451	Mine Legislation	3	0	0	3
2	ME-488	Finite Element Analysis	0	0	3	3
3	MN-4XX	Departmental Elective - II	3	0	0	3
4	MN-4XX	Departmental Elective - III	3	0	0	3
5	MN-450	Summer Internship	-	-	-	3
6	MN-455	Comprehensive Viva Voce	-	-	-	2
7	MN-460	Minor Project	0	0	3	3
8	HU-451	Interview Skills	0	0	1	1
9	MA-454	Quantitative Aptitude	0	1	0	1
10	BM-451	Ethics & IPR	2	0	0	2
11	XX-XXX	Open Elective – III	3	0	0	3
Total Credits						27
12	EP-499	Endeavour Project(Beyond the Syllabus)				
Total Contact hours/week						29

Semester - VIII

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-4XX	Departmental Elective-IV	3	0	0	3
2	MN-470	Major Project	0	0	4	4
3	XX-XXX	Open Elective – IV	3	0	0	3
4	XX-XXX	Open Elective – V	3	0	0	3
Total Credits						13
5	EP-499	Endeavour Project(Beyond the Syllabus)				3
Total Contact hours/week						17

List of Departmental Elective(s) - I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-371	Mine Safety Engineering	3	0	0	3
2	MN-372	Mine Management	3	0	0	3
3	MN-373	Numerical Methods	3	0	0	3
4	MN-374	Entrepreneurship	3	0	0	3

List of Departmental Elective(s) – II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-471	Dimensional Stone Technology	3	0	0	3
2	MN-472	Advanced Methods in Mining	3	0	0	3
3	MN-473	Mineral Processing	3	0	0	3

List of Departmental Elective(s) – III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-481	Environmental Management in Surface Mines	3	0	0	3
2	MN-482	Rock Engineering	3	0	0	3
3	MN-483	Remote Sensing & GIS	3	0	0	3

List of Departmental Elective(s) – IV

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	MN-491	Experimental Stress Analysis	3	0	0	3
2	MN-492	Mine Economics & Financial Management	3	0	0	3
3	MN-493	Mine Planning & Design	3	0	0	3

List of Open Elective - I*

S. No	Course Code	Course Title	L	T	P	Credit(s)
1	HU-252	Language through Literature & Films	0	2	0	2
2	BM-270	Foundation of Economic Sciences	2	0	0	2

*Subjects offered in Sem. IV

List of Open Elective - II*

S. No	Course Code	Course Title	L	T	P	Credit(s)
1	HU-351	Fun with Drama	0	2	0	2
2	BM-370	Marketing Management	2	0	0	2

*Subjects offered in Sem. V

List of Open Elective - III*

S. No	Course Code	Course Title	L	T	P	Credit(s)
1	BT-471	Bioprocess Technology	3	0	0	3
2	CE-462	Air Pollution & Industrial Waste Management	3	0	0	3
3	CS-462	Management Information Systems & E-Commerce	3	0	0	3
4	EE-465	Energy Conversion Process	3	0	0	3
5	MA-451	Probability Theory	3	0	0	3
6	ME-465	Solar Energy & Applications	3	0	0	3
7	PH-452	Nanomaterials	3	0	0	3
8	PH-453	Chaos in Engineering Systems	3	0	0	3

*Subjects offered in Sem. VII

List of Open Elective - IV*

S. No	Course Code	Course Title	L	T	P	Credit(s)
1	BT-475	Bioremediation Technology	3	0	0	3
2	CE-464	Environmental Management	3	0	0	3
3	CS-459	Statistical Simulation & Data Analysis	3	0	0	3
4	EC-473	Robotics & Automation	3	0	0	3
5	ME-466	Power Generation & Economics	3	0	0	3

*Subjects offered in Sem. VIII

List of Open Elective - V*

S. No	Course Code	Course Title	L	T	P	Credit(s)
1	BT-472	Bioelectronics & Biosensors	3	0	0	3
2	CE-463	Finite Element Methods in Engineering	3	0	0	3
3	CS-461	Soft Computing	3	0	0	3
4	EE-466	Hydro Power Generation	3	0	0	3
5	MA-453	Mathematical Statistics	3	0	0	3
6	ME-467	Total Quality Management	3	0	0	3

*Subjects offered in Sem. VIII

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Semester – I

(Departmental Core Subject)

CE-151
Engineering Mechanics

L-T-P-C
3-1-0-4

Objective: *The subject deals with the concepts of static & dynamic systems involving kinematic & dynamic analysis.*

Course Content

Basic principles: Equivalent force system; Equations of equilibrium; Free body diagram; Reaction; Static indeterminacy. Structures: Difference between trusses, frames & beams, Assumptions followed in the analysis of structures; 2D truss; Method of joints; Method of section; Frame; Simple beam; types of loading & supports; Shear Force & bending Moment diagram in beams; Relation among load, shear force & bending moment. Friction: Dry friction; Description & applications of friction in wedges, thrust bearing (disk friction), belt, screw, journal bearing (Axle friction); rolling resistance. Virtual work & Energy method: Virtual Displacement; Principle of virtual work; Applications of virtual work principle to machines; Mechanical efficiency; Work of a force/couple (springs etc.); Potential energy & equilibrium; stability. Center of Gravity & Moment of Inertia: First & second moment of area; Radius of gyration; Parallel axis theorem; Product of inertia, Rotation of axes & principal moment of inertia; Moment of inertia of simple & composite bodies. Mass, moment of inertia. Kinematics of Particles: Rectilinear motion; Curvilinear motion; Use of Cartesian, polar & spherical coordinate system; Relative & constrained motion; Space curvilinear motion. Kinetics of Particles: Force, mass & acceleration; Work & energy; Impulse & momentum; Impact problems; System of particles. Kinematics & Kinetics of Rigid Bodies: Translation; Fixed axis rotational; General plane motion; Coriolis acceleration; Work-energy; Power; Potential

energy; Impulse-momentum & associated conservation principles; Euler equations of motion & its application.

Text/Reference Books

1. Engineering Mechanics: Statics and Dynamics. Shames I. H. 4th Ed. PHI. 2002.
2. Engineering Mechanics. Vol I - Statics, Vol II - Dynamics. Meriam J. L. & Kraige L. G. 5th Ed. John Wiley. 2002.
3. Engineering Mechanics. Vol. I and II. Hibbler R. C. Pearson Press. 2002.

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Semester - I

(Departmental Core Subject)

ME-151 L-T-P-C
Engineering Drawing & Computer Aided Drafting 0-1-1-2

Objective: *Engineering drawing is a visual language of an engineer. It enables students to communicate their ideas about design of an object into visual representation. This course imparts necessary knowledge of drawing principles.*

Course Content

Importance of engineering drawing; Conventions & standards: ISO; Scales; Curves; Orthographic projections : points, lines, planes & solids; Sections of solids; Isometric projections; Development of surfaces; Intersection of solids.

List of Experiments

1. Introduction to Engineering Graphics, Sheet Layout, instruments, BIS standards, Lines, Lettering & Dimensioning
2. Scales -Types of Scales-Plain Scale, Diagonal scale, vernier scale
3. Curves- conic sections, ellipse, parabola, hyperbola, cycloid, epicycloid, hypocycloid
4. Orthographic Projections-Introduction, multi-view projection system, orthographic views, Methods of multi-view projections, projecting side views, Sectional Views
5. Projection of Points -Introduction, position of points in I, II, III & IV quadrant
6. Projection of Lines & Auxiliary projections-, Line inclined to one plane & parallel to the other-Line inclined to both the planes. Projection on auxiliary planes

7. Projection of Planes- Introduction, Perpendicular & parallel to the reference planes Projections of planes inclined to one reference plane & perpendicular to the other, plane inclined to both ref. planes
8. Projection of solids with axes inclined to one of the reference plane & parallel to the other
9. AUTOCAD- Fundamentals of 2-D, Drawing & Edit commands. Draw 2D& 3D object drawing
10. Section of Solids- Sections of prisms, pyramids, cone cylinder
11. Development of Surfaces- Methods of development-Cube, prisms, pyramids, cone cylinder
12. Intersection of Surfaces- Line method-cutting plane method, Intersection of two prisms- Intersection of cylinder & cylinder
13. Isometric Projection- Isometric axes lines & planes, Isometric Scale, Isometric views of standard shapes, solids

Text/Reference Books

1. Engineering Drawing. Dhananjay A.J. Tata McGraw-Hill. 2008
2. Engineering Drawing. Bhatt N. D. & Panchal V.M. 43rd Ed. Charator Publishing House. 2001.
3. Engineering Drawing. Shah M. B. & Rana B. C. 2nd Ed. Pearson Education. 2009.
4. Graphic Science and Design. French T. E., Vierck C. J. & Foster R. J. 4th Ed. McGraw-Hill. 1984.
5. Fundamentals of Engineering Drawing. Luzadder W. J. & Duff J. M. 11th Ed. PHI. 1995.
6. Engineering Drawing and Graphics. Venugopal K. 3rd Ed. New Age International. 1998.

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Semester - I

(Departmental Core Subject)

ME-152
Manufacturing Practices

L-T-P-C
0-0-1-1

Objective: *This course is intended to impart basic knowledge of various hand tools & their usage in different sections of manufacturing; including Carpentry, Fitting, House wiring, Black smithy, Tin smithy.*

List of Experiments

1. Demonstration of the manufacturing practices, workshop safety, trades, tools, experiments
2. Measurement of the dimensions of a given job using precision instruments
3. Fabrication of a fitting job with drilling & tapping of a hole
4. Preparation of a funnel with spout as per drawing from 30 SWG. G.I sheet. Joints to be soldered with the soldering iron
5. Fabrication of a T-half lap joint & T-bridle joint
6. Preparation of a wooden patterns as per given drawings
7. Preparation of a mould for a given wooden pattern
8. Preparation of an aluminum casting with the help of a given wooden pattern

Text/Reference Books

1. Elements of Workshop Technology-Vol. I. Choudhury H. Asia Publishing House. 1986.
2. All About Machine Tools. Gerling H. New Age International. 1995.
3. Workshop Technology. Chapman W. A. J. Oxford IBH. 1975.
4. Lab Manual on Manufacturing Practice Lab. Dept. of Mech. Engg. SPSU.

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Semester - I

(Humanities & Basic Sciences Subject)

HU-153	L-T-P-C
Professional Communication - I	2-0-0-2

Objective: *To develop communicative competence*

Course Content

Communication: Importance of effective communication skills, Objectives and Process of communication; Types of communication: Verbal and non-verbal; Channels of communication, Media of communication; Barriers to communication: Physical, Psychological, Mechanical, Linguistic and Cultural; Types of listening, Principles of effective listening

Word Power: Words often misspelt, One word substitute, Use of idiomatic expressions and phrases

Time & Stress Management: Planning, Scheduling & Prioritizing, Multitasking, Delegating; Saying no assertively; Stress & its causes, Barriers to stress management & Handling stress

Text/Reference Books

1. Technical Communication. Raman M. and Sharma S. Oxford University Press. 2004.
2. Essentials of Business Communication. Pal R. and Korlahalli J. Sultan Chand and Sons. 2011.
3. Word Power Made Easy. Lewis N. 2nd Ed. Goyal Publisher. 2011.

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Semester – I

(Humanities & Basic Sciences Subject)

CH-154
Chemistry- I

L-T-P-C
3-0-1-4

Objective: *The subject deal with the concepts related to Physical chemistry & develops a scientific attitude by means of distinguishing, analyzing & solving various engineering problems. It also provides in-depth knowledge of thermodynamics, quantum chemistry, chemical kinetic, corrosion & colloids.*

Course Content

Concept of Thermodynamic system: Definition with example of di thermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property. Introduction to first law of thermodynamics: different statements, mathematical form. Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas. Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas. Heat Capacity: Definition, Classification of Heat Capacity (C_p & C_v): Definition & General expression of $C_p - C_v$. Expression of $C_p - C_v$ for ideal gas. Reversible & Irreversible processes: Definition, Work done in Isothermal Reversible & Isothermal Irreversible process for Ideal gas, Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P , V & T), slope of P - V curve in adiabatic & isothermal process. Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier & Laplace, Hess's law of constant heat summation, Kirchhoff's law. 2nd law of thermodynamics:

Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson & throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature. Evaluation of entropy: characteristics & expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. Work function & free energy: Definition, characteristics, physical significance, mathematical expression of ΔA & ΔG for ideal gas, Maxwell's Expression (only the derivation of 4 different forms), Gibbs Helmholtz equation. Condition of spontaneity & equilibrium reaction. Chemical potential, Real gas, Real Solution, Cell EMF & its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell, quinhydrone half-cell & calomel half-cell (construction, representation, cell reaction, expression of potential, Discussion, Application) Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, Discussion, Application). Application of EMF measurement on a) Ascertain the change in thermodynamic function (ΔG , ΔH , ΔS) b) ascertain the equilibrium constant of a reversible chemical reaction c) ascertain the valency of an ion. Corrosion - basics & impacts, Reaction laws: rate & order; molecularity; zero, first & second order kinetics. Pseudo unimolecular reaction, Arrhenius equation. Mechanism & theories of reaction rates (Transition state theory, Collision theory: Steady state approximation, Rate determining state approximations, Bohr's theory & its limitations, de-Broglie relation, Heisenberg Uncertainty principle, Schrodinger equation, Schrodinger equation for hydrogen atom in Cartesian coordinate & polar coordinates, Significance of four quantum numbers, shape of s, p & d atomic orbitals, discovery of spin, spin quantum number & magnetic quantum number. Rules for filling electrons in orbitals, stability of half & completely filled orbitals, relative energies of atomic orbitals, anomalous electronic configurations, The properties of liquid surface, surfactants, colloidal systems, solid surfaces, physio sorption, & chemisorption.

List of Experiments

1. Determination of water hardness by complexometric titration.
2. Determination of total alkalinity of water sample.
3. Determination of chloride ion in water sample by Argentometric method.
4. Determination of total dissolved oxygen content in water sample by Winkler's method.
5. Copper sulfate estimation by iodometric titration.
6. Potassium dichromate estimation by iodometric titration.
7. Redox titration: Estimation of FAS by internal & external indicators.
8. Gravimetric analysis: Estimation of Ba as BaSO_4
9. Gravimetric analysis: Estimation of Ag as AgCl
10. pH metric measurements: Determination of strength of unknown HCl solution by pH metric titration.

Text/Reference Books

1. Physical Chemistry. Atkins P. W. 5th Ed. ELBS. 1994.
2. Physical Chemistry. Levine I. A. 4th Ed. McGraw-Hill. 1995.
3. Quantum Chemistry. Levine I. A. 2nd Ed. Prentice Hall. 1995.
4. Introductory Quantum Chemistry. Chandra A.K. 4th Ed. Tata McGraw-Hill. 1994

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Semester – I

(Humanities & Basic Sciences Subject)

MA-151
Mathematics - I

L-T-P-C
3-1-0-4

Objective: *To develop an understanding of the fundamental concepts of the calculus, differential equations & linear algebra to connect them with real world problems from other disciplines along with the development of mathematical reasoning & problem solving abilities.*

Course Content

Differential Calculus (Functions of one variable): Taylor's & Maclaurin's theorems with remainders, concavity & convexity of a curve, points of inflexion, asymptotes & curvature.

Differential Calculus (Functions of several variables): Partial derivatives & their geometrical interpretation, derivatives of composite & implicit functions, Euler's theorem on homogeneous functions, harmonic functions, Taylor's expansion of functions of several variables, maxima & minima - Lagrange's method of multipliers.

Integral Calculus: application to length, area, volume & surface area of revolution.

Multiple integrals with applications to: volume, surface area & moments of inertia.

Ordinary Differential Equations: Solution of $dy/dx = f(x, y)$; linear differential operator L, higher order ordinary differential equations with constant coefficients.

Matrix Algebra: Rank & inverse of a matrix, consistency of linear system of equations; Eigen values, Eigen vectors & their applications to system of ordinary differential equations; Cayley-Hamilton theorem; Diagonalization of matrices.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Calculus and Analytic Geometry. Thomas G. B. & Finney R. L. 9th Ed. Addison-Wesley. 1998.
3. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
4. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2010.
5. Calculus - Vol.2. Apostol T. M. 2nd Ed. Wiley .2003.
6. Higher Engineering Mathematics. Grewal B.S. 42ndEd.Khanna Publishers. 2012.

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Semester - I

(Humanities & Basic Sciences Subject)

PH-151
Physics - I

L-T-P-C
3-0-1-4

Objective: *Objective of this course is to introduce concepts of electrostatics & magnetostatics leading to the Maxwell's electromagnetic waves & understanding the wave nature of light using various optical phenomena like interference, diffraction & polarization. The particle nature of electromagnetic wave will also be introduced.*

Course Content

Gauss law & its applications in electrostatics in vector form, electric polarization, permittivity, energy density in an electric field, Ampere's law, charged particle motion in E & B fields, magnetization, Faraday's law of electromagnetic induction; Equation of continuity, generalized Ampere's law, Maxwell's equations, wave equation, plane wave solutions, electromagnetic wave propagation in dielectrics & conductors, reflection/refraction, polarization, interference, diffraction of EM waves Origin of quantum hypothesis, de Broglie's hypothesis of matter waves, Uncertainty principle, Wave function & wave mechanics, Schrodinger equation, QM operators, Expectation value, one-dimensional solutions: zero potential, step potential, potential barrier & potential well.

