Scheme of Instruction, Evaluation

and

Syllabi of

B.E. MINING ENGINEERING
(I - II Semesters)

With effect from Academic Year 2026-27

DEPARTMENT OF MINING ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous)
Osmania University
Hyderabad – 500 007, TS, INDIA

Estd.1917

Estd.1929

INSTITUTION

The University College of Engineering (UCE) has the distinction of being the oldest and the biggest among the Engineering Colleges of the State of erstwhile Andhra Pradesh. Established in the year 1929, eleven years after the formation of Osmania University, it was the 6th Engineering College to be established in the whole of British India. The College moved to its present permanent building in the year 1947. Today it is the biggest among the campus colleges of Osmania University. The Golden Jubilee of the College was celebrated in 1979, the Diamond Jubilee in 1989 and the Platinum Jubilee in 2004. The College was made autonomous in 1994.
The Institute offers eight UG programmes (AI&ML, Biomedical, Civil, Computer Science, Electrical and Electronics, Electronics and Communications, Mechanical and Mining Engineering) and 22 PG programmes in various specializations. The University College of Engineering (A) is the first Engineering College to get ISO: 9001 Certification in Rank by NIRF, MHRD. The College also offers Ph.D., programmes in various areas of specialization in the various branches of Engineering. Part-time courses are also being offered at postgraduate levels.

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate, disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services to the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programmes
- Technology transfer and incubation

DEPARTMENT

The Department of Mining Engineering was established in 1956 at University College of Engineering, Osmania University, Hyderabad. Later, with a view to impart hands on field experience and very good exposure to the mining industry, the Department of Mining Engineering, was relocated to Kothagudem in 1978 amidst the coalfields of The Singareni Collieries Company Ltd. and rechristened as The Kothagudem School of Mines (KSM). In 1994, the Kothagudem School of Mines was handed over to Kakatiya University and is being called as UCE, KU.
The Department of Mining Engineering was re-started during 2018-19 in OUCE during Osmania University Centenary Celebrations with M.E. in Mining Engineering, Subsequently B.E in Mining Engineering was started from the academic year 2021-22. Establishment of this department is well supported by Industry and Alumni of Mining Engineers.

Vision

To be as a leading academic department on pace with global standards and contribute to the development of economic, technically viable and useful to societal problems and challenges of Mining engineering profession and also contribute to the regional and country's developmental activities.

Mission

- To produce highly competent and capable professionals to face the challenges and provide viable solutions to Mining Engineering problems
- Integration of their knowledge and skills to excel in the profession through continuous learning and contribute to the well-being of the society.
- To enhance the technical knowledge, research aptitude to serve the society in highly competent manner.

Programme Educational Objectives (PEO):

PEO1: Impart basic knowledge in the field of Mining Engineering.
PEO2: Develop skills to analyse and provide viable solutions to various Mining Engineering problems.
PEO3: Enhance communication skills and encourage team work.
PEO4: Prepare Mining Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.

PROGRAM OUTCOMES (POs)

POs	Engineering Graduates will be able to:
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
	PROGRAM SPECIFIC OUTCOMES (PSOs)
PSO1	Analytical Skill :Ability to plan, execute, manage and rehabilitate Mining Engineering systems and processes
PSO2	Entrepreneurial Skill :Ability to become independent practitioners, consultant and entrepreneurs in the field of Mining Engineering

MAPPING OF PEO'S WITH PO'S

S.No.	PEO Statement	M1	M2	M3
PEO 1	Impart basic knowledge in the field of Mining Engineering	3	2	2
PEO 2	Develop skills to analyse and provide viable solutions to various Mining Engineering problems.	3	3	2
PEO 3	Enhance communication skills and encourage team work.	2	2	1
PEO 4	Prepare Mining Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.	3	3	3

Rubrics

1 : Weakly mapped

2 : Moderately mapped

3 : Strongly mapped

PEO	Justification and rationale of the mapping
PEO 1	Mainly focuses on imparting basic knowledge in Mining Engineering to produce highly competent and capable professionals. Accordingly, the correlations are assigned.
PEO 2	Emphasis is on training to inculcate analytical skills to design various Mining Engineering problems. Hence, the correlations are allotted.
PEO 3	Focuses on personality development, character building and to work with peers. Therefore, the correlations are justified.
PEO 4	Equip with required skills to effectively tackle the real life problems of Mining Engineering in sustainable manner. Therefore, M1 to M3 are in good agreement.

Mapping of PEOs with POs

PROGRAMME EDUCATIONAL OBJECTIVES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO-1	3				3				1	1		1	1	
PEO-2	3				3				1	1		1	1	
PEO-3	3				3				1	1		1	1	
PEO-4	3				3				1	1		1	1	
PEO-5														

SEMESTER WISE SCHEMA WITH CREDITS

Scheme of Instruction for BE (Mining Engineering) for 8 Semesters

S. No.	Programme Work-Subject Area	Credits/Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences (HS)	4.5								**4.5**
2.	Basic Sciences (BS)	7.5	7.5	3						**18**
3.	Engineering Sciences (ES)	10	13	13.5	3					**39.5**
4.	Professional Subjects- Core (PC)		3	7.5	17.5	17.5	15	14		**74.5**
5.	Professional Subjects-Electives(PE)				3	3	3	3		**12**
6.	Open Subjects-Electives (OE)						3	3		**6**
7.	Project Work, Seminar and/or Internships (PW)			1		1	2	3	6	**13**
8.	Mandatory Programmes (MC) (*Credit*)					1	1			**2**
	TOTAL	**22**	**23.5**	**25**	**23.5**	**22.5**	**24**	**23**	**6**	**169.5**
9.	Mandatory Programmes (MC) (*Non-Credit*)									
	Contact Hours/ Week	**31**	**31**	**27**	**26**	**25**	**30**	**26**	**21**	

SEMESTER WISE SCHEMA WITH CREDITS

Scheme of Instruction for BE (Mining Engineering) - I Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Contact Hrs/ Week	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	MC100HS	Induction Program	3 weeks							
2	BS101MT	Matrices and Calculus	3	-	-	3	3	40	60	3
3	BS101CH	Engineering Chemistry	3	-	-	3	3	40	60	3
4	HS101EG	Communicative English	3	-	-	3	3	40	60	3
5	ES101CE	Engineering Mechanics	3	-	-	3	3	40	60	3
PRACTICALS										
6	BS151CH	Engineering Chemistry Lab	-	-	3	3	3	25	50	1.5
7	HS151EG	Communicative English Lab	-	-	3	3	3	25	50	1.5
8	ES151CE	Engineering Graphics	2	-	4	6	3	25	50	4
9	ES152ME	Workshop Practice	-	-	6	6	3	25	50	3
		Total	**14**	**00**	**16**	**30**	**24**	**260**	**440**	**22**

L : Lectures T : Tutorials
P : Practical
CIE : Continuous Internal Evaluation SEE : Semester End Evaluation

Induction Program
2 weeks
(Classroom teaching on various issues, campus visits and outside of the campus visit to bring awareness to the students about the future 4 years learning process at UCE, OU)

BS101MT	MATRICES AND CALCULUS						
Pre-requisites	**Contact Hrs/ Week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
Mathematical Knowledge of 12th/ Intermediate level	**L**	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives:

- To study Matrices as vector spaces, subspaces, linear transformation and its use in solving system of linear equations.
- To study Eigenvalue problems, Diagonalizable Matrices and Quadratic Forms.
- To introduce the concepts of Functions of Several Variables and its Applications.
- To introduce the concepts of Multiple Integrals and its Applications.
- To study Vector Differential and Integral Calculus.

