Scheme of Instruction & Examination
B.E. I – SEMESTER
Mechanical Engineering

Semester - I									
S. No	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			Hours Per week			**Duration in Hrs**	**Maximum Marks**		
			L	**T**	**P/D**		**CIE**	**SEE**	
Theory Courses									
1	6BS101HS	Engineering Mathematics - I	3	1	0	4	40	60	4
2	6BS107HS	Engineering Chemistry	3	1	0	4	40	60	4
3	6HS101HS	English	2	0	0	2	40	60	2
4	6ES101ME	Engineering Mechanics-I	3	0	0	3	40	60	3
Laboratories									
5	6BS154HS	Engineering Chemistry Lab	0	0	3	3	40	60	1.5
6	6HS151HS	English Lab	0	0	2	2	40	60	1
7	6ES152ME	Engineering Workshop Practice	0	0	4	4	40	60	2
8	6C151SP	Yoga/NSS/Sports	0	0	2	2	50	-	0
Total			11	2	11	24	330	420	17.5

BS: Basic Sciences ES: Engineering Sciences

HS: Humanities and Sciences MC: Mandatory Courses

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lectures T: Tutorials P: Practicals D: Drawing

Note: Each Contact Hour is a Clock hour

Semester - II									
S. No	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			Hours Per week			**Duration in Hrs**	**Maximum Marks**		
			L	**T**	**P/D**		**CIE**	**SEE**	
Theory Courses									
1	6BS202HS	Engineering Mathematics - II	3	1	0	4	40	60	4
2	6BS205HS	Engineering Physics	3	1	0	4	40	60	4
3	6ES202ME	Engineering Mechanics –II	3	0	0	3	40	60	3
4	6ES202EE	Elements of Electrical and Electronics Engineering	3	0	0	3	40	60	3
5	6MC201CE	Environmental Science	2	0	0	2	40	60	0
Laboratories									
6	6BS252HS	Engineering Physics Lab	0	0	3	3	40	60	1.5
7	6ES252EE	Elements of Electrical and Electronics Engineering Lab	0	0	2	2	40	60	1
8	6ES251ME	Engineering Graphics Lab	1	0	4	5	40	60	3
Total			15	2	9	26	320	480	19.5

BS: Basic Sciences ES: Engineering Sciences

HS: Humanities and Sciences MC: Mandatory Courses

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lectures T: Tutorials P: Practicals D: Drawing

Note: Each Contact Hour is a Clock hour

Course code	Course Title	Core/ Elective					
6BS101HS	Engineering Mathematics – 1	Core					
		L	T	P/D	Credits	CIE	SEE
		3	1	0	4	40	60

Prerequisite: Basics of Matrices, Differentiation, Integration and Trigonometric results

Course Objectives:

The objective of this course is to make the student

- Study matrix algebra and its use in solving system of linear equations and solving Eigen value problems.
- Study mean value theorems and their application to mathematical problems.
- Introduce the concepts of functions of several variables and multiple integrals
- Introduce the concepts of Multiple Integrals
- Study vector differential and integral calculus.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Find the rank of matrix and its use to find solution of linear equations, eigen value problem, Quadratic forms..
- **CO2.**Explain the concepts of derivatives using mean value theorems and their generalization. Concepts of curvature, evolutes, involutes, envelopes of family of curves
- **CO3.**Find Partial derivatives of functions of two variables using concept of limits and continuity and study the concepts of maximum and minimum of functions of two variables.
- **CO4.**Identify the key concepts, theories and mathematical fundamentals to derive mathematical relations involved in evaluation of double integrals and triple integrals and solving Engineering problems.
- **CO5.**Evaluate gradient of a scalar field, divergence, curl of a vector field to find the values of line, surface and volume integrals and establish their relation using Green, Gauss and Stokes theorems.

Unit-I (10Hrs)

Matrices: Rank of a matrix, Echelon form, System of linear equations, Linear dependence, independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic form.

Unit-II (10Hrs)

Calculus of one variable: Rolle's theorem, Lagrange's, Cauchy's Mean value theorems, Taylor's series, Curvature, Radius of curvature, Circle of Curvature, Envelope of family of curves, Evolutes and Involutes.