List of Experiments

1. Determination of wavelength of sodium light source using Newton's Ring Method
2. Determination of wavelength of monochromatic light source using Fresnel's Biprism
3. Determination of the wavelength of monochromatic light using Michelson Interferometer
4. Determination of wavelength of laser using single slit diffraction
5. Determination of the wavelength of prominent lines of mercury using plane transmission grating
6. Determination of specific rotation of sugar solution using Polarimeter
7. Determination of Refractive index and dispersive power of prism material using spectrometer
8. Verification of the Biot Savart's law
9. Study of variation of magnetic field along the axis of a circular coil & determination of the radius of the coil
10. Determination of frequency of AC mains using Sonometer
11. Determination of the characteristic constant or ballistic constant of a ballistic galvanometer

Text/Reference Books

1. Elements of Electromagnetics. Sadiku M. N. O. 6th Ed. Oxford. 2014.
2. Optics. Ghatak A. Tata McGraw-Hill Publishing Company Ltd. 2005.
3. Electromagnetics. Laud B.B. 2nd Ed. New Age International (P) Ltd. 1987.
4. Classical Electrodynamics. Jackson J.D. 3rd Ed. Wiley. 1998.
5. Foundations of Electromagnetic Theory. Reitz J.R., Milford F.J. & Christy R. W. 4th Ed. Narosa Pub. House. 2008.
6. Fundamentals of Optics. Jenkins F. A. & White H. E. 4th Ed. McGraw-Hill International Editions. 2001.

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Semester – II

(Departmental Core Subject)

CS-152	L-T-P-C
Introduction to Computers & Programming	2-0-2-4

Objective: *This course is an introductory course of computer science. It provides basic insight into the building blocks of a modern day computer & the newest peripherals attached with it. In addition to this, the learner is delved into the basic programming concepts of a high level language.*

Course Content

Introduction to computer architecture; memory, ALU, CPU, I/O devices. Introduction to system software; operating systems, compilers and multi-user environments. Concept of an algorithm. Introduction to the design & implementation of correct, efficient and maintainable programs. Use of high level programming language for the systematic development of programs.

List of Experiments

1. Basic & calculation based programs
2. Conversion based programs
3. Decision making statement & operator based programs
4. Loop based programs
5. Multi way decision making statement based programs
6. Array based programs
7. Strings based programs
8. Function based programs
9. Structure based programs

10. Pointers based programs
11. File handling based programs

Text/Reference Books

1. A Book on C. Kelly A. & Pohl I. 4th Ed. Pearson Education. 1999.
2. The C Programming Language. Kernighan B. & Ritchie D. 2nd Ed. Prentice Hall of India. 1988.
3. The Complete Reference. Schildt H. 4th Ed. Tata McGraw-Hill. 2000.

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Semester - I

(Departmental Core Subject)

EC-152	L-T-P-C
Basics of Electrical & Electronics Engineering	3-0-1-4

Objectives: *The aim of this course is to develop an understanding of the basics of electrical & electronics components, circuits & systems, operation of transformers & other electrical machines.*

Course Content

Circuit Analysis Techniques: Circuit elements, Simple RL & RC Circuits, Ohm's law, Kirchoff's laws, Nodal Analysis, Mesh Analysis, Linearity & Superposition, Source Transformations, Thevenin's & Norton's Theorems, Phasor Relationship for R, L & C, Impedance & Admittance, Phasor Diagrams, Response as a function of ω .

Diodes & Transistors: Semiconductor Diode, Zener Diodes, Rectifier Circuits, Wave Shaping Circuits, Bipolar Junction Transistors, Field-Effect Transistors.

Operational Amplifiers: Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer.

Logic Gates: Number Systems & Codes, Logic Gates, Boolean Theorems, De Morgan's Theorems, Sum-of Product Form, Algebraic Simplification, Karnaugh Map Method.

Introduction to Transformers & AC Machines: Ideal Transformer, Circuit Model of Transformer, Efficiency, Three Phase Induction Motor.

Introduction to Fractional-kW Motors & DC Machines: Single Phase Induction Motors, DC Generator & DC Motor.

List of Experiments

1. Study & Verification of Kirchoff's Current Law
2. Study & Verification of Kirchoff's Voltage Law
3. Study & Verification of Thevenin's Theorem for dc network
4. Study & Verification of Norton's Theorem for dc network
5. Study & Verification of R-C series circuit & determination of phase angle
6. Study of the volt-ampere (V-I) characteristics for Silicon P-N Junction diode
7. Study of the volt-ampere (V-I) characteristics for a Zener diode
8. Study of the input & output characteristics for a transistor in common base configuration
9. Verification of Truth Table for basic & universal logic gates
10. Determination of copper loss & core loss for a single phase transformer through O/C-S/C Test

Text/Reference Books

1. Engineering Circuit Analysis. Hayt W.H. & Kemmerly J.E. McGraw-Hill. 1993.
2. Circuits, Devices and Systems. Smith R.J. & Dorf R.C., John Wiley & Sons. 1992.
3. Electronic Devices and Circuit Theory. Boylestad R.L. & Nashelsky L. 6th Ed. Prentice Hall India. 2001.
4. Digital Systems. Tocci R.J. 6th Ed. Prentice Hall India. 2001.
5. Electrical Engineering Fundamentals. Del T. V. Prentice Hall India. 1994.
6. Circuit Theory (Analysis and Synthesis). Chakrabarti A. Dhanpat Rai & Co. 2001.

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Semester - II

(Humanities & Basic Sciences Subject)

HU-154	L-T-P-C
Professional Communication - II	1-1-0-2

Objective: *To build interpersonal skills and communicate effectively.*

Course Content

Business Meetings: Notice, Agenda, Minutes of Meeting

Group Discussions: Classification of GD topics; GD as a part of the selection process; GD phases; Non-verbal communication in GD, Do's & don'ts of GD.

Professional Mannerisms & Grooming: Kinesics, Office etiquette; Telephone skills, Netiquette

SWOT, Résumé, Cover letter writing, Job Acceptance Letter.

Goal setting: Significance, Progressive steps to achieve goals; Anticipating career challenges & utilizing opportunities.

Text/Reference Books

1. Foundations of Business Communication: An Integrative Approach. Young, D. McGraw Hill Education. 2005.
2. How to Succeed in Group Discussions and Personal Interviews. Mandal S. Jaico Publishers. 2004.
3. Business Communication: Connecting in a Digital World (SIE). Lesikar, R. & Pande, N. McGraw Hill Education. 2015.

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Semester - II

(Humanities & Basic Sciences Subject)

CH-155
Chemistry-II

L-T-P-C
3-0-1-4

Objective: *This course aims at understanding various concepts of inorganic & organic chemistry, broad spectrum knowledge of chemical bonding, organic reaction mechanism, stereochemistry, spectroscopy, polymer science, green chemistry & environmental pollution studies.*

Course Content

Bonding Models in Inorganic Chemistry- Introduction, Ionic bonding: Introduction to stoichiometric defects (Schottky & Frenkel) & non – stoichiometric defects (Metal excess & metal deficiency). Role of silicon & germanium in the field of semiconductor. Valence shell Electron Repulsion Theory (VSEPR). Discussion of structures of IF_3 , $SnCl_2$, CO_3^{2-} & Valence bond theory, Molecular orbital theory Linear combination of atomic orbitals (LCAO) method. Structures of simple hetero nuclear diatomic molecules such as CO, NO, HF, Coordination numbers, Crystal field theory, Metal ions in Biological systems, Air Pollution Types of pollutants, source effects, sink & control of primary pollutants – CO, NO_x , HC, SO_x & particulates, effects of pollutants on man & environment – photochemical smog & acid rain. Greenhouse effect, ozone layer depletion, Water Pollution: Classification of pollutants, their sources, effects of water pollutions on human & plant life, waste water treatment – domestic & industrial. Pollution due to Oil & grease in water. Thermal pollution: Sources, effects of thermal pollution on plant & animal life, control techniques, radioactive pollution: sources, effects, treatment & disposal, Solid Waste Management, Weapons of mass destruction,

biological weapons, chemical weapons, disarmament & peaceful uses of chemistry in day to day life. Green Chemistry, 12 principles of green chemistry, application of green chemistry in industrial processes, Renewable & Non-renewable energy resources & Primary & Secondary energy resources, Polymers, Organic Reaction Mechanism, Stereochemistry of Carbon Compounds, Basic concepts of spectroscopy, UV-VIS spectroscopy, applications, Fundamentals of Microwave & IR spectroscopy & its applications, determination of molecular structure.

List of Experiments

1. Inorganic qualitative analysis: Detection of acid radicals.
2. Inorganic qualitative analysis: Detection of basic radicals.
3. Estimation of available chlorine in bleaching powder sample.
4. Thin layer chromatography: Separation of given amino acids by TLC method.
5. Determination of rate constant of a first order reaction by titrimetric method.
6. Spectrophotometry: Verification of Beer's law.
7. Conductometric measurements: Determination of strength of unknown HCl solution by conductometric titration.
8. Qualitative analysis of single solid organic compounds: Detection of characteristic elements (N, Cl, Br & I) by chemical tests.
9. Qualitative analysis of single solid organic compounds: Detection of functional groups by systematic chemical tests.
10. Flame photometry: Determination of Na & K in water sample.

Text/Reference Books

1. Environmental Sciences towards sustainable future. Wright R. Prentice Hall of India. 2007.
2. Essentials of Ecology & Environmental sciences. Rana S.V.S. 3rd Ed. Prentice Hall of India. 2007.
3. Ecology. Subrahmanyam S & Sambamurty S. S. 2nd Ed. Narosa Publishing House. 2007.
4. Concepts of Ecology. Kormondy E. J. 4th Ed. Prentice Hall of India Pvt. Ltd. 2007.
5. Textbook of Environmental Studies for Undergraduate Courses. Bharucha E. 2nd Ed. University Grants Commission. New Delhi. 2004.

6. Advanced Inorganic Chemistry. Cotton F. A. & Wilkinson G. 3rd Ed. Wiley Eastern Ltd. 1972.
7. Inorganic Chemistry. Shriver D. J. Atkins P. W. & Langford C. H. 2nd Ed. ELBS. 1994.
8. Organic Chemistry. Pine S. H. 5th Ed. McGraw-Hill. 1987.
9. Fundamentals of Molecular Spectroscopy. Banwell C. N. & Mc Cash E. M. 4th Ed. McGraw-Hill. 1962.
10. Introduction to Molecular Spectroscopy. Barrow G. M. 5th Ed. McGraw-Hill 1962.
11. Green Chemistry Engineering. Doble M. & Kruthiventi A.K. Academic press.2007.

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Semester - II

(Humanities & Basic Sciences Subject)

MA-152
Mathematics - II

L-T-P-C
3-1-0-4

Objective: *The objective of the course is to make the students familiar with certain important mathematical techniques involving complex analysis & transforms which have applications in various disciplines of Engineering & Technology.*

Course Content

Complex Analysis: Complex Variables: Limit, continuity, differentiability & analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, independence of path, existence of indefinite integral, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros & singularities, Residue theorem, evaluation of real integrals.

Transform Calculus: Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First & second shifting properties, Laplace Transform of derivatives & integrals, unit step functions, Dirac delta-function, error function. Differentiation & integration of transforms, convolution theorem, inversion, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial & boundary value problems. Fourier Transform, Fourier sine & cosine transforms. Linearity, scaling, frequency shifting & time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems. Brief Introduction of Z-Transform, Mellin transform & Wavelet Transform.

Fourier Series : Periodic functions, Fourier series representation of a function, half range series, sine & cosine series, Fourier integral formula, Parseval's identity.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B. V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Complex Analysis for Mathematics and Engineering. Mathews J. H. & Howell R. W. 3rd Ed. Narosa. 1998.
3. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
4. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2009.
5. Complex Variables- Introduction and Applications. Ablowitz M.J. & Fokas A.S. Cambridge University Press. 1998.
6. Complex Variables and Applications. Brown J.W. & Churchill R.V. 7th Ed. McGraw-Hill. 2004.

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Semester - II

(Humanities & Basic Sciences Subject)

PH-152
Physics - II

L-T-P-C
3-0-1-4

Objective: *The objective of this course to introduce the notion of quantum physics & its applications in understanding the electrical, thermal & magnetic properties of various materials, band theory of solids, nanostructures, lasers, superconductivity & its applications.*

Course Content

Nature of waves & particles, Wave-packets & uncertainty, Wave particle duality, Wave mechanics & its mathematical tools, Classical & quantum statistics, Statistics of discrete energy levels, Black body spectral density, Bose condensation; Free electrons, density of states, Kronig-Penny model, Effective mass, Band structure, Electrons in various types of solids, Particle in quantum well, Harmonic oscillator & Hydrogen atom problems, Application to semiconductor doping, Nonperiodic materials; Tunneling of particles & examples, Tunneling through multiple barriers & semiconductor junctions; Interaction among quantum wells: materials under electric & magnetic fields, magnetic resonance effects; Nanostructures – Concepts of electrons in low dimensional confinement, Quantum wells & Super-lattices leading to new device concepts; Lasers – Einstein coefficients, Population inversion, Light amplification, Optical resonators, Characteristics of lasers; Superconductors –Vortex, Flux quantization, SQUID, Levitation & its applications.

List of Experiments

1. Determination of Planck's constant using Light Emitting Diode
2. Determination of temperature coefficient, reverse saturation current and energy band gap of a P-N junction
3. Determination of the energy band gap of semiconductor using four-probe method
4. Determination of the charge carrier concentration & Hall coefficient of a given semiconductor using Hall experiment setup
5. Determination of the ratio of e/m for the electron using the helical method
6. Determination of electronic charge by Millikan's oil drop method
7. Determination of velocity of ultrasonic waves using quartz crystal
8. Determination of wavelength of He-Ne laser using millimeter scale as a grating
9. Determination of wavelength of Diode laser using single slit / double slit & obtain diffraction patterns of different apertures
10. Determination of numerical aperture of an optical fibre cable
11. Determination of capacitance of a parallel plate capacitor with & without dielectric material
12. Determination of the height of a distant object/building with the help of sextant

Text/Reference Books

1. Concepts of Modern Physics. Beiser A. 5th Ed. McGraw-Hill.1995.
2. Modern Physics. Krane K.S. 2nd Ed., John-Wiley. 1995.
3. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles. Eisberg R. & Resnick R. 2nd Ed. John-Wiley. 1985.
4. Introduction to Solid State Physics. Kittel C. 7th Ed. John-Wiley India Pvt. Ltd. 1995.
5. Solid State Physics. Pillai S. O. 6th Ed. New Age International Publishers Ltd. 2009.
6. Semiconductor physics and devices. Neamen D. 4th Ed. McGraw-Hill. 2011.

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EP-199/EP-299/EP-399/EP-499

L-T-P-C

Endeavour Project (Beyond the Syllabus)

0-0-0-3

Our University is continuously looking at innovative ways to deliver knowledge to our students, making learning & delivery mechanism innovative, interesting & easy with truly 'out of the box' teaching-learning process. This beyond the syllabus initiative uses all working second Saturdays as class days.

Endeavour is a compulsory interdisciplinary project for all students of the University. Respective Heads of the Department shall select students & form groups. Each project shall be supervised by a faculty member.

The faculty of SPSU will select a contemporary topic, which is preferably industry relevant & associate a company or professional who can provide application-oriented perspective. The topic chosen may be from wide range of subjects. For example: - Biodiversity, Social subjects, Media & advertisement, Environment, Scientific, Technical, Management, Architecture, Tourism or any other subject or their combination.

The project is evaluated in two phases: Internal Evaluation & External Evaluation. This ensures descriptive assessment of the projects performance & challenges faced during the implementation of the project. The project will be spread over two semesters beginning from the odd semester (July to November) & ending in the even semester (December to May) every year. The grade obtained in this course may be used to improve the student's semester grade point average.

The final report should include the reasons for the choice of the title, the concept, the structure, the results with working models/drawings etc. & its practicality. The role & responsibility of every individual of the group should be indicated clearly. The report should be written in the prescribed format/guidelines, certified by the faculty member & presented as a seminar.

The project is evaluated as per the approved procedure & marks obtained are computed in the even semester.

**Detailed Syllabus for B. Tech. Degree Programme
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Semester - III

(Departmental Core Subject)

MN-253
Mining Geology - I

L-T-P-C
3-0-1-4

Objective: *To develop a basic understanding of the rocks, its various properties, mineralogy and to establish the importance of geological sciences in mining engineering.*

Course Content

Branches and scope of geology in mining; weathering of rocks, geological time scale; plate tectonics; mineralogy; physical, chemical and optical properties of minerals; polymorphism, isomorphism and crystallography, petrology; formation, texture, structure and classification of various types of rocks; structural features of rocks; folds, faults, joints and unconformities; remote sensing; nature of electromagnetic radiation, electromagnetic spectrum and energy; remote sensing platforms and sensor's characteristics, advantages and limitations of remote sensing in various fields of mining engineering.

List of Experiments

1. Study of rocks and minerals under hand specimen.
2. Study of geomorphic and crystal models under hand specimen.
3. Plotting of volcanic belts of World and India.
4. Plotting of structure/tectonic map of India.
5. Determination of hardness of rocks and minerals.
6. Interpretation of aerial photographs with the help of stereoscope.

Text/Reference Books

1. A Text Book of Engineering and General Geology, Singh P., 3rd Edition. Katson Publications.
2. A Text Book of Applied Engineering Geology, Maruthesha Reddy M.T., New Age International. 2013.
3. A Text Book of Geology, Mukherjee P.K., The World Press Pvt. Ltd., Calcutta. 2010.