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

1. Find vector spaces and subspaces and solutions of system of linear equations.
2. Solve Eigenvalue problems, Similar & Diagonalizable Matrices and Canonical Form of Quadratic Forms
3. Find the maximum and minimum values of multiple variable functions.
4. Use the knowledge of Multiple Integrals in finding the area and volume of any region bounded by given curves
5. Apply the knowledge of Vector Calculus to find line, surface and volume integrals.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	-	-	1	-	-	2
CO2	3	2	1	2	2	2	-	-	1	-	-	2
CO3	3	2	2	3	2	2	-	-	1	-	-	2
CO4	3	2	1	1	1	2	-	-	1	-	-	2
CO5	3	2	2	3	1	2	-	-	1	-	-	2

UNIT - I

Matrices and Vector Spaces: Vector Spaces, Subspaces, Linear Independence of Vectors, Dimension and Basis, Linear Transformation, Solution of General linear System of Equations, Elementary row and Column Operations, Echelon form of a Matrix, Gauss Elimination Method for Non – Homogeneous Systems, Homogeneous System of Linear Equations.

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UNIT - II

Eigenvalue Problems: Eigenvalues and Eigenvectors, Cayley - Hamilton theorem (without Proof), Similar and Diagonalizable Matrices, Special Matrices, Quadratic Forms, Canonical Form of a Quadratic Form.

UNIT - III

Functions of Several Real Variables: Introduction, Functions of Two Variables, Limits, Continuity, Partial Derivatives, Total Differential and Differentiability, Derivatives of Composite and Implicit Functions, Higher Order Partial Derivatives, Homogeneous functions, Taylor's Theorem (without Proof), Maximum and Minimum Values of Function, Lagrange's Method of Multipliers.

UNIT - IV

Multiple Integrals: Double Integrals, Evaluation of double integrals by two successive integrations,

Application of double integrals, Triple Integrals, Application of triple integrals, Evaluation of triple integrals Change of Variables in Integrals.

UNIT - V

Vector Differential and Integral Calculus: Gradient of a Scalar Field and Directional Derivative, Divergence and Curl of a Vector Field, Line Integrals, Line Integrals Independent of the Path and Green's Theorem (without Proof), Surface Integral, Divergence Theorem of Gauss and Stoke's Theorem (without Proof).

Suggested Reading:

1. R. K. Jain & S. R. K. Iyengar, Advance Engineering Mathematics, Narosa Publications, 5th Edition 2016 (Fifteenth Reprint 2026).
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley publications, 11thEdition, 2025.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2024(Reprint 2025).
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 11th Edition, 2025.
5. H. K. Dass and Er. Rajnish Varma, Higher Engineering Mathematics, S. Chand Publications 3rd Revised Edition 2014(Reprint 2025).

e-resources: https://onlinecourses.nptel.ac.in/e-learning/noc26_ma133

BS 101 CH	ENGINEERING CHEMISTRY					
Prerequisite if any:	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**	**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
Mathematical Knowledge of 12th/ Intermediate level	3	-	-	**3**	**40**	**60**	**3**

Course Objectives:

- To understand the fundamentals and principles of water chemistry relevant to Engineering chemistry.
- To acquire the knowledge of polymers used for industrial purposes with various applications.
- Interpret spectroscopic data for structural elucidation of molecules.
- Analyze the spontaneity and equilibrium of chemical reactions.
- Apply knowledge of batteries and nanomataerials to aid in engineering and technical applications.

Course Outcomes:

1. Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also teaches the techniques of softening of hard water and treatment of water for drinking purpose. Gains knowledge in causes of corrosion and its prevention.

2. Analyze the basic methods of reaction of organic molecules and study their properties.

3. Distinguishes the ranges of electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

4. Rationalize bulk properties and processes using thermodynamic considerations.

5. Apply the knowledge of basic fundamentals of nanoparticles to design nanosystems in every field.

Course Articulation Matrix:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**		
CO2	**3**	**3**	**2**	-	-	-	-	-	-	-	-	**2**		
CO3	**3**	**3**	**1**	-	-	-	-	-	-	-	-	**2**		
CO4	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**2**		
CO5	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**2**		

UNIT-I

Water Chemistry and Corrosion:

Water chemistry: Hardness of water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Water softening by Ion exchange and Reverse Osmosis methods. Boiler troubles-scales and sludges formation-causes, effects and prevention. Numerical problems.

Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods- Sacrificial anodic and impressed current cathodic protection methods. Surface coating methods: Hot dipping-Galvanizing and Tinning.

UNIT-II

Reaction Mechanism and Polymers:

Reaction Mechanism: Introduction - Addition, Substitution and Elimination reactions. Addition to C=C and C=O, Nucleophilic substitution in aliphatic system: SN^1 and SN^2 mechanism, Elimination reactions: E^1 and E^2 mechanism

Polymers: Introduction, Classification of polymers -Plastics, Fibres and Elastomers.

Preparation, properties and engineering applications of the following polymers:

Plastics: PVC and Bakelite

Fibers: Nylon 6:6, and Dacron.

Elastomers: Buna-S and Butyl Rubber.

Conducting polymers: Introduction. Mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly-aniline. Applications of conducting polymers. Biodegradable polymers, Applications of polymers in concrete materials – Epoxy resins.

UNIT-III

Molecular Structures and Spectroscopy:

Molecular Orbital Theory. Linear Combination of Atomic Orbital's (LCAO).Molecular Orbital energy level diagrams of diatomic molecules-O_2, N_2 and NO.

Description of Electromagnetic spectrum.

Principles of UV-Visible Spectroscopy: Statement of Beer-Lambert Law. Chromophores and Auxochromes. Absorption and intensity shifts: Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts with one example each. Principle and applications of UV Sensors.

IR Spectroscopy: Principle of IR Spectroscopy.IR active and IR inactive molecules (two examples each). Types of vibrational bands, Degrees of Freedom for linear and non linear molecule, Principle and applications of IR Sensors.

NMR Spectroscopy: Principle of ^{1}H-NMR Spectroscopy. Multiplicity, Chemical Shift. Example-Ethyl chloride, Principle and Applications of MRI.

UNIT-IV

Thermodynamics and Electro Chemistry:

Thermodynamics: Terminology of Thermodynamics, thermodynamic processes, Work done in Reversible isothermal and adiabatic processes, efficiency of heat engine by Carnot cycle, concept of entropy, physical significance of entropy, Work function, Gibbs free energy and their significance, variation of free energy with temperature and pressure, criteria of spontaneity in terms of entropy and free energy-Numericals.

Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells, cell-notation, cell reaction and cell potentials. Types of electrodes-Calomel, and Glass electrode. Determination of P^H of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells-Nernst equation and its derivation. Application of Nernst equation & Numericals.
Principles and applications of Conductometric titrations.

UNIT-V
Energy Sources and Nanomaterials:
Batteries: Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications.
Fuel cells: Concept of fuel cells and their advantages. Construction and working of H_2-O_2 and methanol-Oxygen fuel cells.
Solar cells: Concept of solar energy conversion, photovoltaic cells.
Nanomaterials: Introduction. Properties of nanomaterials. Synthesis of nanomaterials-Top down, Bottom up approach and Sol-gel method. Applications of nanomaterials.

Suggested Readings:
1. Jain & Jain, *Engineering chemistry*, Dhanpat Rai publishing Co., 17 th Edition .
2. Shashi Chawla, Text book of Engineering chemistry. Danpat rai & Co.
3. Arun Bahl and BS Bahl, *A text book of Organic Chemistry*, S. Chand Co. Ltd., S. Chand Publishing, 2017.
4. Robert Silverstein spectrometric identifications of organic compounds, Journal of Chemical Education, ACS Publications.
5. L.D.S. Yadav, Organic Spectroscopy. Springer nature-2005.
6. Y.R. Sharma Elementary organic spectroscopy, S.Chand Publications.

HS 101 EG	COMMUNICATIVE ENGLISH						
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives

1. To develop students' listening, speaking, reading, and writing (LSRW) skills for academic and professional communication.
2. To enhance vocabulary, grammar, and language accuracy for effective expression.
3. To improve comprehension and critical thinking through prose, poetry, biographies, and professional ethics.
4. To equip students with technical and professional writing skills such as report writing, email writing, presentations, and resume writing.
5. To enable students to communicate confidently and ethically in professional and social environments.

Course Outcomes:

After successful completion of the course, students will be able to:

1. Demonstrate effective listening, speaking, reading, and writing skills in academic and professional contexts.
2. Apply appropriate vocabulary, grammar, and language structures to communicate accurately and fluently.
3. Analyze literary and non-literary texts to develop comprehension, critical thinking, and interpretation skills.
4. Prepare professional documents such as reports, emails, letters, resumes, and presentations using appropriate formats and conventions.
5. Demonstrate ethical communication practices and interpersonal skills required for teamwork and professional success.