Unit-III (10Hrs)

Multivariable Calculus (Differentiation): Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum of values of functions of two variables, Lagrange's method of undetermined multipliers.

Unit-IV (8Hrs)

Multivariable Calculus (Integration): Double Integrals, Change of order of integration, change of variables from cartesian to plane polar coordinates, Triple Integrals.

Unit-V (12Hrs)

Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals, green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

TEXT BOOKS :

T1. Dr.B.S. Grewal, Higher. Engineering Mathematics, Khanna Publications, 43rd Edition,2014. (Unit 1-5)

T2. Advance Engineering Mathematics by Jain and Iyengar,5th Edition, Narosa Publications (Unit 1-5)

T3.B. V. Ramana, Higher Engineering Mathematics,3rd Edition 2015. (Unit 1-5)

REFERENCES/ SUGGESTED READING:

R1. M.D Raisinghania, Ordinary Differential Equations, 11th Revised Edition

R2. S.S. Sastry, Engineering mathematics, 3rd Edition, Paperback

R3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.

R4. Peter. V. O' Neil, Advance Engineering Mathematics,' Publisher, Global Engineering 7th Edition, 2012

Course code	Course Title	Core/ Elective					
6BS107HS	Engineering Chemistry	Core					
		L	T	P/D	Credits	CIE	SEE
		3	1	0	4	40	60

Prerequisite: Electrochemistry & Batteries, Water& Corrosion, Polymers, Energy Sources, Inorganic Engineering Materials.

Course Objectives: The objective of this course is to make the student

- Understand the principals of electrochemistry in storage of electrical energy in batteries.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Gains knowledge in causes of corrosion and its prevention. Attains knowledge about the disadvantages of hard water and treatment of water for drinking purpose.
- Explain the influence of chemical structure on properties of materials and their choice in engineering applications.
- Exposed to qualitative and quantitative parameters of chemical fuels.

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

- **CO1.**Apply concept of electrode potential in identifying feasibility of electrochemical reaction; illustrate electro analytical techniques and working of batteries
- **CO2.**Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods. Estimate the physical & chemical parameters of quality of water and explain the process of water treatment.
- **CO3.**Explain the influence of chemical structure on properties of materials and their choice in engineering applications.
- **CO4.**Classify chemical fuels and grade them through qualitative analysis.
- **CO5.**Classify Cements and grade them through qualitative analysis.

UNIT-I: (10 Hrs)

Electrochemistry and Batteries :

Electrochemistry: Electrochemical cells, Electrolytic and Galvanic cells-notation, cell notation, cell reaction and cell potentials. Electrodes: Electrode potential and Standard Electrode Potential (SEP). Construction and function of Calomel Quinhydrone and Glass electrodes. Determination of pH of a solution by using Quinhydrone electrode. Thermodynamics of emf , Nernst equation and its derivation. Applications of Nernst equation to electrode potential and emf of cells. Numerical problems.

Batteries: Primary batteries: Zn - Carbon battery. Secondary batteries: Pb-Acid cell & battery and Li-Ion cell battery, Applications. Flow batteries (Fuel cells): Hydrogen-Oxygen fuel cells& functioning. Applications of batteries.

UNIT-II: (10 Hrs)

Water Chemistry--its treatment and corrosion:

Water Chemistry: Hardness of Water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange process and desalination of water by reverse osmosis method. Numerical problems. Specifications of potable water--Steps involved in treatment of water – Sterilization by Chlorination -Disinfection of water by chlorination and Ozonization. Break Point Chlorination – advantages.

Corrosion: Causes and effects of corrosion. Types of Corrosion-Dry corrosion-

Its types or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Concentration cell corrosion. Waterline, Pitting and galvanic corrosion. Factors effecting rate of corrosion.

UNIT-III: (10 Hrs)

Polymers: Basics of terms polymers: Monomer functionality, degree of polymerization. Types of Polymerization (i) Addition--Mechanism of free radical polymerization (ii) Condensation (iii) Co-Polymerization with examples.

Classification of polymers - Thermoplastics & Thermosetting resins.