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Semester - III

(Departmental Core Subject)

MN-254
Elements of Mining

L-T-P-C
3-0-0-3

Objective: *This subject introduces the field of mining and provides basic input about mining unit operations. It deals with history of mining and describes the correlation between the development of mining and cultural progress.*

Course Content

Mineral resources of Rajasthan, India and World; Mining of important economic minerals in India; Various terms used in mining; Stages in the life of the mine, Introduction to unit operations, Economical, Social, Environmental and Health impacts of Mining. Prospecting: Reconnaissance; principles and methods of prospecting - pit, shaft, trench and boreholes; Principle, method, Work schedule and application of Geologic, Geophysical, Geochemical, Electrical, Electromagnetic, Gravity methods of prospecting, Sampling techniques; planning a prospecting programme Application of Remote Sensing and GIS in mineral prospecting. Exploration: Boring, Principles of boring, Selection of sites for boreholes; Surface layout of boring; Details of equipment, Core recovery, 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 Explosives: Classification and comparative properties of explosive; Modern explosives, Mechanisms of rock blasting; Blasting devices; Electric and non -electric methods; Delay blasting techniques; Priming; Charge distribution; Blasting with cut and solid blasting, General application and uses; Safety considerations. Pre mining, mining and post-mining: ancillary mining operation, Types of entries to mineral deposits – Shaft, Incline, Adit –applicable conditions- limitations.

Basic concepts of surface and underground mining, Comparison of underground and surface mining.

Text/Reference Books

1. High Technology in Drilling and Exploration. Chugh C. P. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Diamond Drilling. Chugh C.P. Oxford & IBH Publisher.
3. Introductory Mining Engineering. Howard & Hartman L. John Willey & Sons
4. Engineering Rock Blasting Operations. Bhandari S. A .A. Balkema Publisher. USA
5. Principles & Practices of Modern Coal Mining. Singh R. D. New Age International Pvt. Ltd. New Delhi.

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Semester - III

(Departmental Core Subject)

CE-251	L-T-P-C
Solid Mechanics	3-1-1-5

Objective: *The objective the course is to develop an understanding about various causes of failure of a component. The students undertaking this course will understand to calculate key parameters i.e. stress and strain etc. for safe designing of a component.*

Course Content

Force Transmission and Deformation, continuum, isotropy, homogeneity, conservation of linear momentum, angular momentum and mass, Cauchy Axiom and definition of stress tensor, equation of equilibrium, Principal stress and Principal plane, Strain at a Point: Displacement of a point and relative displacement of line segments, Green Lagrange strain tensor and small strain tensor, Compatibility requirements, Constitutive relations, Relationships between various material constants for linear elastic materials, Boundary Value Problems, Energy Formulation for deformable body: Principle of minimum potential energy, Virtual work method, Failure criteria for materials, Uniaxial tension in bar, thermal stresses. Torsion of right circular section and non-circular section, Bending of Beams, bending moment and shear force diagrams, Stresses due to shear, Shear center, Deflection of beams, Buckling of Columns: Euler's formula, different end conditions and effective length, energy method.

List of Experiments

1. Tension test
2. Compression test
3. Flexure test
4. Impact test
5. Torsion test
6. Hardness test

Text/Reference Books

1. Mechanics of Materials. Gere J. M. & Timoshenko S. P., 4th Ed. CBS Publisher. 1996.
2. Solid mechanics. Kazimi S.M.A, First revised edition. Tata McGraw Hill. 2006.
3. Introduction to Solid Mechanics. Pitarresi J.M. Prentice Hall of India. 2000.

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Semester - III

(Departmental Core Subject)

ME-256
Thermal Engineering

L-T-P-C
3-0-1-4

Objective: *This course introduces the engineering applications of thermodynamic principles. This course discusses steam power cycles as applied to various machines and instruments associated with thermal engineering. The course deals with the application of thermodynamics principles to understand working and analysis of problems related to internal combustion engine, gas turbines and related systems. This course also gives an insight about the combustion thermodynamics of the above systems.*

Course Content

Thermodynamic systems; States, processes, heat and work; Zeroth law; First law; Properties of pure substances and steam, Mollier diagram; Second law, Carnot cycle, entropy, corollaries of the second law; Application of first and second laws to closed and Open systems;

I. C. Engines: Classification - SI, CI, two-stroke, four-stroke etc., operating characteristics – mean effective pressure, torque and power, efficiencies, specific fuel consumption etc., air standard cycles – Otto, Diesel and dual, real air-fuel engine cycles, self-ignition, octane number, cetane number, combustion – combustion in S.I. and C.I. engines, pressure-crank angle diagram, air-fuel ratio, Gas Power Cycles, Vapour Power Cycles: Carnot cycle, Rankine cycle, reheat cycle, regenerative cycle, back-pressure and extraction turbines and cogeneration, ideal working fluid and binary/multi-fluid cycles; Heat Pump and Refrigeration Cycles: reversed Carnot cycle and performance criteria, vapour compression and vapour absorption refrigerators,

refrigerants and environmental issues; Reciprocating Air Compressors: work transfer, volumetric efficiency, isothermal efficiency, multistage compression with intercooling.

List of Experiments

1. Comparative study of four stroke diesel and petrol engines.
2. Comparative study of two stroke petrol and diesel engines.
3. Studies of fuel supply systems of diesel and petrol engines.
4. To find the BHP, Thermal efficiency of four stroke diesel engine.
5. To calculate efficiencies of single and multi-stage Air Compressors.
6. Load test on a single cylinder 4-stroke diesel engine using a rope brake dynamometer and calculate volumetric and thermal efficiency and draw a heat balance-sheet.
7. Study of cooling, lubrication and ignition system in diesel and petrol engines.
8. Tonnage capacity of the air conditioning system
9. Actual and theoretical cop of the air conditioning System
10. Plotting refrigeration cycle on p-h chart.

Text/Reference Books

1. Engineering Thermodynamics Work and Heat Transfer. Rogers G. F. C. and Mayhew Y. R. 4th Ed. Pearson. 2001.
2. Gas Turbine Theory. Saravanamuttoo H. I. H., Rogers G. F. C. & Cohen H. 4thEd. Pearson. 2003.
3. Engineering Fundamentals of the Internal Combustion Engine. Pulkrabek W. W. PHI. 2002.
4. Internal Combustion Engines. Fergusan C. R. & Kirkpatrick A. T. John Wiley & Sons. 2001.
5. Applied Thermodynamics for Engineering Technologists. Eastop T. D. & McConkey A. 5th Ed. Pearson. 2003.
6. Power Plant Technology. ElWakil M. M. McGraw Hill International. 1992.
7. Powerplant Engineering. Nag P. K. 2nd Ed. Tata McGraw Hill. 2002.

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Semester - III

(Departmental Core Subject)

ME-257
Solid Modeling Lab

L-T-P-C
0-0-2-2

Objective: *This course is designed to give the students practical knowledge about the virtual design. The students would learn how to make a solid model and analyze it.*

List of Experiments

1. Introduction to the solid modeling
2. Basics of sketcher geometry, tools & datum features
3. Dimensioning commands and principles
4. Extrusion and ribs
5. Holes, chamfer, shells & round commands
6. Exercises on group, copy, mirror commands
7. Pattern commands
8. Practice on Revolve, sweep, protrusion commands
9. Assembly with constraint
10. Introduction to sheet metal design
11. Primary and secondary sheet metal wall features
12. Modifying sheet metal models
13. Working drawing

Text/Reference Books

1. ATC's Part (Basic) & Assembly Modeling(Basic) - Creo 2.0, PTC, PL-2019-01 Arbortext, 2012.
2. ATC's Part (Adv) & Flexible Modeling -Creo 2.0, PTC, PL-2049-01 Arbortext, 2012.
3. ATC's Assembly (Adv), SheetmetalModeling & Detailing - Creo 2.0, PTC, PL-2020-01 Arbortext, 2012.

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Semester - III

(Humanities & Basic Sciences Subject)

HU-251 L-T-P-C
Business & Technical Communication 1-1-0- 2

Objective: *To develop persuasive and professional competence and awareness about cross cultural communication.*

Course Content

Technical Report Writing: Characteristics and structure of a formal report; Classification and types of reports; Organization, Analysis and Interpretation of data; Revising, Editing and Proof reading in accordance with universally accepted standard practices, especially in areas like abstracting/summarizing as well as in citations, references and bibliographies.

Presentation Skills: Types of presentation; Effective strategies for oral presentations - audience analysis; organizing contents and use of media; Awareness of body language, time and space; Tone, variety of pitch, rate, volume and Articulation.

Cross Cultural Communication: Opportunities and challenges of communication in a diverse world; Sensitivity to culture and diversity; Intercultural communication skills - need for attitude change and benefits; Kinesics, Proxemics, Para linguistics.

Critical Appreciation of seminal texts and selected films.

Text/Reference Books

1. How to Prepare, Stage and Deliver Winning Presentations. Leech T. 2nd Ed. Prentice Hall. 2004.
2. Writing Good Reports. Bowden J. 9th Ed. Viva Books. 2013.
3. Business Communication Today. Boove C and Thill J. 11th Ed. Prentice Hall. 2011.
4. Intercultural Communication in the Global Workplace. Beamer L. 5th Ed. Tata McGraw-Hill Publishing Company Ltd. 2011.

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Semester - III

(Humanities & Basic Sciences Subject)

MA - 251
Mathematics - III

L-T-P-C
3-1-0-4

Objective: *In this course the student is familiarized with some important Mathematical techniques used in various branches engineering.*

Course Content

Ordinary Differential Equations: higher-order linear differential equations with variable coefficients, method of variation of parameters, operator method; series solutions of linear differential equations, Legendre equation & Legendre polynomials, Bessel equation & Bessel functions of first & second kinds; systems of first-order equations, phase plane, critical points, stability. Numerical solutions of IVP - Difference equations, stability, error & convergence analysis. Single step methods – Taylor's series method, Euler's method, Picard's method of successive approximation, Runge Kutta Method. Multi step methods - Predictor-Corrector method, Euler PC method, Milne & Adams Moulton PC method.

Partial Differential Equations: First order partial differential equations; solutions of linear & nonlinear first order PDEs; classification of second-order PDEs; method of characteristics; boundary & initial value problems (Dirichlet & Neumann type) involving wave equation, heat conduction equation, Laplace's equations & solutions by method of separation of variables (Cartesian coordinates); initial boundary value problems in non-rectangular coordinates.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education. 2006.
2. Elements of Partial Differential Equations. Sneddon I.N. McGraw Hill.1957.
3. Differential Equations. Ross S. L. 3rd Ed. Wiley .1984.
4. Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem. Haberman R. 4th Ed. PH. 1998.
5. Applied Numerical Analysis. Gerald C. F. & Wheatley P. O. 6th Ed., Wesley.1999.
6. Elementary Differential Equations and Boundary Value Problems. Boyce W. E. & DiPrima R.C. 9th Ed. Wiley. 2009.
7. An Introduction to Ordinary Differential Equations. Coddington E. A. 2nd Ed. PHI. 1995.

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Semester - IV

(Departmental Core Subject)

MN-261
Mining Geology - II

L-T-P-C
3-0-1-4

Objective: *To provide an understanding of some of the concepts necessary for mineral exploration, various mineral prospecting methods, to give an overview on the different mining and ore dressing methods and to introduce the students to mining economics.*

Course Content

Stratigraphy; its introduction, standard stratigraphic scale, principle of stratigraphic correction; geology of India in brief; fossil fuels; economic geology; ore, gangue, tenore and grade; classification of mineral deposits; occurrence, shape, form, size, mineral composition and texture of various process generated mineral deposits; hydrogeology and its impact on mining; geological mapping, topographic maps; effects of topography on outcrops, computer based geological data plotting and preparation of map; sampling and reserves estimation; mine sample reduction; prospecting and exploration; definition' kind and degree of exploration; geological, geophysical, geo-chemical and remote sensing methods.

List of Experiments

1. Study of stereographic projection.
2. Study of topographic maps.
3. Calculation of attitude, thickness and depth of orebodies.
4. Identification of fracture patterns in rose diagram.
5. Completion of outcrops: 1- and 3- point problems.
6. Study of map illustrating 'V' rules.

Text/Reference Books

1. Stratigraphic Principles and Practice, Weller J.M., 3rd Ed. Universal Book Stall. Delhi.
2. Precambrium Geology of India, Rogers J.J.W. Oxford University Press.
3. Fundamentals of Historical Geology & stratigraphy of India, Kumar R., 2nd Ed. Wiley Eastern Pvt. Ltd. Delhi.

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Semester - IV

(Departmental Core Subject)

MN-262

Mine Machinery - I

L-T-P-C

3-0-0-3

Objective: *The subject deals with wire ropes, aerial ropeway, rail transportation and other conveyor systems.*

Course Content

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: Usage, chemical composition, infield tests of wire, classification of wire ropes, Wire ropes used in mines-their applicability, construction, installation, maintenance, causes of deterioration, precautions, selection parameters, Various tests, computation of numerical problems on size - Weight and strength of wire ropes, space factor, Capping and recapping of wire ropes, classification - description of capping methods – splicing methods, description of splicing and change of ropes Aerial Ropeway: Different types, their suitability, advantages, limitations, construction, installation, operation and maintenance, layouts and working of terminal, loading, unloading, change over, turning station , rope tensioning arrangements Rail Transportation: Purpose of transportation, comprehensive classification of transportation – Various haulage systems, their applications, merits, and demerits, safety devices in haulage system, laying and maintenance of track, gauge selection, constructional details of mine tub/car, factors of selection for rope/loco haulage, computation problems for determination of loco parameters, rope haulage engine H.P. rope size, breaking strength, tub capacity, number of tubs Conveyor haulage: Conveyor usage, different types and applicability, their construction,

installation and maintenance, belt conveyor system, different types of belt constructions, safety devices merits, demerits and limitations of Belt conveying system, belt tensioning arrangements, sequentially controlled conveyors, compilation of numerical problems to find the material quantity, H.P., length and inclination of haulage, tensing strength, breaking strength of belt, amount of slip etc.

Text/Reference Books

1. Surface Mining. Mishra G. B. Geo Minetech Publisher. Bhubneshwar.
2. Mine Hoisting. Ramlu M. A. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Mine Transport. Karelin. Orient Longmans Ltd. New Delhi.
4. High Technology in Drilling and Exploration. Chug C. P. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Principles & Practices of Modern Coal Mining. Singh R. D. New Age International Pvt. Ltd. New Delhi.

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Semester - IV

(Departmental Core Subject)

MN-263
Mine Development

L-T-P-C
3-0-0-3

Objective: *The subject deals with mine entries, mine structures, shaft sinking, drifting and stope development.*

Course Content

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

Text/Reference Books

1. Introductory Mining Engineering. Howard & Hartman L. John Willey & Sons.
2. SME Mining Reference Handbook. Lowrie R. SME Publication. 2002.
3. Underground Mining Methods. Hustrulid W. A. & Bullock R. SME Publication.

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Semester - IV

(Departmental Core Subject)

CE-255
Surveying - I

L-T-P-C
3-0-1-4

Objective: *To impart the knowledge of basics of surveying used in design of various infrastructures like highways, railroads, bridges, tunnels, buildings & utilities.*

Course Content

Introduction to surveying; linear measurements; chain surveying; compass surveying; accuracy, precision and errors, leveling; plane table; contouring, theodolite surveying

List of Experiments

1. Ranging & chaining
2. Chain & cross staff survey
3. Compass survey
4. Level by collimation plane method & rise & fall method
5. L-section of road with Dumpy Level
6. Theodolite traversing
7. Area of irregular figure by using Planimeter
8. Plain table traversing two point problem
9. Contouring

Text/Reference Books

1. Surveying & Leveling, Vol-I & Vol-II. Kanetkar T.P. & Kulkarni S.V. Pune Vidyarthi Griha Prakshan. 1972.
2. Surveying, Vol-I & Vol-II. Punmia B.C. & Jain A.K. Laxmi Publication Pvt., 1996.
3. Remote Sensing & Image Interpretation. Lillesand T.M. & Kiefer R.W. John Wiley & Sons, 1994.

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Semester - IV

(Departmental Core Subject)

ME-269	L-T-P-C
Fluid Mechanics & Hydraulic Machinery	3-1-1-5

Objective: *This course discusses some of the basic concepts of hydrostatics and hydrodynamics and their applications in engineering such as various types of fluid flows. It also discusses various types of hydraulic machines, their working principles and applications with special emphasis on centrifugal pumps, positive displacement pumps and hydro-turbines.*

Course Content

Review of fluid properties and fluid statics. Hydraulic forces on submerged surfaces; forces on vertical, horizontal, inclined and curved surfaces. Kinematics of fluid flow: fluid flow and classifications. Continuity equation in 1D & 3D. Potential flow & Stream function; types of flow lines. Dynamics of fluid: equations of motion; Euler's equation; Bernoulli's equation; Applications of Bernoulli's equation. Momentum Analysis of flow systems; the linear momentum equation for steady flow, differential approach. Flow through pipes; Darcy – Weisbach equation of friction loss; hydraulic grade line and total energy line. Basic principle for flow through orifices, V-notches (rectangular-v), weirs (rectangular). Flow through open channels; use of Chezy's formula. Dimensional Analysis & Model investigation applied to flow systems – Buckingham Pi theorem. Dimensionless numbers in fluid flow. Flow of fluid around submerged bodies; basic concepts of drag and lift. Boundary layer – definition; Boundary layer separation – basic concept. Hydraulic Turbines; Principles and Classifications; Design & working principle of a Pelton Wheel, efficiency and performance curves. Francis Turbine, Kaplan Turbine. Function of Draft Tube. Cavitation in Turbines. Reciprocating Pumps: Components

&Principles, Classification, discharge, work done, power requirement. Centrifugal pumps: Components, working principle, head & efficiency. Multistage Centrifugal pumps. Pump characteristics, NPSH & Cavitation.