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	3	3	-	2
CO2	3	2	-	-	-	-	-	-	2	3	-	2
CO3	2	3	-	-	-	-	-	2	2	2	-	3
CO4	2	2	-	-	1	-	-	-	2	3	-	2
CO5	-	2	-	-	-	2	-	3	3	3	-	2

Correlation Rating: **Low/Medium/High-1/2/3 respectively**

Unit I

Prose: Silent Crisis | *Martha C Nussbaum*
Listening: What is Listening; Process of Listening; Importance of Listening
Speaking: Importance of Communication, Types of Communication (Non-verbal and Verbal)
Reading: Importance of Reading
Writing: Features of Writing Composition: Cohesions, Coherence, Precision and Clarity
Vocabulary and Grammar: Homonyms; Homophones; Homographs; Punctuation; Sentence Structure (Simple, Compound, Complex)

Unit II
Poem: Where the Mind is Without Fear | *Rabrindranath Tagore*
Listening: Types of Listening; Non-Verbal and Verbal Signs of Active Listening
Speaking: Types of Communication (Oral, Written, Visual)
Reading: Reading Skills: Skimming, Scanning
Writing: Discourse Markers and Linking Words; Paragraph Writing; Précis Writing
Vocabulary and Grammar: Root Words: Prefix, Suffix; Synonyms; Antonyms; Idioms and Phrasal Verbs; Concord

Unit III

Biography: Homi J. Bhabha
Listening: Effective Listening: Principles and Techniques
Speaking: Styles of Communication; Channels of Communication (Vertical, Horizontal, Interpersonal, Grapevine)
Reading: Intensive and Extensive Reading
Writing: Essay Writing; Report Writing
Vocabulary and Grammar: Words Often Confused; Tenses

Unit IV

Prose: A World Made by Atoms | *Margaret Cavendish*
Listening: Barriers to Effective Listening
Speaking: Barriers to Communication; Johari Window
Reading: SQ3R Method
Writing: Business Communication: Letter Writing; Resume Writing; Email Writing; Etiquette for WhatsApp /other Messaging Services
Vocabulary and Grammar: One Word Substitutes; Active and Passive; Reported Speech

Unit V

Prose: Professional Ethics
Listening: Note-Taking; Critical Listening Exercises
Speaking: Speaking To Communicate Effectively; Proverb Expansion through JAM
Reading: Critical and Inferential Reading Passages
Writing: Creating Writing

Vocabulary and Grammar: Technical Vocabulary; Common Errors in English; Correct Use of Prepositions and Articles; Avoiding Ambiguity; Misplaced Modifiers; Avoiding Redundancy

Suggested Readings:

1. Ashraf, M. Rizvi. *Effective Technical Communication*. Tata McGraw-Hill, 2006.
2. *Language and Life: A Skills Approach*. Orient Blackswan, 2018.
3. Raman, Meenakshi, and Sangeetha Sharma. *Technical Communication: Principles and Practice*. 2nd ed., Oxford University Press, 2011.
4. Swan, Michael. *Practical English Usage*. Oxford University Press, 1995.
5. Vijaya, B. *Communicative English and Employability Skills*. Orient Blackswan, 2026.

ES 101 CE	ENGINEERING MECHANICS						
Prerequisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

- Understand the resolution of forces, equilibrium of force systems
- Learn the analysis of forces in the structures
- Understand the concept of centroid, moment of inertia and dynamics

Course Outcomes:

1. Determine the resultant and moment of a force system
2. Apply the equations of equilibrium for a generalized force system
3. Analyze the forces in trusses and frames
4. Determine the centroid and moment of inertia for 1D & 2D bodies
5. Apply the concepts of dynamics in solving the engineering problems

UNIT I
Introduction to Engineering Mechanics covering:
Force Systems Basic concepts, Particle equilibrium in 2D & 3D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams,
Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT – II
Basic Structural Analysis covering:
Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple
Trusses; Zero force members; Beams & types of beams; Frames & Machines.

UNIT III
Centroid and Centre of Gravity covering:
Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass
moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT – IV
Virtual Work and Energy Method-Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for
equilibrium. Stability of equilibrium.

UNIT – V

Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums

Suggested Reading:

1. F.L. Singer, Engineering Mechanics, Collins, Singapore, 1975.
2. S.P. Timoshenko and D.H. Young, Engineering Mechanics, McGraw-Hill International Edition, 1983.
3. S. Rajeshakharam and G. Sankarasubrahmanyam, Mechanics, Vikas Publications, 2002.
4. S.B. Junarkar and H.J. Shah, Applied Mechanics, 2001.
5. J.H. Shames, Engineering Mechanics, Prentice Hall, 1987.
6. B. Bhattacharyya, Engineering Mechanics, Oxford Higher Education, 2015.

e-Resources:

1. http://nptel.ac.in/
2. http://mhrd.gov.in/e-contents
3. http://spoken-tutorial.org/

BS 151 CH	ENGINEERING CHEMISTRY LAB					
Prerequisite if any: Mathematical Knowledge of 12th/Intermediate level	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**	**Credits**
	L	**T**	**P**		**CIE**	**SEE**
	3	-	-	**3**	**25**	**50**	**1.5**

Course Objectives:

- To know the quality standards of potable water for health based limits.
- To perform the routine synthesis of commonly used drug in the laboratory.
- Apply electrochemical principles in conductivity, Electrode potentials and verification of Beer' s law.
- To Evaluate Iron content from Iron ores.
- To Synthesize an extensively used polymer in industry.

Course Outcomes

The chemistry laboratory course use consist of experiments illustrating the principle of chemistry relevant to the study of science and engineering. The students will learn to:

- Estimate hardness of Water in various water samples.
- Synthesize a small molecule drug.
- Measure of conductance of solutions and electrode potentials .
- Analysis of Iron content in Iron ore.
- Understand the principles and mechanism of polymerization reaction.

Course Articulation Matrix:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	-	-	-	-	-	1		
CO2	2	3	1	1	-	-	1	-	-	-	-	2		
CO3	2	2	2	2	-	1	-	-	-	-	-	2		
CO4	2	2	1	-	-	-	1	1	-	-	-	2		
CO5	3	2	1	1	-	1	1	1	-	-	-	1		

List of Experiments:-

I) Water analysis.

1) Determination of Total hardness of water by EDTA method.
2) Determination of Permanent hardness of water by EDTA method.

II) Synthesis of a drug molecule:

3) Synthesis of Aspirin.

III) Colorimetry:

4) Verification of Beers law and Estimation of the given permanganate.
5) Verification of Beers law and Estimation of the given $CuSO_4$.

IV) Conductance measurements:

6) Determination of cell constant.
7) Estimation of HCl and CH_3COOH by conductometric titration.

V) Potentiometric Measurements:

8) Estimation of HCl by potentiometric titration.

9) Estimation of ferrous iron by potentiometric titration.

VI) Extraction of Iron From Hematite:

10) Determination of Iron in Hematite.

VII) Synthesis of Polymer:

11) Preparation of phenol-Formaldehyde Resin.

References:

1. Senior Practical Physical Chemistry, B.D.Khosla, A.Gulati and V.Garg (R.Chand&Co., Delhi)
2. An Introduction to Practical Chemistry, K.K.Sharma and D.S.Sharma (Vikaspublishing, N.Delhi)

HS 151 EG	COMMUNICATIVE ENGLISH LAB						
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	3	3	25	50	1.5

Course Objectives:

- To develop learners' pronunciation skills through an understanding of the English sound system, stress, and intonation.
- To enhance contextual and collaborative communication skills for academic, social, and workplace settings.
- To improve fluency, confidence, and interpersonal communication through interactive language activities.
- To develop employability skills required for interviews, group discussions, presentations, and professional interactions.
- To foster effective communication, teamwork, and lifelong learning skills necessary for career growth.