Plastics, Fibers and Elastomers and their characteristics. Preparation, Properties & Uses of the following polymers: Plastics - PVC and Bakelite, Fibers - Nylon 6:6, and Dacron. Elastomers - Buna-S, Butyl Rubbers.

Conducting polymers: Concept, Classification and Mechanism of conduction in Trans Poly-acetylene, Doped Conducting Polymers. Applications of conducting polymers. Biodegradable polymers: Concept. preparation, properties and applications of polylactic acid

UNIT-IV: (10 Hrs)

Energy Sources

Fuels: Introduction. Classification and advantages, disadvantages of solid, liquid and gaseous fuels. Requirements of a good fuel. Biofuels - Biodiesel.

Combustion: Calorific value of the fuel-Lower calorific value (LCV), Higher calorific value (HCV).Theoretical calculations of calorific value by Dulongs formula-Numerical problems. Solid Fuels: Coal-Proximate and Ultimate analysis and its significance.

Liquid Fuels:Source-Fractional distillation of petroleum, important fractions and their uses. Knocking, Fuel rating-Octane and Cetane numbers.

Gaseous Fuels: LPG, CNG composition and uses.

Biodiesel: Sources, Concept of Trans esterification and carbon neutrality. Properties and significance

UNIT-V: (10 Hrs)

Inorganic Engineering Materials:

Refractories: Properties of refractories (Refractoriness, RUL, Thermal Spalling, Porosity, Dimensional Stability). Manufacture of Refractories, common refractory bricks – Silica, Fire Clay, Magnasite, Dolamite, Chromite, and Graphite Bricks).

Lubricants: Definition, Mechanism of Lubrication (Flash Point & Fire Point, Cloud Point & Pour Point)—Hydrodynamics, Boundary Extreme Pressure lubrication. Classification: Solid, Semi Solid and Liquid Lubricants. Properties of Lubricants—determination of Viscosity, Viscosity Index, Saponification Number, Iodine value and its significance. Applications of Lubricants.

Cement: Concept--Natural Cement, Puzzolana Cement, Slag Cement, Portland Cement, Quick Setting Cement, Expanding Cement.

Text Books:

T1. PC Jain, M Jain Engineering Chemistry, Dhanapathi Rai &sons, 16th edition, 2015, New Delhi. (Unit: 1,4,5)
T2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. S. Chand & Company Ltd., Revised edition (2013). (Unit 2)
T3. Sashi Chawla,―Engineering Chemistry, Dhanpat Rai & Sons, New Delhi, 2017 (1St January 2017) (Unit 3)
T4. O G Palanna, ―Engineering Chemistry‖, Tata Mc Graw Hill, New Delhi, First Edition 2009.(Unit 2&4)

Reference Books :

R1. J D Lee, Concise inorganic chemistry, Blackwell science ltd, USA, Fifth edition
R2. P.W. Atkins,Physical Chemistry .
R3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).

Course code	Course Title	Core/ Elective					
6HS101HS	English	Core					
		L	T	P/D	Credits	CIE	SEE
		2	0	0	2	40	60

Prerequisite: Know the basic functions of the Language

Course Objectives: The following are the Objectives of the Course:

To enable and enhance the English language abilities of engineering students, especially in reading and writing, by –

- Using authentic material for language learning and gaining proficiency in it (Knowledge) (Comprehension)
- Exposing them to a variety of content-rich text.
- Strengthening their grammar and vocabulary.
- Improving their reading and comprehension skill.
- Honing their writing skills.
- Encouraging them to think creatively and critically.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Read, understand, interpret and comprehend a variety of written texts and develop positive attitude and commitment towards their (students') goal and society.
- **CO2.**Remember and recognize the significance of vocabulary (roots and affixes, homonyms, one- word substitutes, etc.) and use language accurately for effective communication.
- **CO3.**Apply appropriate grammatical concepts (tenses, articles, prepositions, etc.) to spoken and written English in informal and formal ambience.
- **CO4.**Compile information of various aspects of English diction – Develop creativity in writing skills by framing Paragraphs, Essays, Letters, Emails and SOPs.
- **CO5.**Analyze different ways of life through reading prose and poetry, each symbolizing a particular virtue and the learners develop the ability to be creative.