List of Experiments

1. Calibration of venturimeter
2. Calibration of orificemeter
3. Calibration of rotameter
4. Calibration of rectangular and V-notches
5. Determination of friction factor of pipes
6. Determination of loss coefficients of pipe fittings
7. Determination of jet impact on plane surface
8. Determination of jet impact on hemispherical surface
9. Performance characteristics of variable speed centrifugal pump
10. Performance test of reciprocating pump
11. Performance test of a Pelton wheel turbine
12. Performance characteristics of Francis turbine

Text/Reference Books

1. Fluid Mechanics. White F. M. 6th Ed. Tata McGraw-Hill. 2008.
2. Introduction to Fluid Mechanics. Fox R.W., McDonald A.T. & Pritchard P.J. 6th Ed. John Wiley. 2004.
3. Fundamentals of Fluid Mechanics. Munson B.R., Young D.F. & Okhiishi T.H. 5th Ed. Wiley India Edition. 2002.
4. Fluid Mechanics. Douglas J.F., Gasiorek J.M., Swaffield J. A. & Jack L.B. Pearson Education. 2008.
5. Fluid Mechanics. Cengel Y. A. & Cimbala J.M. Tata McGraw-Hill. 2006.

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Semester - IV

(Departmental Core Subject)

ME-270	L-T-P-C
Theory of Machines	3-1-1-5

Objective: *The student acquires the skills for analyzing linkages, cams, gears and other mechanisms. It also discusses the dynamics of various machine parts with special emphasis on force and moment analysis of various machine elements.*

Course Content

Introduction to simple mechanisms, different types of kinematics pairs, Grubler's rule for degrees of freedom, Grashof's criterion for mobility determination, Inversions of 3R-P, 2R-2P chains, Kinematics analysis of planar mechanism, velocity and acceleration analysis. Friction Thread friction, pivot and collar friction, clutches, belt and rope drives, friction axis, friction circle. Cams: Classification, Cams with uniform acceleration and retardation, SHM, Cycloidal motion, oscillating followers. Gears: Geometry of tooth profiles, Law of gearing, involutes profile, interference, helical, spiral and worm gears, simple, compound gear trains. Epicyclic gear trains Analysis by tabular and relative velocity method. Vibrations: Vibration analysis of SDOF systems, natural, damped, forced vibrations, base-excited vibrations, transmissibility ratio. Dynamic Analysis: Slider-crank mechanism, turning moment computation Balancing: Static and dynamic balancing, balancing of revolving and reciprocating masses, single and multi-cylinder engines. Gyroscopes: Gyroscopic law, effect of gyroscopic couple on automobiles, ships, aircraft.

List of Experiments

1. Conduction of static & dynamic balancing system
2. Determination of gyroscopic effect of a rotating disc
3. Experiment on Watt & Porter governor system
4. Demonstration of various mechanisms
5. Experiment on Proell & Hartnell governor system
6. Demonstration of various gear systems
7. Determination of time period of oscillation and radius of gyration
8. Determination of time period of given torsional pendulum damping torsional coefficient
9. Determination of the natural frequencies of 2 d.o.f rotor
10. Determination of the time period of undamped free vibration of equivalent spring mass system & study the forced vibration of the beam for different damping constants

Text/Reference Books

1. Kinematics, Dynamics and Design of Machinery. Waldron K. J. & Kinzel G. L. 2nd Ed. Wiley Student Edition. 2004.
2. Theory of Mechanisms, and Machines. Ghosh A. & Mallik A. K. 3rd Ed. East West Press Pvt Ltd. 2009.
3. Theory of Machines and Mechanisms. Uicker J. J., Pennock G. R. & Shigley J. E. 3rd Ed. Oxford International Student Edition. 2009.
4. Theory of Machines. Rattan S. S. 3rd Ed. Tata McGraw Hill. 2009.
5. Mechanism and Machine Theory. Rao J. S. & Duggipati R. V. 2nd Ed. New Age International. 2008.
6. Mechanism Design: Analysis and Synthesis. Vol.1. Erdman A. G. & Sandor G. N. PHI Inc. 1997.
7. Theory of Machines. Bevan T. CBS Publishers & Distributors. 1984.

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Semester - IV

(Open Elective - I)

HU-252	L-T-P-C
Language through Literature & Films	0-2-0-2

Objective: *To introduce the nuances of English Literature and develop reflective, creative and literary abilities.*

Course Content

The Eyes Have It - Ruskin Bond

Appro JRD – Sudha Murthy

Bacon - Of Study; Of Youth and Age

Douglas Malloch - Be the best of whatever you are

Rabindranath Tagore - Where the mind is without fear

Enhancement of emotional, creative and social quotient through viewing and discussions on selected films

Text/Reference Book

1. Literature and Language Teaching: A Guide for Teachers and Trainers. Lazar G. Cambridge University Press. 2008.

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Semester - IV

(Open Elective - I)

BM-270
Foundations of Economic Science

L-T-P-C
2-0-0-2

Objective: *The objective of this course is to learn completion of projects by optimizing production with limited resources and also to know infrastructure and development needs of a country and perform tasks accordingly.*

Course Content

Engineers and Economics: Meaning of economics, why engineers should know economics, important basics: consumption, production, exchange, distribution and public finance, cost of production and revenue through sales

Consumption and Pricing: Cardinal and Ordinal approach to Utility, Laws of Diminishing Marginal Utility and Equi-marginal Utility, Demand: Meaning, Law, Types, Elasticity of Demand: Meaning and Degrees. Laws of Supply, Pricing of all products: Theory and practice.

Factors of Production & Markets: Land, Labour, Capital, Organization and Enterprise, Laws of Returns, Classification of Markets: Perfect and Imperfect competition including Monopoly, Discriminative Monopoly and Oligopoly.

Financial Aspects of Engineering: Money and Finance, An overview of Banking, Money Market, Capital Market, Public Finance and Private Finance, Direct and Indirect Taxes, Canons of Taxation, National Income.

Developmental Aspects of Engineering: Underdevelopment, Stages of economic development, Economic Growth, Growth Theories Economic Reforms: LPG. Application of financial accounting techniques for engineering projects.

Text/Reference Books

1. Textbook of Economic Theory. Stonier A.W. & Hague D.C. 5th Ed. Longman Higher Education. 1980.
2. Introduction to Positive Economics. Lipsey R.G. & Chrystal K.A. 8th Ed. Oxford University Press. 1995.
3. Business Economics (Micro). Shankar G. Nirali Prakashan. 2014.
4. Micro Economic Theory. Jhingan ML. 7th Ed. Vrinda Publications Pvt. Limited. 2014.
5. Managerial Economics. Theory and Application. Mithani D.M. 7th Ed. Himalaya Publishing House Pvt. Ltd. 2013.
6. Micro economics. Pindyck R.S., Rubinfeld D.L. & Mehta P.L. 7th Ed. Pearson Education India. 2009.

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Semester - V

(Departmental Core Subject)

MN-351
Strata Control

L-T-P-C
3-0-0-3

Objective: *The subject deals with Strata and ground movements, subsidence, supports, stowing and mine openings.*

Course Content

Strata and ground movements: Strata conditions before and after mining operations- Theories of mechanics of strata behavior. Strata pressure redistribution in and around Bord and pillar and long wall workings. Surface movements and deformation during Bord and pillar and longwall mining subsidence: causes and impact, mechanics and theory of subsidence, angle of draw and angle of fracture, factors affecting subsidence, protective measures, subsidence measurements, estimation of vertical and lateral movements, subsidence monitoring and prediction, sub-critical, critical and super-critical widths of extraction supports: necessity, materials used, classification of supporting systems, applicability of various types of supports, size and shape of supports, rigid and yielding props, constructional details of friction and hydraulic props, principle of roof bolting, stitching-merits and demerits of bolting, self-advancing powered supports, method of setting various supports at different locations, systematic supporting, clearance of roof collapse, withdrawal of supports stowing: applicability conditions, classification, advantages & limitation, factors influencing and description of various methods of goaf stowing, surface and underground arrangements and precautions with stowing, sand gathering methods manual, shovel, pontoon, pumping of sand slurry, transportation of sand, mixing chambers, hydraulic profile, face arrangements. Pneumatic and hydraulic stowing, their applicability, merits and demerits. Comparison of

various mining methods. Mine openings: stress distribution around narrow and wide openings. Extent of failure around mine openings. Determination of size of opening and extent of failure. Determination of shape and size of pillars in coal and hard rock mines, shaft pillars, barrier pillars. Slopes: Types of slope failure; analysis of slope failure, failure affecting slope stability. Caving: Mechanics of caving. Induced caving subsidence: mechanics of surface subsidence; theories of subsidence. Discontinuous and continuous subsidence; monitoring, prediction, control and management of subsidence. Rock bursts and bumps.

Text/Reference Books

1. Principles & Practices of Modern coal mining. Singh R.D. New Age International Pvt. Ltd. New Delhi.
2. Rock Mechanics and design of structures in rock. Obert & Duall. John Willey & Sons
3. Experimental stress analysis. Railey & Dalley. McGraw Hill Book Company.
4. Elements of Mechanics of Mining Ground. Verma B. S. Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
5. Handbook of Mechanical properties of rock Vol.I&II. Vutukuri & Lama. Transtech, Germany.
6. Coal Mine Ground Control. Peng S. S. John Willey & Sons.

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Semester - V

(Departmental Core Subject)

MN-352
Surface Mining

L-T-P-C
3-0-0-3

Objective: *To develop an understanding of surface mining equipment and its operations in a surface mine. To achieve the ability to classify and select surface mining methods and understand the slope failures in a surface mine and study the concept of waste dump formations.*

Course Content

Applicability: Applicability, advantages 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, Determination of mine parameters. Opening of Deposits: Box cut, site selection and driving, Formation of benches. Trenches, Driving of entry and opening trenches; lying of communication routes, Different methods of opening up the deposits Overburden Removal: Systems of overburden removal and disposal; Site selection for disposal, Design of waste dumps, 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) Blast hole drilling: Types of drilling equipment, Selection of Drills; Drilling concepts – Operation and performance, Drilling patterns, Inclined drilling, Computation of Productivity of Drill Machines; Control of dust. Blasting: Choice of explosive; Blast round design, Blasting calculation for charges, Mode and points of initiation; Sequence of blasting and delay interval; Multi row blasting, Blast hole deviation, Inclined hole blasting; Fragmentation monitoring; Secondary blasting; Blasting hazards - noise,

ground vibration, fly rock, dust & air over pressure and their remedial measures
Excavation Machinery: Different Types of Excavators used in Open Pits; Shovel, Dragline, Hydraulic Excavators, Multi Bucket Excavators, Front end loaders, Selection criteria, Their Construction, Operation, Suitability and Applicability; Calculation of Their Productivity. Transportation: Rail, Road, Pipe line, Conveyors and aerial ropeway transportation systems; Their Suitability, limitations and comparative study; Computation of Their Productivity, Optimization of shovel- dumper combination; Computerized truck dispatch system; Haul road design, construction and safety measures, Steep angle conveyor, high angle conveyor, in pit crushing and conveying, Layouts. Reclamation: Different Types, Applicability, Planning. Drainage: Assessment of water make; Drains, sumps and pumping systems; Pre-drainage through diversion channels and boreholes. Storage: Stockpiling and blending. Spreaders. Reclaimers.

Text/Reference Books

1. Surface Mining. Mishra G. B. Geo Min Tech Publisher. Bhubneshwar.
2. Introductory Mining Engineering. Hartman H. L. John Willey & Sons.
3. Engineering Rock Blasting Operations. Bhandari S.A.A. Balkema Publisher.USA.

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Semester- V

(Departmental Core Subject)

MN-353
Mine Machinery - II

L-T-P-C
3-0-0-3

Objective: *To develop an understanding of various types of windings, their design procedure. It also discusses about different types of pumps used in mines.*

Course Content

Winding I: Head gear arrangement, Shaft fittings and head gear design;, rigid and rope guides; cages types & Construction, their suspension arrangements, Location of winding engine. Electric winders, winding drums, types of construction, duty cycle, Methods of counterbalancing loads; Torque- time & power- time diagram; Pit top and pit bottom arrangements, Types of koepe Winder, Advantages and disadvantages , Koepe wheel, floating platforms Winding II: Mechanical and electrical braking; Electrical & Electronic methods of speed control, Safety devices on winders - depth indicators, Detaching hooks, over speed and overwind preventors, keps, slow banking and other safety devices, Ward Leonard control; Automatic winding;, Multi rope winding, Winding from different horizons, two winders working in the same shaft, winding with side by side and up and down sheaves. skips types & Construction, their suspension arrangements. Design calculation for different types of winding systems; Signaling system used in winding Loader And Transporting Machine: Rocker shovel, gathering arms loaders, LHD and SDL machines- their construction and operation and maintenance cavo loader, shuttle car and underground trucks, its construction, operation and application Layout of faces for working with power loaders under varied conditions Cutter Loaders: Basic principles of cutting and ploughing. Different types of cutter loaders suitable for

long wall and short wall faces, their constructions, operation and maintenance, different types of road headers and continuous miners, their construction, operation and conditions of applicability, Mechanics of rock cutting, rock cutting tools and their performance. Layout of faces working with cutter loaders Mine Pumps: Sources of mine water types of pumps, construction, characteristics and operation, maintenance and selection, pump fittings, Design, installation and maintenance of pumping systems. Series and parallel operations of pumps. Borehole and submersible pumps. Slurry pumps. Airlift pumps. Automatic pump control, special types of pumps used in mines, Design calculations.

Text/Reference Books

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

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Semester – V

(Departmental Core Subject)

MN-354	L-T-P-C
Computer Application in Mining	3-1-0-4

Objective: *To impart knowledge of computer applications in mining industry. It also deals with the development of algorithms on various mining related problems*

Course Content

Importance of computer applications in mining, Different areas of application. 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 Basic Introduction for application of Computers in areas of :Mine Planning & Design- Introduction of mine planning concept. Introduction to numerical methods in Mining. Environmental Engineering. Basic concept of data generation, collection & analysis through computers for environment management. Relevant software application Basic Introduction for application of Computers in areas of 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. Mining Software Mine Planning Software Basic introduction, salient features, planning by different mining software like Geovia SURPAC Software for various applications.

Text/Reference Books

1. Manuals of different software
2. Introductory Mining Engineering. Hartman H.L. and Mutmansky J.M. 2nd Ed. Wiley. 2007
3. Principles and Practices of Modern Coal Mining. Singh R.D. New Age Intl. Publishers.1997.
4. Analysis, Optimization and Simulation Modeling. Albright B. 4th Ed. Cengage. 2012.
5. Simulation. Ross S.M. 4th Ed. Academic Press. 2006.
6. System Simulation. Gordon G. PHI Learning. 2005.
7. System Simulation with Digital Computer. Deo N. P H I Learning. 2006.
8. Sukumar Bandopadhyay, "Application of the Computers and Operation Research in the Mineral Industry" Proceedings of the 30th international Symposium SME Publication, Year of Publication 2002

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Semester - V

(Departmental Core Subject)

MN-355
Mine Computation Lab

L-T-P-C
0-0-2-2

Objective: *The subject deals with strain and stress analysis of rocks, slope stability analysis, mine deposits, designing a drift for metalliferous mining, mine opening, blast design and mine ventilation system.*

List of Experiments

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 Surpac software of massive deposit
7. Detailed planning by 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 condition
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.

Text/Reference Books

1. Manuals of different software
2. SURPAC Surveying Software User's Manual. Young K.W. Surpac. 2014
3. Introduction to Scilab : For Engineers and Scientists. Nagar S. Apress.2017.
4. Engineering and Scientific Computing with Scilab. Gomez C. Birkhäuser. 1999

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Semester - V

(Departmental Core Subject)

CE-356
Surveying-II

L-T-P-C
3-0-1-4

Objective: *To learn about tachometry, geodetic surveying & satellite surveying. To get introduced to different geodetic methods of survey such as triangulation, trigonometric leveling & advanced surveying techniques such as remote sensing, total station, GPS, photogrammetry, etc.*

Course Content

Tacheomatic survey; trigonometrical surveying; triangulation; curves; advanced survey instruments; Electronic Distance Measurement, Total station and Global Positioning System, Introduction to photogram-metry and remote sensing.

List of Experiments

1. Additive & multiplying constants of given tacheometer.
2. Elevation of points & horizontal distance between them by tacheometric survey.
3. Determination of area by tacheometric survey.
4. Trigonometric levelling.
5. Determination of horizontal distance between two inaccessible points with theodolite.
6. Setting out simple curve – offset from chord method.
7. Setting out simple curve – rankine method of tangential angle.
8. Demonstration – EDM instruments & use of total station.