Course Outcomes:

After successful completion of the course, students will be able to:

1. Demonstrate correct pronunciation using the English sound system, stress patterns, and intonation in spoken communication.
2. Communicate effectively in various contexts using appropriate verbal and non-verbal communication skills.
3. Participate actively in collaborative communication activities, demonstrating teamwork and interpersonal skills.
4. Apply employability communication skills in interviews, group discussions, presentations, and workplace interactions.
5. Exhibit confidence, professionalism, and ethical communication practices for lifelong learning and career development.

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	2	3	-	2
CO2	-	1	-	-	-	-	-	1	2	3	-	2
CO3	-	-	-	-	-	-	-	1	3	3	-	2
CO4	-	1	-	-	-	1	-	2	2	3	-	2
CO5	-	-	-	-	-	2	-	3	3	3	-	3

Correlation Rating: **Low/Medium/High-1/2/3 respectively**

Unit I English Sound System

a. Sounds of English
b. Vowels
c. Consonants
d. Using a dictionary to decode Phonetic Transcription
e. Transcription exercise with the help of CALL (Computer Aided Language Lab)

Unit II Stress and Intonation

a. Syllable
b. Word-Stress and its importance
c. Intonation-Falling and Rising tone
d. Listening comprehension: Listening to various accents & Listening practice and exercises

Unit III Contextual Conversation Skills

a. JAM
b. Picture Perception
c. Public Speaking
d. Role plays: Use of dialogues in various situations like Social, Formal, Academic and Professional contexts.

Unit IV Collaborative Communication

a. Group discussion forms and techniques
b. Mock GDs
c. Factual GDs and Controversial GDs
d. Abstract GDs and Case Studies
e. Debate: Form, techniques, topics for mock debates in class

Unit V Employability Communication

a. Presentation Skills
b. Presentations with emphasis on visual aids and body language,
c. Interview Skills: Techniques
d. Frequently asked Interview Questions
e. Mock interviews

Suggested Readings

1. Kumar, E. Suresh, and P. Sreehari. *A Handbook for English Language Laboratories*. Cambridge University Press, 2014.
2. Balasubramanian, T. *A Textbook of English Phonetics for Indian Students*. Macmillan, 2008.
3. Sethi, J., et al. *A Practical Course in English Pronunciation*. Prentice Hall of India, 2005.

4. Prasad, Hari Mohan. *How to Prepare for Group Discussions and Interviews*. Tata McGraw-Hill, 2006.
5. *English for Engineers and Technologists*. Combined ed., vols. 1–2, Orient Blackswan, 2010.
6. Vijaya, B. *Communicative English and Employability Skills*. Orient Blackswan, 2026.

Suggested Software:

- Sky Pronunciation Suite
- K-van Software
- Study Skills
- English Pronunciation Dictionary –CALD

ES 151 CE	ENGINEERING GRAPHICS						
Pre-requisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	2	-	4	3	25	50	4

COURSE OBJECTIVES:

- Introduce the fundamentals of engineering drawing standards, geometrical constructions, conic sections, and engineering curves.
- Knowledge about AutoCAD software, coordinate systems, drawing tools, and basic drafting techniques for engineering graphics
- Develop proficiency in the use of AutoCAD commands for creating, modifying, dimensioning, annotating, and printing engineering drawings.
- Impart knowledge of engineering scales and orthographic projections of points, lines, planes, and solids.
- Enhance visualization skills for drawing sectional views of Engineering solids and for effective graphical communication of engineering concepts.

COURSE OUTCOMES:

1. Apply the principles of engineering drawing to construct basic geometrical figures and curves using standard drawing practices.
2. Perform drafting operations using AutoCAD 2D commands to create, edit, dimension, and print engineering drawings.
3. Draw engineering scales and apply projection principles to points, straight lines, and various views of 2D and 3D objects.
4. Develop projections, sectional views, of regular solids, including prisms, pyramids, cylinders, and cones, in various orientations.
5. Demonstrate visualization and graphical communication skills using engineering drawing and CAD tools.

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	1	1				2		2	1	1		2	2	2
CO-2	1	1				2		2	1	1		2	2	2
CO-3	1	1				2		2	1	1		2	2	2
CO-4	1	1				2		2	1	1		2	2	2
CO-5	1	1				2		2	1	1		2	2	2

UNIT I:
Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering.
Geometrical Constructions (General method only), Conic sections (General and special method); Cycloid, Epicycloid, Hypocycloid and Involute (line, triangle, square, circle, Regular Polygons), Construction of Tangent and Normal to all General methods of Conic sections, Cycloid, Epicycloid, Hypocycloid and Involutes.

UNIT II:
Overview of Computer Graphics: Listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning, Snap to objects manually and automatically; Drawings straight lines using various coordinate input entry methods, Applying various ways of drawing circles.

UNIT III:
Commands, initial settings, Drawing basic entities, Modify commands, Text and Dimensioning, Blocks Applying dimensions to objects, applying annotations to drawings.
Setting up and use of Layers, Create, edit and use customized layers; Changing line lengths through modifying existing lines (Extend/Lengthen); Printing Options.

UNIT IV:
Scales – Reduced and Enlarged scales, Representative Fraction, Problems - Plain, Diagonal and Vernier Scales,
Projections of Points – projection when placed in different quadrants
Projection of Straight lines – Projections when parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.

UNIT V:
Projections of Planes – Projections when parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.
Projections of Regular Solids – Projections covering those parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.
Sections of Solids - sectional Views of Right regular solids covering Prism, Cylinder, Pyramid, and Cone

Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers
5. S.N. Lal., Engineering Drawing (2018), M/s. Cengage Learning India Pvt. Ltd., Pratap Gunj, Delhi
6. CAD Software Theory and User Manuals.

ES 151 ME	WORKSHOP PRACTICE						
Pre-requisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	6	3	25	50	3

Course Objectives: The course is taught with the objectives of enabling the student to:

- To train students for identifying, selecting, and use proper tools
- To impart practical, hands-on skills in basic manufacturing processes and fabrication across multiple trades.
- To instill a safety-first mindset regarding shop floor operations in an industrial environment
- To learn the fundamentals of house wiring which is used in daily life
- To measure mechanical dimensions accurately using standard instruments like Vernier calipers etc.

Course Outcomes: On completion of this course, the student will be able to:

1. Identify and select tools appropriate for specific manufacturing, assembly, and fabrication tasks across various engineering trades.
2. Fabricate physical products by applying hands-on skills in basic manufacturing and fabrication processes like carpentry, fitting, welding, foundry and other trades
3. Practice industrial safety by adhering to shop floor regulations, recognizing potential hazards, and using personal protective equipment.
4. Understand how individual trades work together to manufacture and assemble a complete engineering product.
5. Perform precise measurements on machined or fabricated components using standard metrology instruments like Vernier calipers and gauges

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	2	1	-	2	1	-
CO2	2	-	2	-	2	-	-	-	3	1	-	2	1	-
CO3	1	-	-	-	-	3	2	2	2	1	-	2	1	-
CO4	2	1	2	-	2	-	1	-	3	2	1	2	1	-
CO5	2	1	-	2	3	-	-	-	2	1	-	1	1	-

LIST OF EXPERIMENTS:

1. **Carpentry shop:**
   a) Making of a cross-lap joint with Wood
   b) Making of End Lap / Tee Lap Joint with wood

2. **Fitting shop**
   a) Making of a step cut with a mild steel flat
   b) Making of semicircular and V-cut with a mild steel flat

3. **Sheet metal shop**
   a) Making of Funnel with GI Sheet
   b) Making of a rectangular box with GI Sheet

4. **House wiring**
   a) Making of Cleat wiring
   b) Making of casing wiring

5. **Welding shop**
   a) Making of Butt joint using Arc Welding
   b) Making of a Lap Joint using Arc Welding

6. **Machine shop**
   a) Making of Step turning on MS cylindrical rod
   b) Making of Taper turning on MS cylindrical rod

7. **Foundry shop**
   a) Preparation of casting using a single-piece pattern
   b) Preparation of casting using a core pattern.