Text/Reference Books

1. Surveying & Levelling. Vol-I & Vol-II. Kanetkar T.P& Kulkarni S.V. Pune Vidyarthi Griha Prakshan. 1972.
2. Surveying. Vol-I & Vol-II. Punmia B.C. Jain A.K. Laxmi Publication Pvt. 1996.
3. Remote Sensing & Image Interpretation. Lillesand T.M & Kiefer R.W. John Wiley & Sons. 1994.
4. Fundamentals of Remote Sensing. Joseph G. Universities Press. 2003.

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Semester- V

(Departmental Core Subject)

EE-359	L-T-P-C
Theory of Electrical Machines	3-1-0-4

Objective: *To expose about the mathematical modeling, characteristics and performance of the D.C. & A.C. Machines as well as three phase Transformers.*

Course Content

Magnetic circuits and transformer including 3-phase transformers; modeling of D.C. machines; phasor diagram of cylindrical rotor and salient pole machines- electromagnetic and reluctance torque, response under short circuit conditions; modeling of induction machines- derivation of equivalent circuits, dynamics under load change, speed reversal and braking, unbalanced and asymmetrical operation; single phase induction motor and applications in domestic appliances; modeling of synchronous machines – equivalent circuit, d-q transformations, short circuit studies in synchronous machines; variable reluctance, permanent magnet, stepper motors and their applications.

Text/Reference Books

1. Electrical Machines. Rajput R. K. 3rd Ed. Laxmi Publications (P) Ltd. 2003.
2. Electrical Machinery and Transformers. Kosow I. L. 2nd Ed. Prentice- Hall of India Pvt. Ltd. 2003.
3. Electrical Machinery and Transformers. Guru B. S. & Hizioglu H.R.3rd Ed. Oxford University.2008.

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Semester - V

(Open Elective - II)

HU-351
Fun with Drama

L-T-P-C
0-2-0-2

Objective: *To stimulate imagination, cultural enrichment and explore multidimensional use of language through drama.*

Course Content

Script writing: Story, structure, character development, dialogue, visuals and language with emphasis on critical and analytical thinking, problem-solving and communication skills

Direction: Techniques and art of play direction with emphasis on methods of actor coaching, rehearsal procedures and presentation of several scenes of varying dramatic styles

Enactment: Controlled use of body and voice, analysis and interpretation of roles, characterization and emotional projection

Analysis: Insightful analysis of various aspects of translating a play from script to stage, director's concepts, visual composition, attention to character development and narrative structure and power of the unspoken word

Text/Reference Books

1. Drama Techniques in Language Learning. Maley A. and Duff A. 3rd Ed. Cambridge University Press. 2005.
2. Drama (Resource Book for Teachers). Wessels C. Oxford University Press. 1987.

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Semester-V

(Open Electives - II)

BM-370
Marketing Management

L-T-P-C
2-0-0-2

Objective: *Marketing is no longer a department charged with a limited number of tasks-it is a companywide undertaking. Marketing succeeds only when all departments work together to achieve goals. The syllabus is designed to serve as an introduction to the theory and practice of marketing to the engineering students. It will help them develop competencies in the use of the modern marketing techniques and their applications in design, development and commercialization of new products and services in the rapidly changing markets.*

Course Content

Introduction: Nature and scope of marketing; Importance of marketing as a business function; Marketing concepts – traditional and modern; Selling vs. marketing; Marketing mix and environment, Marketing Myopia

Consumer Behaviour and Market Segmentation: Significance of consumer behavior; Market segmentation; concepts and importance; Bases for market segmentation,

Product: Concept of product, consumer and industrial goods; Product planning and development: Product life cycle concept, New Product Development, Product Differentiation and Positioning.

Branding: Role of brand and its Significance, Types of Brands, Challenges for Brands, Brand Equity

Price: Importance of price in the marketing mix; Factors affecting price of a product/service

Distributions: Distribution channels; concept and role; Types of distribution channels; Factors affecting choice of a distribution channel.

Communications: Techniques of promotion; Integrated Marketing Communications; Advertising: Role and Significance. Media and their relative merits and limitations, Public Relations and Personal Selling.

E-marketing management: Overview of e-commerce, E-marketing: Role of IT in marketing, E-Marketing-mix, Emerging technology trends and their implications for marketing, Social media and marketing, E-CRM and building relationship.

Text/Reference Books

1. Marketing Management- A south Asian Perspective. Kotler P., Keller K., Koshy A. & Jha M. 12th Ed. Pearson Education. 2007.
2. Marketing Management. Kotler P. & Keller K. Prentice Hall. 2003
3. Fundamentals of Marketing. Stanton W.J., Michael E.J. & Walker B.J. McGraw Hill International. 1997.
4. Principles of Marketing. Kotler P. & Armstrong G. Pearson Education. 2007.
5. Fundamentals of Marketing. Stanton W.J. 5th Ed. McGraw Hill, New York. 1978.
6. Marketing Environment: Planning, Implementation and Control, the Indian context. Ramaswamy V.S. & Namakumari S. Mcmillan. 1990.

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Semester - VI

(Departmental Core Subject)

MN-361
Underground Coal Mining

L-T-P-C
3-0-0-3

Objective: *To introduce concepts of coal mining and coal mining terminology. It deals with the study, development and operations of coal mines.*

Course Content

Introduction: Origin of Coal, Theories of Coal Formation, Classification of Coal, Distribution of Coal in India, Indian Coal Mining Industry; Coal Seam and its classification, Coal Seam Structures and Abnormalities like Faults, Joints, Cleats, Folds etc., 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 of different underground coal mining methods. Trend of change in technology of mining coal vis-a-vis demand Bord And Pillar Method: Important Terminology, Size and Shape of The Pillar, Galleries, Division of mine area into panels on district and level patterns, Size of Panel, Panel System and Without Panel System of Development, Development of panels by drivage of group of headings to strike, dip and rise with V, diagonal and straight fronts, Mechanised B&P development, Cutting, drilling, blasting, loading and transportation; Support, ventilation, drainage and lighting, manpower, Cycle of operations, layouts Depillaring: Problems in Depillaring, Preparatory Arrangements, Depillaring of panels with V, straight and diagonal fronts. Conventional and mechanized depillaring schemes with emphasis on coal, water, air routes and supports. Pillar Extraction Techniques, Depillaring by Stowing Depillaring by Caving Methods, Depillaring by continuous miner, Dangers Associated with Depillaring Longwall Mining: Important Terminology, Types of Long wall Faces and Their Choice,

Merit and Demerits of Long wall Mining, size of panel, development of panel with single and multiple heading gate roads, various orientations of long wall face, single and double unit long wall, Long wall Advancing Method, Long wall Retreating Method, Length of Long wall Faces, Rate of Face Advance, Double Unit Long wall Faces, Extraction of long wall panels with conventional and fully mechanized methods, length of face, daily advance, cycle of operations, Face organisation, scheduling and layouts with special reference to coal, water and air routes, Gate, goaf and face area support in conventional and fully mechanized long walls Thick/steeply inclined/Thin Seam Mining: Problem in Mining of Thick Seams, Choice of Thick Seam Mining Methods, Inclined Slicing, Horizontal Slicing, Diagonal Slicing, Transverse Slicing, Sublevel Caving, Blasting Gallery Method and wide-stall method, Cable-Bolting Method of Thick Seam Extraction. Winning of thin seams – methods, equipment and associated problems. Room and Pillar Mining: Suitability, Different methods viz. Vermelles Method, Slant Method, Sublevel Method, Coal Saw Method, Performance and limitations of the method, Mechanization.

Text/Reference Books

1. Principles & Practices of Modern Coal Mining. Singh R. D. New Age International Pvt.Ltd. New Delhi.
2. Underground winning of coal. Singh T.N. Oxford & IBH. New Delhi.
3. Thick Seam Mining. Singh & Dhar. Oxford & IBH. New Delhi.
4. Modern coal mining. Das S. K. Geeta book store. Dhanbad.
5. Underground Coal Mining Method. Singh J. G. Braj-Kalp Publisher. Varansi.
6. Underground Mining Methods. William A. Hustrulid W. A. & Bullock R. SME Publication.

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Semester - VI

(Departmental Core Subject)

MN-362
Underground Metal Mining

L-T-P-C
3-0-1-4

Objective: *To introduce concepts of metal mining and metal mining terminology. It deals with the study, development and operations of metal mines.*

Course Content

Introduction - Historical development; present status of metal mining industry in India and world, 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: Definitions of important terms used in underground metal mining methods Classification of different stoping methods, Factors influencing selection of stoping methods Development: Opening of deposits – shafts (vertical and inclined), declines and adits. Cross-cuts. Division of ore body into levels and blocks Level interval. Variables affecting the choice of mode of access, Driving of raises – conventional and raise boring machines methods Introduction to Raise boring and introduction to tunnel boring Open Stoping Method: Overhand, Underhand and Breast stoping methods; Open stoping; Vertical, Crater Retreat method; Sub level stoping, Room and Pillar method, Pillar Recovery Methods Stull mining; Shrinkage; Blast hole and their variations Caving stoping methods: Sublevel caving, Block caving, Top slicing and their variations spontaneous and induced. Dilution and recovery. Productivity Supported stoping methods: Timber, Post pillar; Cut and fill and their variations; Square set; Different types of support used. Support Systems: Unit supports and mass support

systems, Pillars; Back fill, Cable bolting, Steel Rock bolts, Grouting, Shotcreting etc., code of timbering rules.

List of Experiments

1. Various terms, factors influencing selection of method of work and classification of underground methods.
2. Designing sub-level stoping for a 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. Stopping techniques used in excavation of gold deposit at deeper depth.
10. Designing an underground metalliferous mine on given geological physicommechanical 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/Reference Books

1. Introductory Mining Engineering. Hartman H.L. John Willey & Sons.
2. SME Mining Engineering Handbook. Vol. I & II. Cummins & Givens. A.I.M.M. New York.
3. Computer in Mineral Industry. Ramlu et al. Oxford & IBH. New Delhi.
4. Underground Mining Methods Handbook. Hustrulid W. A. Society of Mining Engineers of the American Institute of Mining Metallurgical and Petroleum Engineers Inc. New York.

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Semester - VI

(Departmental Core Subject)

CE-366
Rock Mechanics

L-T-P-C
3-0-1-4

Objective: *To develop an understanding of the engineering properties of rocks and soils, rock classification, rock failure theories and the fundamental concepts and principles of rock and soil mechanics.*

Course Content

Status of rock mechanics: role and status of rock mechanics, physico-mechanical properties of rock; 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. Stress state: stress distribution around narrow and wide openings (single and multiple). Geological investigation of rock mass; classification, identification and survey of joints; basic geological description of rock mass; graphical representation of joint systems; dynamic properties of rock and rock mass, time dependent properties of rock, behavior of rock mass; failure criteria for rock and rock mass, weathering of rocks, metamorphism; folds and faults in rocks. Geophysical investigation of rock mass; rock mass classification – RQD, RSR, RMR, Q-system rock indices: specific gravity, hardness, porosity, moisture content, permeability, swell index, slake durability, thermal conductivity, point load strength index, proto dyakonov strength index, impact strength index. 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 instrumentations. Deformation and related instrumentation: measurement of rock

movements and interpretation of data; load cells, convergence recorders, borehole extensometers and borehole cameras. Insitu and induced stresses and their measurement. Basics of numerical methods in geo mechanics with applications. Theories of rock failure. Post-failure phenomenon. Rock bursts: rock bursts and bumps; mechanism of occurrence, prediction and control.

List of Experiments

1. Determination and identification of different types of rocks.
2. Determination of hardness of different rocks and minerals.
3. To measure dip, dip direction and strike of given rock formation with the help of clinometers compass.
4. Field identification of different types of soil as per Indian Standards, determination of natural moisture content.
5. Determination of Atterberg's Limits (liquid limit, plastic limit and shrinkage limit).
6. Determination of compaction characteristics of soil.

Text/Reference Books

1. Fundamentals of Rock Mechanics. Jaeger J.C., Cook N.G.W. & Zimmerman R., 4th Ed. Wiley Publishing House 2007.
2. Engineering and General Geology. Singh P., 2nd Ed. S.K. Kataria & Sons. 2013.
3. Soil Mechanics and Foundations. Punmia B.C. & Jain A.K., 16th Edition. Laxmi Publications 2013.
4. Coal Mine Ground Control. Peng S.S., John Willey & Sons.

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Semester - VI

(Departmental Core Subject)

MN-363

Mine Ventilation & Environment

L-T-P-C

3-0-1-4

Objective: *To understand the basic concepts of mine ventilation, awareness for practical problems and application of various methods applied to mitigate the ventilation problem in the mines.*

Course Content

Introduction to underground mine ventilation. Mine Gases: Occurrence, properties, detection, measurement and monitoring; Methane layering; Methane drainage.

Heat and Humidity: Sources; Geothermic Gradient, Different ways of expressing humidity, measurement, Effect and control of heat and humidity in mines; Climatic conditions, Comfort Conditions and assessment; Cooling power of mine air; refrigeration and Air conditioning

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; Homotropical and Antitropical ventilation; Central and boundary ventilation. Network analysis.

Natural Ventilation: Mechanism; Estimation and measurement of natural ventilation pressure; Restarting and Reversal of natural ventilation, motive column, natural ventilating pressure and problems on these.

Mechanical Ventilation: Mine fans: Types, Construction and working, Characteristics and suitability, Pressure developed, series and parallel operations; characteristic curves, Installation and testing; Reversal of air flow.

Auxiliary Ventilation: Types of Auxiliary Ventilation: Forcing, Exhaust, Overlap, Reversible and Line Brattices System. Booster Fans, Purpose of Booster Fans, Disadvantage of Booster Fans, Critical Pressure of Booster Fan, Pressure required to be developed by Booster Fan, Installation of Booster Fans, Auxiliary fans- Types, construction, characteristics, location and installation; Comparison of booster and auxiliary fans, Air ducts; Risk of re-circulation

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

Illumination: Introduction, General lighting arrangements, Standards for mine lighting, Important guidelines with respect to luminance, Mine lighting and its effects on accidents, production and health, Miner's Cap lamp construction, maintenance and use, Lamp room.

List of Experiments

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. Measurement of air velocity with the help of anemometer, vinometer etc. measurement of temperature, pressure etc.

Text/Reference Books

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

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Semester - VI

(Departmental Core Subject)

MN-364

Underground Mine Hazards

L-T-P-C

3-0-0-3

Objective: *The subject deals with the causes, detection and control of surface and underground fires and various types of rescue methods and equipment.*

Course Content

Fires: Classification of fires; Causes, detection, monitoring and control of surface and underground fires; fire extinguishers, Preventive measures; Fire-fighting - direct methods, sealing off and intersection, firefighting organizations Monitoring of atmosphere behind sealed-off areas; Precautions to be taken before reopening. Methods of reopening, Case histories Spontaneous Heating: Physical and chemical characteristics of coal liable to spontaneous heating, Mechanism, susceptibility indices, Incubation period and its determination, Causes, detection, monitoring and control of spontaneous heating in underground mines, on surface and in coal stacks and dumps; Incubation period; Preventive measures Explosions: Types, causes and mechanism of firedamp and coal dust explosions; limits of explosibility, inflammability and factor affecting these, sources of initiation, Preventive measures; Water spraying, Stone dusting, stone-dust and water barriers; Investigations after an explosion; Case histories Mine Rescue and Recovery work: Different types of rescue equipment- constructional features, functions and uses; Test on rescue apparatus; Rescue stations and rescue room; Organization of rescue work. Fresh air base and its advancing. Rescue rules. 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 Mine Inundation: Causes and precautionary measures,

Precautions to be taken while approaching old workings and while working under water bodies; Burnside boring apparatus; Design and construction of bulk head doors, water dams and barriers; Recovery of flooded mines; Dewatering of old working; Water blast: dangers and precautions, Enquiry Report Preparation.

Text/Reference Books

1. Mine Environmental Engineering. Mishra G. B. Geo Min Tech Publisher, Bhubneshwar.
2. Mine Fires, Prevention, Detection fighting. Mitchell D. ISEE Publication Cleveland, Ohio.
3. Mine Fires, Explosion, Recovery & Inundation. Ramlu M. R. Dhanbad Publisher, Dhanbad.