8. **Smithy shop**
   a) Forging of a square-shaped peg from a cylindrical workpiece
   b) Forging of square shape L- bend peg from a cylindrical workpiece

9. **Demo of advanced manufacturing equipment**
   CNC Machine / Injection Molding / FDM 3D Printer

Note: Minimum six trades should be conducted.

Suggested Reading:

1. Hajra Choudhury S.K., Hajra Choudhury A.K.and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

SEMESTER WISE SCHEMA WITH CREDITS

Scheme of Instruction for BE (Mining Engineering) - II Semester

Sl. No	Course Code	Course Title	Scheme of Instruction			Cont.Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	BS201MT	Differential Equations and Fourier Series	3	-	-	3	3	40	60	3
2	BS201PH	Engineering Physics	3	-	-	3	3	40	60	3
3	ES201CS	Programming for Problem Solving	3	-	-	3	3	40	60	3
4	PC201MN	Development of Mineral Deposits	3	-	-	3	3	40	60	3
5	ES201EE	Basic Electrical Engineering	3	-	-	3	3	40	60	3
PRACTICALS										
6	BS252PH	Engineering Physics Lab	-	-	3	3	3	25	50	1.5
7	ES251CS	Programming for Problem Solving Lab	-	-	3	3	3	25	50	1.5
8	ES251MN	Machine Drawing Practice	2	-	4	6	3	25	50	4
9	ES251EE	Electrical Engineering Lab			3	3	3	25	50	1.5
		Total	**17**	**00**	**13**	**30**	**27**	**300**	**500**	**23.5**
* At the end of II semester, students should undergo Internship-I (UG Mines). Marks will be awarded in III semester.										

L : Lectures T : Tutorials
P : Practical
CIE : Continuous Internal Evaluation SEE : Semester End Examination

BS 201MT	DIFFERENTIAL EQUATIONS AND FOURIER SERIES						
Pre-requisites if any:	**Contact Hrs/ Week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
Mathematical Knowledge of 12th/ Intermediate level	**3**	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives:

- To study the ordinary differential equations of first order.
- To study the linear ordinary differential equations of second and higher order with Variable and constant coefficients.
- To apply general methodology to solve linear first-order and second-order partial differential equations.
- To learn about expansion of functions by Fourier series.
- To study the classification of second order partial differential equations and solve them by
- using separation of variables methods.

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

1. Find the solutions of ordinary differential equations of first order.
2. Find the solutions of linear ordinary differential equations of second and higher order with variable and constant coefficients.
3. Find the solutions of first and second order PDE.
4. Obtain the Fourier series for a given function.
5. Find solutions of the heat equation, wave equation, and the Laplace equation subject to boundary conditions.

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	1	1	-	-	1	-	-	2
CO2	3	2	1	2	2	2	-	-	1	-	-	2
CO3	3	2	2	3	2	2	-	-	1	-	-	2
CO4	3	2	1	1	1	2	-	-	1	-	-	2
CO5	3	2	2	3	1	2	-	-	1	-	-	2

UNIT - I

Ordinary Differential Equations of First Order: Exact First Order Differential Equations, Integrating Factors, Linear First Order Equations, Bernoulli Equation, Application of Differential Equations of First Order –Newton's Law of Cooling, Rate of Decay of Radio – Active Materials.

UNIT – II

Linear Differential Equations: Introduction, Solutions of Linear Differential Equations, Linear Independence and Dependence, Methods for Solution of Linear Equations, Differential Operator $\boldsymbol{D}$, Solutions of Second and Higher Order Linear Homogeneous Equations with Constants Coefficients, Method of Reduction of Order for Variable Coefficient Linear Homogeneous Second Order Equations, Solutions of Non- Homogeneous Linear Equations, Method of Variation of Parameters, Solution of Euler – Cauchy Equation, Operator Methods for Finding Particular Integrals Case $\boldsymbol{r(x) = e^{\alpha x}}$, Case $\boldsymbol{r(x) = \cos(\alpha x)\ or\ \sin(\alpha x)}$, Case $\boldsymbol{r(x) = x^{\alpha}, \alpha > 0}$ and integer.

UNIT – III

Partial Differential Equations: Introduction, Formation of First and Second Order Equations, Solution of First Order Equations, Lagrange's Equation, Higher Order Linear Equations with Constant Coefficients.

UNIT – IV

Fourier series: Introduction, Fourier series, Fourier series Expansions of Even and Odd functions, Convergence of Fourier series, Fourier Half - Range Series.

UNIT – V

Application of Fourier series: Classification of Linear Second Order Partial Differential Equations, Separation of Variables Method (Fourier Method) Fourier series Solution of the Heat Equation, Fourier series Solution of the Wave Equation, Fourier series solution of the Laplace Equation.

Suggested Reading:

1. R. K. Jain & S. R. K. Iyengar, Advance Engineering Mathematics, Narosa Publications, 5th Edition 2016 (Fifteenth Reprint 2026).
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley publications, 11thEdition, 2025.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2024(Reprint 2025).
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 11th Edition, 2025.
5. H. K. Dass and Er. Rajnish Varma, Higher Engineering Mathematics, S. Chand Publications 3rd Revised Edition 2014(Reprint 2025).

e-resources: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma98

BS 201 PH	ENGINEERING PHYSICS						
Prerequisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

- To understand the fundamental laws of electromagnetism and how they lead static and time-varying electric and magnetic fields and to apply wave theory to optical phenomena, such as interference, diffraction, and polarization
- To appraise significance of stimulated emission and laser light production. Subsequently propagation of light through optical fibers.
- To make student understand the formation of energy bands and classification of the solids based on the band theory and to sensitize the students towards nanomaterials.
- To understand the different types Magnetic materials and Dielectric materials with their origin of evolution.
- To understand Schrodinger's wave equation and its applications and to understand the concept of superconductors.

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

1. Know how electric and magnetic fields lead the behavior of electromagnetic wave. It bridges classical physics and modern optics, empowering learners to analyze complex electromagnetic systems and waves optics.
2. Understand the construction and working of different laser systems and apply them to propagate light through optical fiber cable as cutting edge application.
3. Understand semiconducting materials and their properties, operating electronic devices, and applying them in circuits and also equips students with the fundamental principles, how materials behave at the nanoscale and how these unique physical, chemical, and biological properties differ from bulk materials.
4. Understand the fundamental physics behind how materials interact with electric and magnetic fields.
5. Enrich and understand the implications of matter waves in quantum mechanics evolution and to equip students with the theoretical skills to analyze, and apply materials that conduct electricity with zero resistance and expel magnetic fields.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	3	-	-	-	-	-	3
CO2	3	2	3	2	3	3	-	-	-	-	-	3
CO3	3	2	3	2	3	3	-	-	-	-	-	3
CO4	3	2	1	2	1	3	-	-	-	-	-	3
CO5	3	2	3	2	3	3	-	-	-	-	-	3

UNIT-I

Modern Optics: Interference – Newton's Rings by reflected light – Experimental arrangement – Types of diffraction – Diffraction due to single slit - Diffraction due to double slit (qualitative)- diffraction grating (Conditions of maxima and minima) – Polarization – Malus law – Double refraction – Nicol's Prism. – Optical activity and polarimeter.

Electro Magnetic Theory: Basic laws of electricity and magnetism – Derivation of Maxwell's equations in integral and differential forms - Conduction and displacement current – modification of Ampere's law - Equation of plane wave in free space – Poynting theorem.

UNIT-II

Lasers: Characteristics of lasers – Absorption of radiation, spontaneous and stimulated emission of radiation - Einstein's coefficients and their relation - Population inversion– Types of lasers - Ruby laser, Helium-Neon laser and semiconductor laser – state of art applications of lasers.

Fiber Optics: Construction of an optical fiber – Propagation of light through an optical fiber - Acceptance angle - Numerical aperture – Types of optical fibers (Based on number of modes and refractive index profile) – Fiber drawing process (double crucible method) - Applications of optical fibers

UNIT-III

Quantum Mechanics: Schrödinger's time independent and time dependent wave equation – Physical significance of wave function – Particle in 1-D box – Wave function, Probability function – Quantum states – Introduction to quantum technology and applications.

Semiconductor Physics: Classification of materials based on band theory - Kronig-Penney model (qualitative treatment) - Energy band formation in solids - Intrinsic and Extrinsic semiconductors - Concept of a hole - Carrier concentration and conductivity in intrinsic semiconductors – Formation of P-N junction diode, Light Emitting Diode and their I-V characteristics – Thermistor and its characteristics - Hall effect and its applications.

UNIT-IV

Dielectric Materials: Dielectrics - Types of polarizations – Electronic, Ionic, Orientational and Space charge polarizations – Expression for Electronic polarizability - Frequency and temperature dependence of dielectric polarizations - Determination of dielectric constant by capacitance Bridge method - Ferro electricity - Barium Titanate – Piezo electricity – Super capacitor.

Nanomaterials: Introduction - Properties of materials at reduced size - Surface to volume ratio – Quantum confinement effect – Classification of nanomaterials - Preparation of nanomaterials: bottom–up methods (e.g., Sol Gel method and Chemical Vapor Deposition method), Top-down methods (e.g., Ball milling method) - Basic ideas of carbon nanotubes – Applications of nanomaterials and their health hazards.

UNIT-V

Magnetic Materials: Origin of magnetism (Orbital and Spin magnetic moments) - Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials – Weiss molecular field theory of ferromagnetism - Magnetic domains - Hysteresis curve - Soft and hard magnetic materials – Ferrites: Applications of ferrites.

Superconductivity: Introduction - General properties of super conductors - Meissner effect - Type I and Type II superconductors - BCS theory (qualitative) – Introduction to High T_c superconductors - Applications of superconductors.

Suggested Reading:

1. M.S. Avadhanulu and P.G. Kshirasagar - Engg. Physics, S.Chand & Co.
2. C.M. Srivastava and C. Srinivasan - Science of Engg. Materials, New Age International.
3. R.K. Gour and S.L. Gupta – Engg. Physics, Dhanpat Rai Publications.
4. B.K. Pandey and S.Chaturvedi – Engineering Physics, Cengage Learning.
5. A.K Bhandhopadhya - Nano Materials, New Age International.

ES201CS	PROGRAMMING FOR PROBLEM SOLVING						
Prerequisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

- To introduce the basic concepts of Computing environment, number systems and flowcharts
- To familiarize the basic constructs of C language – data types , operators and expressions
- To understand modular and structured programming constructs in C
- To learn the usage of structured data types and memory management using pointers
- To learn the concepts of data handling using files

Course Outcomes:

On completion of this course, the student will be able to:

1. Explain various functional components in computing environment
2. Develop algorithmic solutions to problems and draw the flow charts
3. Explain and use basic constructs of C in writing simple programs
4. Use standard library functions in C and develop modular programs using user defined functions and structured data types
5. Use files and file handling for applications.

UNIT – I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, And Hexadecimal.

Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements

Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT – II

Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and Go to statements

Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers

UNIT– III

Preprocessors: Preprocessor Commands

Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

UNIT – IV

Pointers - Introduction, Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, L -value and R-value, Arrays and Pointers, Pointer Arithmetic and Arrays, passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.

Strings - Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions

UNIT –V

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types.

Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/Output Functions, Character Input/Output Functions.

Suggested Reading:

1.B.A. Forouzan and R.F. Gilberg, “A Structured Programming Approach in C” , Cengage Learning, 2007

2.Kernighan BW and Ritchie DM, “The C Programming Language”, 2nd Edition, Prentice Hall of India, 2006.

3.Rajaraman V, “The Fundamentals of Computer”, 4th Edition, Prentice-Hall of India, 2006.

4.Dromey “ How to Solve it By Computer , Pearson education, 2006

PC201MN	DEVELOPMENT OF MINERAL DEPOSITS						
Prerequisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

COURSE OBJECTIVES:

- To demonstrate the importance of mining in the national economy, understand the terminology associated with the discipline, and be familiar with the available regulatory mechanisms to enable safe & sustainable mining operations.
- To know the history of mining and describe the correlation between the development of mining and cultural progress.
- To introduce the field of mining and provide basic input about mining unit operations.
- To learn the various modes of access and study the methods of designing the access.

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

1. Know the status and significance of the mining Industry.
2. Know about different modes of entries for underground mines.
3. Known to select suitable drilling and blasting practices for mining operations.
4. Analyze conventional and special shaft sinking methods, evaluate modern shaft sinking techniques, and deepening procedures in accordance with statutory requirements.
5. Know about different modern drivage methods of tunnelling.

UNIT-I: INTRODUCTION

Role & importance of Mining and Mineral industry in nation building. Brief introduction of mineral distribution world-over. Brief introduction to procedures to be completed for starting a mine. Classification of minerals. Comparison of coal and other mineral deposits along with special problems associated with them. Classification of mining methods, their fields of application and selection criteria. Brief introduction to exploration of minerals. Adverse effects of mining and the availability of statutes to control them.

UNIT -II: MINE ENTRIES

Mining terminology like Dip, Strike, definitions of Opencast and underground mining, Duties and role of mining Engineers in the mining industry. Knowledge to be acquired by Mining Engineers to successfully discharge his/her duties in the mining industry, keeping in view the latest and continuing developments in the industry. Various operations to be performed in opencast and underground mines and equipment for the same (names only).

Scheme of mining. Opening up of deposits by opencast box cut and underground methods. Types, size and location of entries into underground coal and other minerals. Selection criteria and comparison of different modes of entries like shaft, Incline, adit and decline into underground mines. Preliminary investigations about strata for making entry and selection of equipment.

UNIT -III: INTRODUCTION TO DRILLING AND BLASTING

Drilling: Purposes of drilling, methods of drilling and their fields of application, selection of drilling method and operating parameters, distinguish between core and non-core drilling, Introduction to various types of drilling machines in opencast and underground mines (names and principle of operation only).

Blasting: Importance of blasting, types of explosives, accessories, importance of delay in blasting, blasting patterns for underground mines like shafts, inclines and tunnels. Permitted explosives, Direct and indirect initiation of explosives, detonator with cap and non-cap sensitivity, charge factor, powder factor, Pull and Progress, Volume of rock produced. Adverse effects of blasting.

UNIT -IV: SHAFT SINKING

Location, shape and size of vertical shafts. Surface arrangements for sinking shafts, tools and equipment, ordinary methods of sinking shaft, removal of debris and water, ventilation and lighting, temporary and permanent lining by various materials. Special Methods of Shaft Sinking: Piling, Caisson, Freezing and Cementation methods with conditions under which each method is adopted. Design of shafts insets and pit bottoms. Modern shaft sinking techniques include shaft boring, shaft raising (raise boring), and reaming of an initially drilled pilot borehole when underground access to the shaft axis has already been established. Widening and deepening of shafts, especially operating shafts with statutory requirements.

UNIT -V: DEVELOPMENT OF WORKINGS

Selection of location and drivage of inclines, declines (including open excavation), cross cuts, drifts, and raises by conventional and mechanized methods like Tunnel Boring Machine, New Austrian Tunnelling Method (NATM), and Road header. Prefabricated Undersea Tunnels. Calculation of OMS.

Arrangements for loading, transportation, ventilation, support, lighting, and drainage. Unsafe aspects associated with underground and opencast mines, with technological and statutory support available to control them briefly.

SUGGESTED READING:

1. *Introductory mining engineering, Howard L. Hartman, Jan M. Mutmansky/Wiley India (P) Ltd*
2. *Elements of mining technology Vol-I - D.J. Deshmukh /Denett & Company*
3. *Roy Piyush Pal, Blasting in ground excavations and mines, Oxford and IBH, 1st ed 1993*
4. *Ratan Raj Tatiya, Surface and Underground Excavations: Methods, Techniques and Equipment*
5. *C.P. Chugh, Drilling technology handbook, Oxford and IBH, 1st ed,1977*

ES201EE	BASIC ELECTRICAL ENGINEERING						
Prerequisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

The course is taught with the objectives of enabling the student to:

- To understand the fundamentals of DC electrical circuits.
- To understand the fundamentals of AC electrical circuits
- To understand the working principles of Transformers
- To understand the working principles of DC motor and DC generator
- To understand the working principles of protection devices used in electrical circuits.