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Semester - VI

(Departmental Core Subject)

ME-367

Numerical Computation Lab

L-T-P-C

0-0-2-2

Objective: *In this course the students would learn computation methods for solving different partial differentials equations, ordinary differential equations and many other mathematical equations which are derived after mathematical modeling of various engineering systems.*

List of Experiments

1. Introduction, operation with arithmetic ,logarithmic and trigonometric function
2. Operations with arrays, polynomials, problem practice
3. Script file, problem practice
4. Function file, problem practice
5. Programming: graphics, input / output
6. Plotting of 2D and 3D curves, problem practice
7. Symbolic mathematics & lap-lace transforms
8. Roots : programming for general method
9. Linear regression, general linear least-squares problem practice
10. Polynomial: introduction and evaluation
11. Nonlinear regression, polynomial interpolation
12. Splines and piecewise interpolation problem practice
13. Numerical integration formulas, numerical integration of functions
14. Numerical differentiation, problem practice
15. Ordinary differential equation problem practice

16. Problems on lumped and continuum models from solid and fluid mechanics
17. Heat transfer problem practice.

Text/Reference Book

1. Numerical Methods for Scientists and Engineers, R.W. Hamming, 2nd Ed. Dover Books

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Semester - VI

(Departmental Elective - I)

MN-371
Mine Safety Engineering

L-T-P-C
3-0-0-3

Objective: *The subject deals with topics related to accidents, safety engineering, safety organization and safety education.*

Course Content

General: Safety Philosophy, Development of industrial safety movement with special reference to mining, principles of Accident prevention, accident, injury, unsafe act, unsafe condition, reportable accidents, need for safety, Regulation: American (OSHA) and Indian Regulation, Arousing and maintaining safety, interest, publicity and propaganda for safety, safety drives and campaigns, appraisal of safety programmes, development of safe behavior, safety standards Accidents: Theories & Principle of accidents, classification of accidents on different bases, Casualty, safety and productivity, cost of accident, computation of cost, utility of cost data, accident compensation and insurance, Accident proneness, frequency and severity rates, accident records and statistics, accident and incident analysis, purpose and procedure of accident reporting & Investigation, Identification of the key facts, corrective actions, classification of facts, Accident reports, corrective actions. Safety organization: Safety Management Division of responsibility, Location of Safety function, size of safety department, safety committee – structure and functions, safety organization, role of management, supervisor and workers, role of safety officer, qualification for safety specialist Safety Engineering: Lay out and safety, maintenance and safety, job safety analysis, Incidental safety devices and methods, audio visual aids. statutory of

provisions related to safeguarding of Machinery and working condition, Safety in Operation and Maintenance, safety instructions, Operational activities and hazards, starting and shut down procedures, safe operation of mining machines, work permit system, Safety in Storage and Emergency Planning Safety in storage, handling of chemicals and gases, storage layout, ventilation, emergency preparedness on site plan, off site plan, toxic hazard control Safety Education: Vocational training as an aid of safety and productivity, techniques of training, lesson plan, training aids, training games, discussion methods, motivation of workers, Mine vocational training scheme, staff and institution facilities, training records and reports, appraisal of trainees, assessment and evaluation of training schemes.

Text/Reference Books

1. Legislation in Indian Mine. Vol. I and II. Prasad R. Ashalata Publisher. Varanasi.
2. Safety in Mines. Khejriwal B. K.

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Semester - VI

(Departmental Elective - I)

MN-372
Mine Management

L-T-P-C
3-0-0-3

Objective: *The subject deals with the personal management, material management, production management and financial management.*

Course Content

Management: Definition of Management, Nature and Basics concepts of Management, Management and Administration, Functions of Manager in Information age, Principles of Scientific Management; Organization, Principles of organization. Departmentation Levels of management and organizational chart. Management by objective, Management information systems, 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 Personnel management: Planning, organizing, directing, motivating, controlling, coordinating and communicating, staffing, manpower planning and recruitment. Performance appraisal, human resource development and planning, Directing, Decision making, Motivation – Meaning, Need for motivation, Theories of motivation, welfare measures, incentives and penalties Leadership – Meaning and styles, Group and team working, Human resource management, human resource development, workers participation in management, human relationship Production management:, Production planning, scheduling and control short and long term, Queing theory, productivity concept and its measurement, Methods of improving productivity; Determination of norms and standards of operation by work study, Time and motion study; Improving

working environment,. analysis of mine capacities, PERT and CPM, net work diagrams, Industrial psychology, operational research Material management: meaning and objectives, Purchase and stores management, inventory, Systems of inventory control; Different techniques, ABC Analysis, Ordering of Inventory, Procurement Techniques, inventory analysis, value analysis, Purchase procedures in public sector; Preparation of tender documents; Tender completion formalities; Consideration of bids and finalization of purchase order Financial management: Capital and capital management in public and private enterprises, methods of cost analysis and cost control, break even charts and analysis, standard costing and budgetary control, Marketing function –Market and marketing environment, Consumer/buyer behavior, Marketing mix, Advertisement and sales promotion. Introduction to book keeping and financial Statements.

Text/Reference Books

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

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Semester - VI

(Departmental Elective - I)

MN-373
Numerical Methods

L-T-P-C
3-0-0-3

Objective: *The subject deals with the various numerical methods and their practical application in mining.*

Course Content

Introduction to Elastic Rock Models: Fundamentals; Elastic, homogenous isotropic, nonlinear elastic and elasto-plastic models Finite Element Method- the concept, formation of mesh elements and finite difference patterns solution; Discretization and element configuration; Element stiffness, assemblage and solution Boundary element method: The concept, discretization, different methods of solution for isotropic and infinite media Practical application of above methods.

Text/Reference Books

1. An Introduction to FEM. Reddy J. N.
2. The FEM: Its Basics and Fundamentals. Zienkewicz O. C. & Taylor R. L.
3. Programming for Boundary Element Method: An Introduction to Engineers. Beer G.
4. An Introduction to Boundary Element Methods Kythe P. K.

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Semester - VI

(Departmental Elective - I)

MN-374
Entrepreneurship

L-T-P-C
3-0-0-3

Objective: *This Course has been designed with a specific purpose to identify, nurture and support budding young entrepreneurs realize their dreams. The program imparts essential knowledge of how to start one's own business venture and the various facets that influence successful set up and operations*

Course Content

Concept, Nature, Types of Entrepreneurs, Entrepreneurship & Innovation, Role in Socio-economic development, Qualities of a successful entrepreneur. Introduction: Meaning, elements, determinants & importance of entrepreneurship & creative behavior; Entrepreneurship & creative response to the society' problems & at work; Dimensions of entrepreneurship: intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, ecopreneurship & social entrepreneurship.

Opportunity Identification – Generating ideas. Positioning as an Entrepreneur – Starting Your own Business. Developing an Effective Business Model. Industry and Competitor Analysis. Building and Presenting a Business Plan Preparing the Legal and Ethical Foundation for a Startup – Types of startups and licensing systems, GST, MSME etc.

Sources of business ideas & tests of feasibility: Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment, nature of product,

market potential); Project submission/ presentation & appraisal thereof by external agencies, such as financial/non-financial institutions.

Theories of Entrepreneurship (Economic, Social & Psychological), Factors affecting entrepreneurial growth, Entrepreneurship Development Programmes.

Small, Medium and Micro Enterprises. Setting up a Small Business Enterprise: Project Identification & Selection, Project Formulation, Project Evaluation & Implementation.

Financing Small Business: Sources of Finance, Capital Structure, Term Loans, Short term Finance, Capitalization, Venture Capital, Export Finance. Tax Benefits to Small Scale Industry. Concept of business groups & role of business houses & family business in India; The contemporary role models in Indian business: their values, business philosophy Conflict in family business & its resolution

Institutional Finance to Entrepreneurs: State finance corporations, Commercial Banks & other Institutions, availability & access to finance, marketing assistance, technology, & industrial accommodation, Role of industries/entrepreneur's associations & self-help groups, The concept, role & functions of business incubators. Types of Sources – VCs, Angel funding private equity fund. Mobilizing Resources: Mobilizing resources for start-up. Accommodation & utilities; Preliminary contracts with the vendors, suppliers, bankers, principal customers; Evaluating the Financial Strength of a New Venture/Project. Getting Financing or Funding. The Importance of Intellectual Property. Strategies for New Venture Growth. Talent Acquisition and Management for New Ventures. Intrapreneurship in Action. Environment and sustainability, and new ventures. Exit strategies for a New Venture and Trends in India.

Project on a Business Plan and implementation through state agencies.

Text/Reference Books

1. Innovation and Entrepreneurship. Drucker P. Collins.2006.
2. Essentials of Entrepreneurship and Small Business Management. Thomas Z. Prentice Hall. 2001.
3. Entrepreneurship and Small Firms. David D. McGrawHill Education. 2002.
4. Entrepreneur and Small Scale Industries. Akansha P.PHI. 2006.
5. Entrepreneur and Innovation in Tourism. Frank N. Sagamore Publications Ltd. 2005.
6. SIDBI Reports on Small Scale industries:
 - a. <http://dcmsme.gov.in/publications/traderep/sidbirep.pdf>
 - b. <http://www.sidbi.com/sites/default/files/financials/SIDBI>
 - c. ANNUAL%20REPORT 2012-13.pdf

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Semester - VII

(Departmental Core Subject)

MN-451
Mine Legislation

L-T-P-C
3-0-0-3

Objective: *The subject deals with the various rules and regulations related to mining industry.*

Course Content

General Principles of Mining Laws, Development of mining legislation in India, Post-independence trend of changes, National Mineral Policy. Principal provisions of Mines and Minerals (Development and Regulation) Act & Mineral Concession and Development Rules. Mines Act 1952 with upto date amendments Mines Rules 1955 with upto date amendments Coal Mines Regulation 1957 with upto date amendments Metalliferous Mines Regulations 1961 with upto date amendments Principal provisions of pit head and bath rules, crèche rules , mine vocational training rules, Explosive rules(related to mines); Electricity rules applicable to mines and oil fields Principal provisions of industrial dispute act, workmen's compensation act, trade union act, payment of wages act and minimum wages act, Rescue rules; Legal requirements, Important technical circulars issued by DGMS.

Text/Reference Books

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

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Semester - VII

(Departmental Elective - II)

MN-471	L-T-P-C
Dimensional Stone Technology	3-0-0-3

Objective: *The subject deals with the properties of dimensional stone, blasting techniques in dimensional stone mines and processing of dimensional stones.*

Course Content

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. 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 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 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, Environmental management plan, Environment Protection measures.

Text/Reference Book

1. Dimensional Stone Technology. Rathore S. S., Bhardwaj G. S. & Jain S. C. Himanshu Publication, New Delhi

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Semester - VII

(Departmental Elective - II)

MN-472

Advanced Methods in Mining

L-T-P-C

3-0-0-3

Objective: *The subject deals with the recent developments in underground metal mining and coal mining and special methods of mining.*

Course Content

Supports; Powered supports, their Classification, principles of operation and design, constructional features and application, support of wide excavation, longwall faces and depillaring, Hydraulic fluids, Shotcreting, Roof stitching Special surface Mining Situations : Mining over old underground workings; Placer mining: hydraulicking, dredging, dump leaching, deep sea mining. highwall mining. Steep angle conveyor, high angle conveyor, Mining by surface miner, In pit crushing and cross pit conveying techniques. Application of skip transportation in open cast mines. Cross pit conveying, High wall mining, Twin bench blasting, Blast design for casting, coyote blasting, chamber blasting, Application and use of GPS and Mining of coal under difficult Situations: Contiguous seams, seams prone to outburst and bumps; Mining of seams prone to fire and spontaneous combustion, Mining of seams in the vicinity and under of water bodies and structures. Recent developments in underground coal mining technology, Remote controlled operations and use of robots in coal mining Hydraulic Mining: The concept; Layout of workings on district and level systems; Winning of panels; Pillar methods (square pillars, rectangular pillars and long pillars); and sublevel stoping; In-situ Gasification: The concept and chemistry; Methods- using underground excavations, and using vertical or directionally drilled boreholes from surface Special Metal Mining Situations: Stopping of superimposed veins and parallel ore bodies;

Combined methods; Extraction of underground pillar, Recent developments in underground metal mining, Special method of mining for deep deposit and difficult mining conditions, Scope of applications for mining of deep seated low grade mineral deposits, Solution mining, ore mining by leaching, Bacterial leaching, under water/Sea-bed mining, nuclear device mining systems, different methods for winning manganese nodules from the ocean floor.

Text/Reference Books

1. Principles & Practices of Modern Coal Mining. Singh R. D. New Age International Pvt. Ltd. New Delhi.
2. Underground winning of coal. Singh T. N. Oxford & IBH, New Delhi.
3. Thick Seam Mining. Singh & Dhar. Oxford & IBH, New Delhi.
4. Modern coal mining. Das S. K. Geeta book store, Dhanbad.
5. Underground Coal Mining Method. Singh J. G. Braj-Kalp Publisher, Varansi.
6. Underground Mining Methods. William A. H & Bullock R. SME Publication.

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Semester - VII

(Departmental Elective - II)

MN-473
Mineral Processing

L-T-P-C
3-0-0-3

Objective: *The subject deals with the different methods of mineral processing.*

Course Content

Scope, object and limitations of Mineral Dressing; Role of microscopic study
Comminution and Liberation: Theory and practice of crushing & grinding; Conventional
units used-their fields of application and limitation Sizing and Classification: Laws of
settling 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 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, physico-chemical, principles underlying flotation-
reagents, flotation machines; Flotation of sulphides, oxides and non-metals 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
V 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.

Text/Reference Books

1. Mineral Dressing. Gaudin M. A.
2. Handbook on Mineral Dressing. Vijendra H. G. Vikas Publishing house, New Delhi.
3. Mineral Dressing. Jain S. K.

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Semester - VII

(Departmental Elective - III)

MN-481	L-T-P-C
Environmental Management in Surface Mines	3-0-0-3

Objective: *The subject deals with various pollution related to mining industries, case studies of coal and metalliferous mine dumps/spoils and factors of environmental management.*

Course Content

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. 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 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 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 Circulars issued by MoEF, Forest Conservation Act 1980 and Forest Conservation Rules 1981 related with the Mining.

Text/Reference Books

1. Environmental Management of Mining Operations. Dhar B. B.
2. Proceeding of the National & International Seminars/Symposium organized in concern with mine environment
3. Environmental Geology. Ghosh R. & Chatterjee D. S. Capital Publishing Co. New Delhi.

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Semester - VII

(Departmental Elective - III)

MN-482
Rock Engineering

L-T-P-C
3-0-0-3

Objective: *The subject deals with the concepts of design of slopes, mine excavations, pillar and drills.*

Course Content

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 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 Drill ability 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 Rock reinforcement; Estimation of support requirements of underground excavation. Mining subsidence, bumps and rock burst, distressing to control rock bursts Mechanics of rock breakage in blasting; Influence of rock properties; Controlling damage.

Text/Reference Books

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

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Semester - VII

(Departmental Elective - III)

MN-483
Remote Sensing & GIS

L-T-P-C
3-0-0-3

Objective: *The subject deals with remote sensing process, Geographical Information System and applications and modern trends of GIS in various natural resources and engineering applications.*

Course Content

Remote Sensing Process: Introduction to Remote Sensing, data acquisition and processing, sensor systems, applications Radiation (EMR) and its characteristics, Radiation principles, Planck's Law Electromagnetic , Stefan's Law, properties of solar radiant energy, atmospheric windows Physical Basis of Remote Sensing: Interaction in the atmosphere, nature of atmospheric interaction, atmospheric effects of visible, near infrared thermal and microwave wavelengths, ispectral characteristics of individual leaf interaction at ground surface, interaction with soils and rocks, effects of soil moisture, organic matter, particles, size and texture, interaction with vegetation, vegetation canopies, effect of leaf pigments, cell structure, radiation geometry Platform and Sensors: Multi concept in remote sensing, general requirements of a platform, balloon aircraft, satellite platforms sunisynchronous orbits, sensors for visible near infraired wavelengths, profilers, images, scanners, radiometers optical mechanical and push button scanners, spectral, spatial, radiometric and temporal resolution, IFOV, FOV, geometric characteristics of scanners, V/H ratio, comparison of satellite/ aerial platforms and sensors and remote sensing data products, land sat and TM, SPOT, IRS, ERS etc Visual & Digital Image Processing: Remote Sensing Data Products, Elements of visual Image Interpretations, Generation of Thematic Maps, Digital Image Processing System,

Image Enhancement, Image Transformation, Image Classification Geographical Information System: Difference between image processing system geographical system (GIS), utility of GIS, various GIS packages and their salient features, essential components of a GIS, scanners and digitisers, raster and vector data storage, hierarchical data, network systems, relational database, data management, conventional database management systems, spatial database management data manipulation and analysis, reclassification and aggregation, geometric and spatial operation on data management and statistical modeling, Applications and Modern Trends of GIS in various natural resources and engineering applications.

Text/Reference Books

1. Remote Sensing and GIS. Bhatta. B.
2. Remote Sensing and Image Interpretation. Lillens and T.M. & Keifer R.W.
3. Principles of Remote Sensing. Curren P.J.
4. Principles of Geographical Information systems for land Resources Assessment. Baurrough P.A.
5. Manual of Remote Sensing, Vol.2. American Society of Photogrammetry and Remote Sensing.
6. Geographical Information systems Management Perspective. Aromoff S.

**Detailed Syllabus for B. Tech. Degree Programme
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Semester- VII

(Departmental Core Subject)

MN-450
Summer Internship

L-T-P-C
0-0-3-3

Summer Internships offer students personal and real world spirits and exposes to an actual working life, an experiential foundation to their career choices and the chance to build valuable business networks. Under this programme each student undergoes training in an Industry for a minimum period of six weeks during the summer vacation after VI Semester. Through the internship students are exposed with the various processes involved at any typical industrial unit such as, operating procedure, construction processes, management procedures etc. and have the opportunity to relate with the knowledge they acquired in the classroom. Students execute a small project based on any of the above mentioned aspects under the supervision of competent personnel in the industry and a faculty member of the university.

After completion of the Internship, students are required to prepare a report, based on the activities performed during the internship, as per the prescribed format/ guidelines. The report should be certified by the Supervisors, and presented in the form of a seminar in the VII Semester.

Evaluation of the Summer Internship will be done as per the approved procedure.

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Semester- VII

(Departmental Core Subject)

MN-455
Comprehensive Viva Voce

L-T-P-C
0-0-2-2

The knowledge gained by the students during their B. Tech programme will be evaluated through a Comprehensive Viva Voce Test in the VII Semester. The test will cover the entire syllabi of the B. Tech degree programme. Preparation for the Comprehensive Viva Voce Test will also help the students in their placement activities. The evaluation will be done as per the approved procedure.