Course Outcomes:

On completion of this course, the student will be able to :

1. Analyze the performance of simple electrical circuits & Apply different theorems to solve complicated electrical circuits to obtain the current, voltage and power With AC excitations.
2. Analyze the performance of simple electrical circuits exciting with DC
3. understand the working principles of Transformers and AC Motors
4. Understand the main components, characteristics, applications of different DC electrical machines used in industry
5. Understand the importance of protective devices and their rating used in electrical circuits and appliances required for any industry.

Course Outcome	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 3	3	2	2	-	-	1	-	-	-	-	-	-	2	3
CO 4	3	2	2	-	-	2	-	-	-	-	-	-	2	3
CO 5	3	2	1	-	-	2	-	-	-	-	-	-	2	3

Correlation rating**: Low / Medium / High – 1 / 2 / 3** respectively

UNIT - I : DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Ohm`s Law, KCL and KVL, series, parallel circuits, analysis of simple circuits with dc excitation. Thevenin`s, Norton`s & Superposition Theorems

UNIT - II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - III: Transformers

Transformers: Electromagnetic induction, Faradays laws, statically induced EMF, EMF equation, ideal and practical transformer, OC & SC tests , losses and efficiency, Auto-transformer and three-phase transformer connections. **AC Motors**: Induction Motors and BLDC Motors,Principle of operation ,Advantages and Applications.

UNIT IV: - DC Machines

DC Generators: Dynamically induced emf, construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications
DC Motors: Principle of working, Torque expression**,** Types of DC Motors, characteristics, applications

UNIT - V: Electrical Installations

Components of LT Switchgear: Switch, Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing & types of Earthing. Elementary calculations for energy consumption, power factor improvement by capacitors.

Suggested Reading:

1. J.B.Gupta, “Fundamentals of Electrical Engineering and Electronics” S.K.Kataria & Sons
2. Publications, 2002.
3. J.B.Gupta, “Utilization of Electric Power and Electric Traction” S.K.Kataria & Sons Publications, 2010
4. V.N.Mittle,Aravind Mittal “Basic Electrical Engineering” *Tata Mc.Graw Hill Publicationss* second edition2007.
5. Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Wesley
6. Longman Inc., 1995.
7. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda,“Basic Electrical Engineering” Tata McGraw Hill, Publications, 2009

BS 251 PH	ENGINEERING PHYSICS LAB						
Prerequisite if any:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	3	3	25	50	1.5

Course Objectives:

- To provide practical, experimental verification of fundamental physics concepts learned in lectures.
- To familiarize students with the operation, calibration, and maintenance of modern laboratory equipment and electronic measuring devices such as Four probe setups, Hall effect setup, polarimeters, diodes, lasers, spectrometers, and multimeters.
- To develop analytical and critical thinking skills. Students learn how to accurately record observations, perform graphical data analysis, apply experimental statistics, and estimate % of error and measurement precision.
- To estimate and evaluate the physical properties of engineering materials and components (e.g., determining energy gap in semiconductors, magnetic hysteresis or dielectric constants).
- To train students in the proper execution and documentation of scientific inquiry. This involves constructing proper experimental setups, drawing valid conclusions from collected data, and accurately maintaining laboratory records.

Course Outcomes:

1. Students learn to correlate theoretical physics concepts with real-world observations.
2. Students able to design experimental setups, conduct measurements, and compare your practical findings with theoretical models or calculations.
3. Students will gain expertise in handling advanced lab instruments (e.g., spectrometers, four-probe setups, and lasers etc.). This includes an understanding of instrument sensitivity, targeted accuracy, and error analysis.
4. This course trains the students in meticulous data recording, graphical representation, and logical deduction.
5. Students learn to identify discrepancies between expected and measured values and draw evidence-based conclusions.

List of Experiments:

1. To Estimate Radius of curvature of given lens by forming Newton's rings.
2. To determine specific rotatory power of a given solution by using Laurent's Half shade polarimeter.
3. To determine the wavelength of prominent spectral lines of mercury vapour lamp by plane diffraction grating with the help of spectrometer by using Normal Incidence Method.
4. To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT)/Barium Titanate ($BaTiO_3$).
5. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron), and find out (a) Coercivity, (b) Retentivity and (c) Hysteresis loss.
6. To draw the I-V Characteristics of P-N Junction diode and to evaluate the value of potential barrier of the diode.
7. To find the values of Electrical conductivity and energy gap of Ge crystal by Four probe method.
8. To study V-I characteristics of Light Emitting Diode.
9. Determination of carrier concentration, Mobility and Hall Coefficient of Ge Crystal using Hall Effect Experiment.
10. To calculate the Numerical aperture (NA), acceptance angle of a given optical fibre.
11. Determination of wavelength of LASER using diffraction grating.
12. To determine the constants of A, B and α of given Thermistor.

BS251CS	PROGRAMMING FOR PROBLEM SOLVING LAB						
Prerequisites	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	3	3	25	50	1.5

Course Objectives:

- To use tools available under LINUX for C programming
- To gain hands-on experience on basic constructs of C programming
- To gain hands-on experience on basic constructs of C programming
- To write modular programs in C using structure programming techniques and data file.
- To gain hands-on experience in using Python Programming constructs

Course Outcomes:

On completion of this course, the student will be able to:

1. Write, compile and debug C programs in Linux environment
2. Write simple programs using control structures, user defined functions and data manipulation using arrays
3. Use standard C library functions to develop modular programs in C
4. Write basic Python Programs, using conceptual understanding of Programming.
5. Create Programs, solutions for any problem statements with Programmatic, logic based approach

ES151CS – Programming for Problem Solving Lab

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2		3						1	1
CO2	3	3	2		2						1	1
CO3	3	2	3		2	1					1	2
CO4	3	3	3	2	2						1	1
CO5	3	3	3	2	2						1	2

1. Introducing to programming Environment (Linux commands, editing tools such as vi editor, sample program entry, compilation and execution)
2. Write programs using arithmetic, logical, bitwise and ternary operators.
3. Write programs simple control statements : Roots of a Quadratic Equation, extracting digits of integers, reversing digits ,finding sum of digit ,printing multiplication tables, Armstrong numbers, checking for prime, magic number,
4. Sin x and Cos x values using series expansion
5. Conversion of Binary to Decimal, Octal, Hexa and Vice versa
6. Generating a Pascal triangle and Pyramid of numbers

7. Recursion: Factorial, Fibonacci, GCD
8. Finding the maximum, minimum, average and standard deviation of given set of numbers using arrays
9. Reversing an array ,removal of duplicates from array
10. Matrix addition , multiplication and transpose of a square matrix .using functions
11. Bubble Sort, Selection Sort ,
12. Programs on Linear Search and Binary Search using recursion and iteration
13. Functions of string manipulation**:** inputting and outputting string , using string functions such as strlen( ),strcat( ),strcpy( )……etc
14. Writing simple programs for strings without using string functions.
15. Finding the No. of characters, words and lines of given text file
16. File handling programs : student memo printing
17. Create linked list, traverse a linked list, insert a node, delete a node, reversing list.
18. Python Basics and Input/Output
    a) Print "Hello, Engineering Students!"
    b) Read two integers and display their sum, difference, product, quotient, and remainder.
    c) Calculate the area and circumference of a circle.
    d) Swap two numbers (with and without a temporary variable).
    e) Convert temperature from Celsius to Fahrenheit.
    f) Calculate simple and compound interest.
19. Develop programs using conditional statements.
    a) Find the largest of three numbers.
    b) Check whether a year is a leap year.
    c) Determine whether a number is positive, negative, or zero.
    d) Check whether a number is even or odd.
    e) Display grades based on marks using if-elif ladder.
    f) Develop a menu-driven calculator using if-elif.
20. Develop programs using loops
    a) Print multiplication table of a given number.
    b) Generate first N Fibonacci numbers.
    c) Find factorial of a number.
    d) Check whether a number is prime.
    e) Reverse a given integer.
    f) Display Armstrong numbers between 1 and 1000.
21. Develop modular Python programs using functions.
    a) Write a function to find the maximum of two numbers.
    b) Write a function to calculate factorial using recursion.

c) Write a function to check palindrome.
d) Write a function to compute GCD of two numbers.
e) Write a function to determine whether a number is prime.
f) Create a menu-driven mathematical calculator using functions

22. Lists & Tuples - Perform operations on Python collections.

a) Read N numbers into a list and find the largest and smallest.
b) Compute average and median of list elements.
c) Remove duplicate elements from a list.
d) Sort a list in ascending and descending order.
e) Search an element using linear search.
f) Count frequency of each element in a list.

23. Develop programs using dictionaries.

a) Create a student dictionary containing Roll Number, Name, Branch, and CGPA.
b) Count frequency of characters in a string.
c) Count frequency of words in a paragraph.
d) Create a telephone directory using a dictionary.
e) Implement a simple student record management system using dictionaries.
f) Find the student with the highest marks from a dictionary of student names and marks.

ES251MN	MACHINE DRAWING PRACTICE						
Prerequisite	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	2	-	4	3	25	50	4

Course Objectives:

- To understand format of drawing sheet, angle of projections, isometric projections, sectional views and practice on simple machine elements
- To practice sketching of standard machine elements
- To have knowledge on ISO system of Limits and Fits
- To understand assembly drawings of typical machine parts such as Connecting rod, Eccentric,
- Cross head, Machine vice, Screw jack, Bearings, Tail stock etc.

Course Outcomes:

At the end of the course students will be able to

1. Will be able to draw isometric and orthogonal projections and sectional views of various mechanical components
2. Will be able to draw free hand sketches of various mechanical components
3. Will be able to understand the shape and structure of different types of joints, screws, keys and Couplings
4. Will be sufficiently knowledgeable to produce assembly views of various machines components from part drawings
5. Will be able to read and have preliminary understanding of the industrial drawings.

UNIT-I

Standard Drawing Practices: Format of drawing sheet, title block, conventions of drawing lines and dimensions.

Abbreviated indication of standard parts in assembly drawings. First and third angle projections, views of simple machine elements from the given pictorial and orthographic views.

UNIT II

Machine Drawing Conventions: Need for Machine Drawings –Introduction to types of Drawings and working Drawings for Machine Parts.

a) Types of Sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

b) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centre lines, curved and tapered features.

c) Title boxes - size, location and details - common abbreviations in general usage

UNIT-III

Drawing of Machine Elements and Simple Parts: Selection of Views, additional views for the following machine elements and parts with easy drawing proportions.

a) Screw Threads and Fasteners - Popular forms of Screw Threads, Bolts, Nuts, Stud Bolts, Tap Bolts, Set Screws.
b) Keys – Saddle Keys, Sunk Keys, Feather Keys, Woodruff Keys, Splines
c) Cotter Joints – with Sleeves, with Socket and Spigot ends, with Gibs
d) Pin Joints – Knuckle Joint.
e) Riveted Joints: Various types of Riveted Joints for plates.
f) Welded Joints: Various types of Welded Joints and symbols.

g) Shaft coupling – Sleeve or Muff Couplings, Flanged Couplings, Universal Couplings, Oldham Coupling.
h) Pipe Joints: Cast Iron Pipe Joints, Joints for Hydraulic Pipes, Pipe Fittings
i) Pulleys: Flat Belt Pulleys, 'V' – Belt Pulleys, Rope Pulleys. 67
j) Bearings: Journal Bearings – Solid, Bushed and Collared Journal Bearings, Pivot or Foot-Step Bearings.

UNIT-IV

Assembly Drawings (Engine Parts): Drawings of Assembled Views for the part drawings of the following using conventions and easy drawing proportions.
Engine Parts: Steam Engines: Stuffing Box, Cross Head, Eccentric. Petrol Engine: Connecting Rod, Piston Assembly.

UNIT V

Other Machine Parts Assembly Drawings (Valves parts): Drawings of Assembled Views for other parts drawings of the following using conventions and easy drawing proportions.
Valves Parts: Gate Valve, Screw-down Stop Valve, Spring Loaded Safety / Relief Valve, Feed Check Valve and Aircock.

Pattern of Exam:

Internals: Conventional and CAD Software Externals: Conventional
N.B. Tolerance charts to be provided in the examination Hall for calculation of limits.

Suggested Reading:

1. Siddeshwar N, Kannaiah P and Sastry VVS, "Machine Drawing", Tata McGraw Hill Publishing Co. Ltd., 5th Edition, 1994.
2. Bhatt N.D, "Machine Drawing", Charotar Publishing House, Anand, New Delhi, 28th Edition, 1993.
3. Machine Drawing: N.D. Bhatt; Charotar Publications, 47th Edition,2012
4. Narayan K.L, Kannaiah P, Venkat Reddy K, "Machine Drawing", New Age International (P) Ltd., 2nd Edition, 1999.
5. Machine Drawing: K. L. Narayana, P. Kannaiah& K. Venkata Reddy; New Age Publishers, 5th Edition, 2016.
    a. K. C. John, "Text book of Machine Drawing", PHI Learning, 2010.
    b. P. Narsimha Reddy, T.A. Janardhan Reddy, C.S. Rao, Production Drawing
6. Practice, High Tech Publishers, 2001.
    a. R.K. Jain, Engineering Metrology, Khanna Publishers, 8th Ed. 1985.
    b. K.L. Narayana, P. Kannayya and K. Venkat Reddy, Production Drawing, New Age International (p) Ltd. Revised edition, 1997.
    c. The Solid Works software manual

Reference Books:

1. Ajeet Singh, "Machine Drawing", TMH Publications, 4th Edition, 2010.
2. P. S. Gill, "Machine Drawing", Kataria Publications, 16th Edition, 1996.
3. Junarkar. N. D, "Machine Drawing", Pearson Publication, 2009

E - Resources:

1. https://rb.gy/eln9yk
2. https://rb.gy/erlhm8
3. https://rb.gy/p9q0o0

ES251EE	ELECTRICAL ENGINEERING LAB						
Prerequisite	Contact Hrs/ Week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	3	3	25	50	1.5

Course Objectives:

The course is taught with the objectives of enabling the student to:

- To understand the fundamentals of DC and AC electrical circuits.
- To Analyze the balanced three phase circuits to obtain the current,
- voltage and power.
- To understand the working principles of Transformers and three phase transformer connections
- To understand the working and performance characteristics of DC Motors
- To understand the Magnetisation characteristics of DC Generators

Course Outcomes:

On completion of this course, the student will be able to:

1. Get an exposure to common electrical components and their ratings.
2. To Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Analyze the performance of AC and DC circuits with appropriate operating conditions.
5. Understand the basic operation ahd characteristics of transformers and electrical machines.

Course Outcome	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO 3	3	2	2	-	-	-	-	-	-	-	-	-	2	3
CO 4	3	2	2	-	-	-	-	-	-	-	-	-	2	3
CO 5	3	2	2	-	-	-	-	-	-	-	-	-	3	3

Correlation rating**:** **Low / Medium / High – 1 / 2 / 3** respectively

Suggested List of Laboratory Experiments/Demonstrations:

I - Cycle

1. Verification of Kirchhoff's Laws
2. Verification of Thevenin's & Norton's Theorems
3. Steady-state and transient time-response of R-C circuit to a step change in voltage
4. Sinusoidal steady state response of series R-L-C circuits - impedance calculation and verification
5. Measurement of three-phase power in balanced three-phase circuits using Two-Wattmeter method

II - Cycle

6. Load test on single-phase transformer: Measurement of primary and secondary voltages, currents and power
7. Three-phase Transformer: Star and Delta connections. Voltage and current relationship
8. Performance Characteristics of DC-Shunt Motor
9. Speed control o f DC-Shunt Motor
10. Magnetization curve of a separately excited DC Generator

Suggested Reading:

1) J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K.Kataria & Sons Publications, 2002.
2) J.B.Gupta, "Utilization of Electric Power and Electric Traction" S.K.Kataria & Sons Publications, 2010
3) Abhijit Chakrabarti,,Sudipta Nath, Chandan Kumar Chanda, "Basic Electrical Engineering" Tata
4) McGraw Hill, Publications, 2009
5) Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Wesley Longman Inc.. 1995.