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Semester- VII

(Departmental Core Subject)

MN-460
Minor Project

L-T-P-C
0-0-3-3

Students undertake project work to develop the skill and aptitude of problem-solving. The project work is divided into two parts: Minor and Major. The Minor project is to be undertaken in the VII Semester.

Students will choose an area of their interest in consultation with a faculty member of the department, who will act as the Supervisor. The area of interest could be confined to his/her discipline or may be interdisciplinary.

The project work will involve all or some of the following processes: identification of problem, study of related literature, data collection and analysis, theoretical formulation, fabrication, experimentation and result analysis.

The preliminary work such as problem identification through literature survey, field survey etc. and preparation of plan of execution should be compiled in the form of a report, in the prescribed format/ guidelines. The report, duly certified by the Supervisor, should be submitted to the Head of the Department.

Progress made by students will be continuously monitored and evaluated as per the approved procedure.

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Semester - VII

(Departmental Core Subject)

ME-488
Finite Element Analysis

L-T-P-C
0-0-3-3

Objective: *This course deals with various analysis and design methodology using various simulation tools and techniques.*

List of Experiments

1. Analysis and design of structures
2. Simply supported beam.
3. Cantilever beam and Propped cantilever beam.
4. Continuous beam.
5. Portal frame: Non sway frame, Sway frame.
6. Analysis and design of residential building (Gravity loading)
7. Analysis of bar element: Bar of uniform section, Bar of non-uniform section.
8. Analysis of beam: Simply supported, Fixed beam.
9. Heat conduction problems
10. Vibration analysis

Text/Reference Books

1. Analysis and Design of Structures Kindle Edition by Trevor Jones .
2. Illustrated Design of Reinforced Concrete Buildings (GF+3storeyed) -V.L. Shah & S. R. Karve- Structures Publications.

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Semester - VII

(Management Subject)

BM-451
Ethics & IPR

L-T-P-C
2-0-0-2

Objective: *The aim of this course is to sensitize students towards professional ethics, values, and associated aspects. It initially addresses concerns relating to product and service quality and then moves on to ethical aspects of organizational functioning. The course throws light on ethical issues and crimes that are likely to remain at the core of corporate concerns and discusses intellectual property related issues that are the need of modern industrial and business enterprises.*

Course Content

Role of Corporations: Some big changes in the world in last 60 years (WW II, GATT, WTO) and impact on business, Need for strategic planning & process management, Business strategies & challenges in leading global organizations.

Quality Management: Quality as a strategic imperative, Evolution of quality management, Distinction between quality control, quality assurance & quality management, International standards (ISO family of standards) & International models for quality management, quality in services, enhanced focus on accreditation, the accreditation process, standards for key services (food processing: HACCP & education: NAAC).

Ethics and Human Values: Ethics and morals values, Ethical theories, Common features of unethical companies & leaders, Professional ethics, Professional Codes of Ethics, Benefits & limitations of code of ethics, Corporate social responsibility and its business implications.

Intellectual Property Issues: Protecting the intangible, Evolution of knowledge as property, What are Intellectual property rights, Classification of intellectual property, Role of WTO & WIPO, The patenting process, Patent infringement, Copyrights, Requirements for registration of a copyright, Copyright infringement. Fair use of copyrighted material, Trade secrets, Reverse engineering, Protecting software.

Environmental and Health Concerns: Introduction, Manufacturing in the 21st century, Resource conservation, the social costs of environmental destruction (land, water & air pollution), ISO 14000 standards & approaches to environmentally friendly technology, carbon trading, international treaties & their limitations.

Text/Reference Books

1. Managing intellectual Capital: Organizational, Strategic and Policy Dimensions. Teece D.J. Oxford University Press. 2000.
2. Profiting from Intellectual Capital: Extracting Value from Innovation. Sullivan P.H. John Wiley. 1998.
3. Intellectual property law in India. Narang P.S. Georgia Law Agency. 2001.
4. ISO 9000 Quality systems Handbook. Hoyle D. 6th Ed. A Butterworth-Heinemann Title. 2009.
5. Implementing ISO 9000: 2015. Purushothama B. Edited. WPI Publishing. 2014.

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Semester - VII

(Humanities & Basic Sciences Subject)

HU-451
Interview Skills

L-T-P-C
0-0-1-1

Objective: *To understand the intricacies of interview & develop skills to perform satisfactorily.*

Course Content

SWOT Analysis.

Significance of Etiquette, Grooming, Kinesics, Paralanguage & Proxemics in interviews.

Résumé, Cover letter, Thank you Letter, Job Acceptance Letter.

Interview types, Open-ended, Behavioral & Hypothetical questions, FAQs.

Group Discussion & Interview sessions.

Text/Reference Books

1. How to Succeed in Group Discussions and Personal Interviews. Mandal S. Jaico Publishers. 2004.
2. Cover Letters. Fein R. Jaico Publishers. 2005.
3. The Definitive Book of Body Language. Barbara P. Manjul Publishing House Pvt. Ltd. 2013.

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Semester - VII

(Humanities & Basic Sciences Subjects)

MA-454	L-T-P-C
Quantitative Aptitude	0-1-0-1

***Objective:** To introduce certain topics from quantitative aptitude with emphasis on analytical ability & computational skills needed in competitive examinations. This module would also train the students to solve quantitative aptitude problems during the placement drives.*

Course Content

Problems on Alligation or mixture.
Problems on Ages.
Problems on Clock.
Problems on Calendar.
Problems on Speed, Time and distance.
Problems on Time and Work.
Problems on Heights and distances.
Problems on Trains.
Problems on Boats and Streams.
Problems on Pipes and Cisterns.

Text/Reference Books

1. Quantitative aptitude. Aggarwal R. S. S. Chand. 2012.
2. Quantitative aptitude. Trishna Knowledge Systems, Pearson. 2014.

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Semester - VII

(Open Elective- III)

BT-471
Bioprocess Technology

L-T-P-C
3-0-0-3

Objective: *A bioprocess is a specific process that uses complete living cells or their components to obtain desired products which is an importance part of biotechnology industry. This course is designed to make a learner efficient in bioprocess calculations and to impart knowledge of different technology used in bioprocess*

Course Content

Bioprocessing v/s chemical processing, Substrates for bioconversion processes Inoculum development. Process technology for production of primary metabolites: such as baker's yeast, ethanol, citric acid, amino acids, polysaccharides & plastics, Microbial production of industrial enzymes such as glucose isomerase, cellulose, amylase, protease etc., Production of secondary metabolites: penicillin& cephalosporin etc.

Text/Reference Books

1. Encyclopedia of Bioprocess Technology. Flickinger Michael & Drew Stephen. John Wiley & Sons.1999.
2. Principles of Fermentation Technology. Stanbury P.F., Whitaker A. & Hall S. J. 2nd Ed. Elsevier.1995.
3. Microbial biotechnology: Fundamentals of Applied Microbiology. Glazer A. N. & Nikaido H. 2nd Ed. W.H. Freeman & Company.1995.

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Semester - VII

(Open Elective– III)

CE-462	L-T-P-C
Air Pollution & Industrial Waste Management	3-0-0-3

Objective: *To give understanding of air pollution and its impact, modeling of dispersion of pollutant, control measures, types of waste from different industries and their management.*

Course Content

Air Pollutants, their sources and harmful effects on the environment; Meteorology as applied to air pollution and dispersion of air pollutants, Air quality and emission standards, Removal of gaseous and particulate matter. Sources and types of wastes; solid, liquid and gaseous wastes; Water use in industry, industrial water quality requirements; Control and removal of specific pollutants in industrial wastewaters from dairy, fertilizer, distillery, tannery, sugar, pulp and paper, iron and steel, metal plating etc.

Text/Reference Books

1. Air Pollution-Its Origin and Control. Wark K. & Warner C. F. Harper & Row New York. 1981.
2. Air Pollution Control Engineering. Nevers N. D. McGraw Hill International Ed. 1985.
3. Zero Pollution for Industry: Waste Minimization through Industrial Complexes. Nemerow N. L. John Wiley & Sons.1995.
4. Liquid Waste of Industry: Theoy, Practices and Treatment. Nemerow N L. Addison-Wesley. 1971.
5. Wastewater Treatment for Pollution Control. Arceivala S. J. Tata McGraw Hill. 1999.
6. Industrial Water Pollution Control. Eckenfelder W. W. McGraw Hill. 2000.

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Semester - VII

(Open Elective - III)

CS-462	L-T-P-C
Management Information Systems & E-Commerce	3-0-0-3

Objective: *The course aims at acquainting students with the fundamentals of Information Systems and their application in the various areas of business. It also provides an overview of the emerging domain of e-commerce, its concepts, issues and technologies.*

Course Content

Management Information Systems: Need, Purpose and Objectives- Contemporary Approaches to MIS: Business processes and Information Systems –Information systems function in Business-Use of Information Systems for competitive advantage - MIS as an instrument for the organizational change: Management issues – Types of Business Information Systems.

Enhancing Decision Making: Information, Management and Decision Making - Models of Decision Making - Classical, Administrative and Herbert Simon's Models - Attributes of information and its relevance to Decision Making - Types of information, Decision Support Systems - Group Decision Support Systems – Executive Support Systems

E-commerce: Introduction, Definition of e-commerce, emergence of Internet, commercial use of Internet, history of e-commerce, advantages and disadvantages of e-commerce

Business models for e-commerce: B2C, B2B, C2C, C2B, brokerage model, aggregator model, info-mediaries, communities, value-chain model, manufacturer model, advertising model, subscription and affiliate model

Enabling technologies: Internet Client server applications, networks, Uniform Resource Locator (URL), search engines, software agents, Internet Service Providers (ISP), broadband technologies, Electronic Data Interchange(EDI).

E-marketing: characteristics, methods, e-marketing value-chain, site adhesion, browsing behavior model, e-advertising, e-branding, e-marketing strategies

E-security: Security risks, risk management issues, legal and ethical issues, security mechanisms, encryption, digital signature, digital certificates.

E-payment systems: token-based system, card-based system, e-cash. E-cheque, e-banking, risks, data protection.

Text/Reference Books

1. Management Information Systems. Laudon and Laudon, 7th Ed. Pearson Education.
2. E-commerce: An Indian Perspective. Joseph P. T. 2nd Ed. Prentice Hall India. 2007.
3. Management Information Systems. Bagchi N. 1st Ed. Vikas Publishing. 2010.

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Semester - VII

(Open Elective - III)

EE-465	L-T-P-C
Energy Conversion Process	3-0-0-3

Objective: *To get acquainted the students with various energy conversion processes used in non-conventional energy sources.*

Course Content

Physics of photovoltaic energy conversion in P-N junctions. Effect of physical properties of photovoltaic converters; Performance characteristics of different types of photovoltaic devices; Design considerations and manufacturing processes; Regulations and efficiency of conversion. Charge carriers and thermoelectric phenomena; Thomson, Peltier, Seebeck effect; Kelvin's relations; Thermoelectric energy conversion; Materials, size and capacity; Performance analysis and optimized design of thermoelectric devices. Physics of thermionic emission; Operation of high level vacuum and low pressure thermionic converters; Vacuum and gas-filled converters; Thermionic nuclear reactors; Heat pipes. Basic principles of Magneto hydro dynamic power generation; Hall effect; Ionization and seeding; Faraday, Segmented electrode, Hall and Cross-connected generators, Open and closed cycles; Liquid metal MHD. Fuel cells, Thermodynamics of Fuel Cells. Performance Analysis. Low, medium, high temperature Fuel Cells.

Text/Reference Books

1. Energy Conversion Systems. Begamudre R. D. 1st Ed. New Age Pub.2000.
2. Solar PV and Wind Energy Conversion Systems: An Introduction to Theory, Modeling with MATLAB/SIMULINK & the Role of Soft Computing Techniques (Green Energy and Technology). Sumathi S., Kumar Ashok & Surekha P. Springer. 2015.

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Semester-VII

(Open Elective – III)

MA-451
Probability Theory

L-T-P-C
3-0-0-3

Objective: *In this course the student is familiarized with the basics of probability and stochastic processes.*

Course Content

Introduction, Experiment, Events, Classical Definition Counting Techniques, Combinatorial Probability Algebra of events, Addition theorems Conditional probability, Independent events, Bayes Theorem, Discrete Random Variables, Probability Mass Function, Cumulative Distribution Function, Expectation, Variance, Discrete Uniform, Binomial, Geometric, Negative Binomial, Hyper geometric, Poisson Distributions. Continuous Random Variables, Probability Density Function, Cumulative Distribution Function, Expectation, Variance. Continuous Uniform Distribution, Normal, Exponential, Gamma, Chi-Square Distributions. Moment generating function, Characteristic function, Tchebysheff's Theorem.

Bivariate Discrete Distribution, Joint Probability Mass Function, Marginal Probability Mass Function, Conditional Probability Mass Function, Independent Random Variables, Mean, Variance, Correlation Coefficient, Conditional Mean and Variance, Cumulative Distribution Function.

Bivariate Continuous Distribution, Joint Probability Density Function, Marginal Probability Density Function, Conditional Probability Density Function, Independent Random Variables, Mean, Variance, Correlation Coefficient, Conditional Mean and Variance, Cumulative Distribution Function.

Transformation Of random Variables-Univariate and Bivariate Case.
Stochastic Processes, Markov Chain, Poisson Process.

Text/Reference Books

1. Statistical methods. Vol. II. Das N. G. 1st Ed McGraw-Hill. 2009.
2. Fundamentals of mathematical statistics. Gupta S. C. & Kapoor V. K. 11th Ed. S. Chand and Sons. 2002.
3. Statistical Inference Casella G., Berger R. L., Mood, Graybill, & Boes, 2nd Ed. Duxbury Press. 2000.
4. Probability statistics and random processes. Veerarajan T. 3rd Ed. T. M. H. 2008.

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Semester - VII

(Open Elective - III)

ME-465	L-T-P-C
Solar Energy & Applications	3-0-0-3

Objective: *This course discusses solar energy as an important alternative conventional sources of energy- its generation & utilization.*

Course Content

The energy crisis- causes & options, renewable & non-renewable forms of energy & their & at the characteristics, solar energy option availability & land are requirements. Solar radiation outside the earth atmosphere earth`s surface, instruments for measuring solar radiation, solar radiation geometry, basic earth-sun angles, fluxon tilted surfaces. Liquid flat-plate collectors design & performance parameters, solar air heaters, concentrating collectors, solar ponds & energy storage. Solar thermal power generation: low, medium & high temperature cycles, solar cooling, drying & desalination, solar air & water heating, solar passive architecture. Solar phovoltaic power generation: mono crystalline, polycrystalline & amorphous cells, Fabrication & performance of SPV modules. Indirect methods of solar energy utilization: biomass, wind, wave & ocean thermal energy conversion technologies. Economic considerations.

Text/Reference Books

1. Solar Energy principles of thermal collection & storage by Sukhatme. Tata McGraw-Hill. 1996.
2. Solar Energy fundamentals & applications by Garg & Prakash. Tata McGraw-Hill.1997.

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Semester - VII

(Open Elective - III)

PH-452
Nanomaterials

L-T-P-C
3-0-0-3

Objective: *The objective of this course is to introduce the various techniques used for the production of nanomaterials, their characterization & applications in mechanical & civil engineering.*

Course Content

Introduction to Nanomaterials: Amorphous, crystalline, microcrystalline, quasi-crystalline & nano-crystalline materials. Historical development of nanomaterials- Issues in fabrication & characterization of nanomaterials.

Synthesis of Nanomaterials: Methods of production of Nanoparticles, Sol-gel synthesis, Inert gas condensation, High energy Ball milling, Plasma synthesis, Electro deposition & other techniques. Synthesis of Carbon Nanotubes - Solid carbon source based production techniques, Gaseous carbon source based production techniques - Growth mechanisms Nano wires

Characterization of Nanomaterials: Scanning Probe Microscopy (SPM) - Scanning tunneling microscope, Transmission electron microscope, Scanning transmission electron microscope, Atomic force microscope, Scanning force microscopy, electrostatic force microscopy , Dynamic force microscopy, Magnetic force microscopy, Scanning thermal microscopy, Peizo force microscopy, scanning capacitance microscopy, Nano indentation.

Applications of Nanomaterials: Applications in Mechanical, Electronics engineering industries-Use of nanomaterials in automobiles, aerospace, defense & medical applications -Metallic, polymeric, organic & ceramic nanomaterials.

Nanofabrication & Nanomachining: LIGA, Ion beam etching, Molecular manufacturing techniques-Nanomachining techniques -, Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum materials.

Text/Reference Books

1. Nano Materials. Bandyopadhyay A. K. 1st Ed. New Age International Publishers. 2007.
2. Handbook of Nanotechnology. Bharat B. 3rd Ed. Springer. 2010.
3. Nanotechnology. Timp G. 1st Ed. Springer. 1999.
4. Nanomanufacturing Handbook. Busnaina A. 1st Ed. CRC Press. 2006.

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Semester - VII

(Open Elective - III)

PH-453
Chaos in Engineering Systems

L-T-P-C
3-0-0-3

Objective: *The objective of this course is to introduce the importance of nonlinearity & its ubiquity in engineering systems. The various techniques/tools used to understand the dynamics of nonlinear systems with examples from various engineering disciplines shall be discussed.*

Course Content

Introduction to chaos. Various examples of chaos in engineering systems, electrical systems (Van Der Pol oscillator); Fluid mechanical systems (Lorenz equations, Aero elastic flutter), Vibration (Duffing equation), Chemical reactions (Belousov-Zhabotinski reaction) etc. Basic concepts in the mathematical treatment of non-linear systems. Note: The emphasis in this course will be on developing a physical understanding of chaotic systems. There will be computer simulation demonstration.

Text/Reference Books

1. Chaos & Non-linear Dynamics. Hilborn R. 2nd Ed. Oxford University Press. 2001.
2. Non-linear Dynamics & chaos. Strogatz S. H. 1st Ed. Perseus books. 2001.
3. Non-linear Dynamics. Lakshmanan M. & Rajsekar S. 1st Ed. Springer. 2003.

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Semester - VIII

(Departmental Elective - IV)

MN-491	L-T-P-C
Experimental Stress Analysis	3-0-0-3

Objective: *The subject deals with the experimental methods of stress analysis and various measuring instruments.*

Course Content

Importance of experimental methods, similitude laws and design of experiments, some simple measuring instruments Bagg's deformeter. Strain gauges-principles and applications Mechanical, optical and electrical strain gauges; semi-conductor strain gauges; strain recording instruments Photo-elasticity-two dimensional stress analysis, principles and applications, Moir's techniques, three dimensional stress analysis Non-destructive testing, Brittle coatings. Some application of experimental stress analysis and research, design and field problems.

Text/Reference Books

1. Rock Mechanics and design of structures in rock. Obert & Duall, John Willey & Sons.
2. Experimental stress analysis. Railey & Dalley. McGraw Hill Book Company.
3. Handbook of Mechanical properties of rock Vol. I & II. Vutukuri & Ima. Transtech, Germany.
4. Coal Mine Ground Control. Peng S. S. John Willey & Sons.
5. Fundamentals of Rock Mechanics. Jeager J. C & Cook N. G. W. Chapman & hall, London.
6. Rock Mechanics & Engineering. Charles J. Cambridge University Press, Cambridge London.

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Semester - VIII

(Departmental Elective - IV)

MN-492	L-T-P-C
Mine Economics & Financial Management	3-0-0-3

Objective: *The subject deals with the economic importance of the mining industry, cost of mining and cost analysis.*

Course Content

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 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 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 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/Reference Books

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

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Semester - VIII

(Departmental Elective - IV)

MN-493
Mine Planning & Design

L-T-P-C
3-0-0-3

Objective: *The subject deals with the various methods of designing of mines and different planning stages.*

Course Content

Feasibility study: Its function and preparation of feasibility report for metallic and non-metallic minerals. Minerals inventory and ore reserves 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, underground mining and the combination of both. The ultimate open pit profile based on physical and economical parameters; Optimum pit design 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 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/Reference Books

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

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Semester- VIII

(Departmental Core Subject)

MN-470
Major Project

L-T-P-C
0-0-4-4

After completion of the Minor Project, students shall undertake the Major Project in the VIII Semester. The idea conceived in the Minor Project shall be executed in this semester under the supervision of the faculty member. Students shall complete the practical aspect of the project. Thereafter they will prepare a report, as per the prescribed format/ guidelines, incorporating the results, their analysis and interpretation. The report, duly certified by the Supervisor, should be submitted to the Head of the Department.

Progress made by the student will be continuously monitored and evaluated as per the approved procedure.

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Semester - VIII

(Open Elective- IV)

BT-475
Bioremediation Technology

L-T-P-C
3-0-0-3

Objective: *This course is designed to learn advance technology which use microorganisms & plants to remediate polluted & contaminated sites eg. Industrial waste water, sewage etc. as well as to make students learn about emerging technologies in this area.*

Course Content

General Introduction, toxic chemicals in the environment, Xenobiotic compounds, Properties, toxicity & types of toxicity, classification of toxicants in environment; atmospheric toxicants; Conventional remediation, thermal, chemical & physical processes, role of microorganisms in pollutant degradation, Bioremediation: process, classification: *In situ* & *Ex situ* bioremediation; constrains & priorities of bioremediation; evaluation of bioremediation; factors affecting process of bioremediation, methods in determining biodegradability; contaminant availability for biodegradation. Microbial remediation & phytoremediation, Impact of biotechnology on bioremediation & global application of bioremediation technologies & case studies, Emerging Environmental Biotechnologies: Bioleaching, Biosorption Biotransformation, Biomonitoring, Microbial fuel cells.

Text/Reference Books

1. Cell biology, Genetics, Molecular Biology Evolution and Ecology. Verma P.S & Agarwal V. K. S Chand publication.2005.
2. Environmental Biotechnology. Shrinivas T. New Age International (P) Limited. 2008.

3. General Microbiology. Stanier R Y., Doudoroff M. & Adelberg E. 2nd Ed. McMillan Publications. 1989.
4. Environmental Biotechnology. Foster C.F & Ware J. DA Ellis Horwood Ltd. 1987.
5. Biotechnology & Biodegradation: Advances in Applied Biotechnology Series. Vol-4, Karrelly D. Gulf Publications Co. 1989.
6. Bioremediation Engineering: Design & Application. Cookson John 1st Ed. McGraw Hill.
7. Introduction to Environmental Biotechnology. Chatterjee A.K. 3rd Ed. PHI Learning Pvt. Ltd. 2011.
8. Environmental Biotechnology. Joganand S.N. 4th Ed. Himalaya Publishing. 2015.

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Semester-VIII

(Open Elective - IV)

CE-464	L-T-P-C
Environmental Management	3-0-0-3

Objective: *To develop the understanding of various environmental management techniques, legal procedure in India, development of environmental friendly industries, environmental audits and concept of green buildings.*

Course Content

The need for environmental awareness and protection in both natural and man-made systems – effects on atmosphere, water, ecological systems and quality of life. Environmental Impact Assessment and Integrated Environmental Management, Practical applications – cradle to grave concept, life cycle analysis, and clean technologies. Environmental Audit, Compliance Audit; Concept of ISO and ISO 14000. Needs of developing countries. Governmental standards for Environmental Protection. Emerging Global Environmental Issues. Environmental Legislation.

Text/Reference Books

1. Environmental Impact Analysis Handbook. John R. G. & David W. C. McGraw-Hill. 1980.
2. Environmental Management in South Africa. Fuggle R. F. & Rabie M. A. Juta & Co. Ltd. 1991.
3. Pollution – Causes, Effects and Control. Harrison R. M. Whitstable Lithop Ltd. 1990.
4. Environmental Impact Assessment. Canter L. W. McGraw-Hill. 1996.

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Semester - VIII

(Open Elective - IV)

CS-459	L-T-P-C
Statistical Simulation & Data Analysis	3-0-0-3

Objective: *The course is designed to discuss the methods to simulate the statistical inferences obtained from the various datasets. The course discusses the various data analysis methods available and their usage in generating inference from the datasets.*

Course Content

Introduction to probability distributions. Basics of estimation and testing of hypothesis (frequentist approach, Bayesian approach).

Different censoring schemes: Type-I, Type-II, hybrid, progressive. Different models and EM algorithm: mixture model; bivariate distributions; cure rate model; competing risk model.

Generating random sample: discrete and continuous multivariate distributions (multinomial, multivariate normal, multivariate exponential); acceptance rejection principle; Monte Carlo Markov chain (metropolis Hastings algorithm, Gibbs sampler); Convergence of MCMC : Harris irreducibility, recurrence, minorization, limit theory for Harris recurrent markov chains.

Resampling techniques: jackknife; bootstrap. Hidden Markov Model (forward-backward algorithm, Viterbi algorithm, Baum-welch algorithm). Artificial Neural Network: framework, topology (feed forward neural network, recurrent neural network), training of ANN (supervised, unsupervised, reinforced learning), robustness. Genetic Algorithm: single objective GA, multi-objective NSGA.

Text/Reference Books

1. Simulation. Ross S.M. 4th Ed. Academic Press. 2006.
2. Data Analysis and Decision Making. Albright S.C., Winston W.L., Zappe C.J., Hinrichs C. & Rogove J. South-Western Publisher. 2002.
3. Data Analysis, Optimization and Simulation Modeling. Albright B. 4th Ed. Cengage. 2012.

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Semester - VIII

(Open Elective - IV)

EC-473
Robotics & Automation

L-T-P-C
3-0-0-3

Objective: *To introduce the basic concepts, parts of robots and types of robots and to make the student familiar with the various drive systems for robot and various applications of robots, justification and implementation of robot.*

Course Content

Introductory Concepts: Introduction to robotics, robotics history and development, classification of robotics, robotics applications and current research trends in robotics.

Basic Components of Robotics Systems: Robotics manipulators and mechanism actuators-pneumatics, hydraulics and electrics, sensors classifications, internal and external sensors.

Kinematics: Introduction to robotic manipulators, position and orientation of object space, robots coordinate transforms, Forward position analysis, Denavit-Hartenberg presentation and parameter calculation, inverse position analysis and parameter calculation.

Euler angles and computation of parameters for different robot configurations.

Statics: Force and moment balance, recursive calculation, equivalent joint torque

Dynamics: Inertia properties, Euler-Lagrange formulation, Newton-Euler formulation, recursive Newton-Euler algorithm, dynamic algorithm, recursive robot dynamics

Control: control techniques, second order linear system, feedback control system and performance of feedback control system, robotic joints and joint controller, non-linear trajectory control

Motion planning: General consideration in path description and generation, Joint space planning, Cartesian space planning, position and orientation trajectory, point to point planning, continuous path generation

Introduction to robotic vision, image representation and analysis, template matching edge detection, space analysis, prospective transformation, camera calibration, image compression techniques.

Text/Reference Books

1. Introduction to Robotics. Saha S. K. TMH. 2009.
2. Introduction to robotics: Mechanics and control. Craig J. J. Addition Wesley Longman Publishing Co. 1989.
3. Introduction to Robotics: Analysis, Control, Applications. Niku S. B. 2nd Ed. Wiley India. 2011.
4. Robot Dynamics & Control. Spong M. W. & Vidyasagar M. Wiley. 1989.
5. Industrial Robotics & Manufacturing Automation. Groover M.P. TMH. 1998.

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Semester - VII

(Open Elective - IV)

ME-466	L-T-P-C
Power Generation & Economics	3-0-0-3

Objective: *The goal of the course is to provide a fundamental understanding of the principles of hydro-electric, steam power, gas power, nuclear power and non-conventional power along with the economy associated with them as well as the present status, growth and developments of these power plants in India and across the world.*

Course Content

Introduction of power plants, Understanding of Hydro Electric Power Plant, Layout and Present status, Gas Turbine & Combined Cycle Power Plants, Thermal Power Plants, Nuclear Power Plants, Non-Conventional Power Generation & direct energy conversion systems, Power Plant Economics, Major Electrical equipment's in power plants, Instrumentation & control, Introduction to cogeneration principle & plants.

Text/ Reference Books

1. Power plant Engineering. Arora C.P. & Domkundwar S. Dhanpat Rai & Co. 2014.
2. Power Plant Engineering. Raja A.K., Shrivastav A. P. & Dwivedi M. New Age International Publication. 2006.
3. Power Plant Engineering. Nag P.K. Tata McGraw Hill. 2002.
4. Non-conventional energy source. Rai G.D. Khanna Publication. 2011.
5. Power Plant Engineering. Black & Veatch, Springer. 1996.

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Semester - VIII

(Open Elective- V)

BT-472

Bioelectronics & Biosensors

L-T-P-C

3-0-0-3

Objective: *This course imparts the knowledge of Biosensors, types of biosensors and their applications in online monitoring of bioprocesses.*

Course Content

Biosensors: components of biosensors, advantages & limitations; types of biosensors; biocatalysts based biosensors, bio affinity based biosensors & microorganisms based biosensors, biologically active material & analyte. Types of membranes used in biosensor constructions. Design of enzyme electrodes & their applications as biosensors in industry such as health care & environment. Transducers in biosensors: piezoelectric, semiconductor, impedimetric, mechanical & molecular electronics based transducers. chemiluminiscene - based biosensors principles & applications; calorimetric, optical, potentiometric / amperometric conductrometric / resistormetric transducers; biosensors in clinical chemistry, medicine & health care, biosensors for veterinary, agriculture & food. Low cost- biosensor for online & environmental monitoring, Molecular electronics, assembly of photonic biomolecular memory store, information processing; commercial prospects for biomolecular computing systems.

Text/Reference Books

1. Biosensors for Environmental Monitoring. Bilitewski U. Turner A.P.F Harwood. 2000.
2. Biotechnology the Science & Business. Harwood. Moses V & Cape R. E. Academic Publisher London, 1991.
3. Biosensors for Analytical Monitoring. Rogers K.R. & Mascini M. EPA Biosensors Group, 2001.

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Semester-VIII

(Open Elective – V)

CE-463	L-T-P-C
Finite Element Methods in Engineering	3-0-0-3

Objective: *To impart knowledge about the strain-displacement and linear constitutive relation; to be able to understand numerical techniques applied in FEM; to be able to know about 2-D isoparametric concepts and to be able to analyze 2-D frame element by FEM technique.*

Course Content

Basic concepts of engineering analysis, Methods of weighted residuals and variational formulations, Finite element discretization, Shape function, Lagrange and serendipity families, Element properties, Iso-parametric elements, Criteria for convergence, Numerical evaluation of finite element matrices (Gauss quadrature integration), Assemblage of elements, Analysis of plane stress/strain, axi-symmetric solids, Three dimensional stress analysis, Poisson's and Laplace equations, Flow through porous media, Solution technique; Finite element programming, Use of package Programs.

Text/Reference Books

1. Text book of Finite Element Analysis. Seshu P. Prentice Hall of India. 2003.
2. Finite Element Analysis: Theory and Programming. Krishnamoorthy C.S. Tata McGraw Hill. 1994.
3. Finite Element Procedures in Engg. Analysis. Bathe K.J. Prentice Hall of India. 1996.
4. An introduction to the finite element method. Reddy J. N. McGraw Hill Inc. 1993.

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Semester - VIII

(Open Elective - V)

CS-461
Soft Computing

L-T-P-C
3-0-0-3

Objective: *This course deals with soft computing concepts, neural networks, fuzzy logic, use of heuristics based on human experience, Genetic algorithm and its applications to soft computing , Optimization problems to Text*

Course Content

Introduction to Soft Computing: Rationale and Basics of Learning: Neural Networks: Multi-layer Feed-forward Networks, Recurrent Networks, Self-organizing Networks; Fuzzy Logic: Basics, inference scheme, Neuro-Fuzzy systems; Evolutionary Algorithms: GA and Optimization, Evolutionary Systems, Genetic Programming; Introduction to Rough Sets, Rough-Fuzzy representations, Belief Networks; Principles of SVM; Research based applications.

Text/Reference Books

1. Soft Computing: Fundamentals and Applications. Pratihar D.K. Narosa. 2015.
2. Neuro Fuzzy and Soft Computing. Jang J.S.R. Sun C.T. and Mizutani E. PHI. 2004.
3. Principles of Soft Computing. Sivanandam S.N. & Deepa S.N. 2nd Ed. Wiley. 2007.

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Semester-VIII

(Open Elective - V)

EE-466	L-T-P-C
Hydro Power Generation	3-0-0-3

Objective: *To get acquainted the students with various factors and control of hydro power plants.*

Course Content

Types of Hydro plants subsystems of hydro plant, turbines, hydro alternates hydro plant. Auxiliaries, control of hydro power, micro hydel systems, special problems in hydro plants.

Text/Reference Books

1. Hydro Plant Electrical Systems. Clemen David M. HCI Publications. 1999.
2. Hydro-electric and Pumped Storage Plants. Jog M G. 1st Ed. New Age Pub. 1989.

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Semester-VIII

(Open Elective – V)

MA-453	L-T-P-C
Mathematical Statistics	3-0-0-3
Pre-requisite	MA-254 / MA-451

Objective: *To introduce the fundamental techniques of Sampling, Estimation and Hypothesis testing and illustrate these techniques with applications.*

Course Content

Review of Random variables. Order Statistics. Random sampling. The Central Limit Theorem. Sampling Distribution related to normal distribution. Point estimation. Bias and mean square errors of point estimators. Properties of point estimation and Methods of estimation. Confidence intervals. Large sample and small sample confidence intervals. Hypothesis testing. Common large sample testsp values. Small sample hypothesis tests. Power of tests and Neyman-Pearson Lemma.

Text/Reference Books

1. Statistical methods (Vol. II). Das N.G. 1st Ed. McGraw-Hill. 2009.
2. Probability statistics and random processes. Veerarajan T. 3rd Ed. Tata McGraw-Hill Education. 2008.
3. Higher Engineering Mathematics. Ramana B. V. 1st Ed. Tata McGraw-Hill Education. 2006.
4. Fundamentals of mathematical statistics. Gupta S.C. and Kapoor V. K. 11th Ed. S. Chand and Sons. 2002.

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Semester - VIII

(Open Elective - V)

ME-467	L-T-P-C
Total Quality Management	3-0-0-3

Objective: *This course discusses total quality is a description of the culture, attitude and organization of a company that aims to provide, and continue to provide its customers with products and services the satisfy the needs.*

Course Content

Quality Concepts: Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product :Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

Quality Management: Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme. Human Factor in Quality: Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods. Control Charts: Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts: Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart. Defects Diagnosis and Prevention : Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building

reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. ISO-9000 and its concept of Quality Management: ISO 9000 series, Taguchi method, JIT in some details

Text/Reference Books

1. Total Quality management. Lal H. Wiley Eastern Limited. 1990
2. Beyond Total Quality Management. Bounds G. McGraw Hill. 1994
3. TQM in New Product manufacturing. Menon, H.G. McGraw Hill. 1992.