Unit – I : (6 Hrs)

Reading : Amitav Ghosh "Coming Home"
Vocabulary : Word Formation – Prefixes, Suffixes , Root words
Grammar : Articles, Prepositions, Determiners
Writing : Types of Sentences; Guided Writing (Expanding the Outline / Writing from verbal cues)

Unit – II : (6 Hrs)

Reading : Rudyard Kipling, "If"
Vocabulary : Word Formation – Compounding and Blending, Contractions
Grammar : Transitions, Connectives, Question Tags
Writing : Précis & Paragraph Writing

Unit – III : (6 Hrs)

Reading : Martin Luther King Jr. "I have a Dream"
Vocabulary : Synonyms, Antonyms, One-Word Substitutes
Grammar : Voice
Writing : Letter Writing

Unit – IV : (6 Hrs)

Reading : Robert Frost, "Road Not Taken"
Vocabulary : Homophones, Homonyms, Homographs
Grammar : Narration (Direct – Indirect Speech)
Writing : Reporting Events (Swearing in, Poll-Address, News Events, Visit to Book Exhibition, Annual /Farewell Day)

Unit – V : (6 Hrs)

Reading : George Orwell' " The Sporting Spirit" (Excerpt)
Vocabulary : Inclusive Language, Euphemism
Grammar : Tense
Writing : SOP

Text Books :

T1. E. Suresh Kumar, *Engineering English,* Orient Black Swan, 2014.

References / Suggested Reading:

R1. Modern English Grammar
R2. "Grammar in Use" Raymond Murpphy
R2. Sudharshana, NP and C Savitha, English for Engineers. Cambridge University Press 2018.

Course code	Course Title	Core/ Elective					
6ES101ME	Engineering Mechanics-I	Core					
		L	T	P/D	Credits	SEE	CIE
		3	0	0	3	40	60

Prerequisite Basics of Trigonometry& Physics.

Course Objectives:

The objective of this course is to make the student

- Force systems in plane and in space, their resolution, and resultants
- Equilibrium equations of planar and spatial force systems, and their applications to solving unknown forces.
- Laws of friction and applications to simple mechanical systems
- Centroids and moment of inertia of various plane figures and rigid bodies
- Analysis of plane trusses to find the support reactions and the axial forces in members

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.Apply** the concepts of force systems and static equilibrium for solving for unknown forces
- **CO2.Understand** free body diagram and apply equilibrium equations to solve for unknown forces
- **CO3.Solve** for unknown forces in problems involving friction between contacting bodies
- **CO4.Determine** centroids and moment of inertia for elementary, composite figures and solid bodies.
- **CO5.Analyse** a plane truss to solve for unknown support reactions and member forces.

Unit-I:

Resultant of Force Systems: Force, Resultant, Parallelogram Law, Triangle Law, Polygon Law, Resolution of Forces, Systems of Forces - Collinear, Coplanar & Non-Coplanar Concurrent Force Systems. Moment of a Force, Couple, Varignon's Theorem, Coplanar Non-Concurrent Force System, Spatial Concurrent Forces.

Unit-II:

Equilibrium of Force System: Equilibrant, Free body diagram, Equations of Equilibrium, Lami's theorem, Applications on Planar system of forces, Non-coplanar, Concurrent forces

Dry Friction: Laws of Friction, Coefficients of Static & Dynamic Friction, Angle of Repose, Friction Cone, Friction Circle, Applications to Single &

Connected Bodies involving Blocks, Wedges, Pulleys & Belts.

Unit-III:

Analysis of Trusses: Introduction, Pin Joints, Degrees of Freedom & its Significance, Forces in Members of Perfect Frame, Method of Joints & Method of Sections for Cantilever & Simply Supported Trusses. (Analytical Method)

Unit-IV:

Centroid and Centre of Gravity: Introduction, Centroid of Standard 1D objects (Straight Line & Arcs) & their Composites, Standard 2D Areas (Triangles, Sector, Semi & Quarter circles, Parabolic Laminae) & their Composites, Standard 3D Volumes (Cylinders, Cones, Pyramids) & their Composites, Pappus Theorems & Their Applications.

Unit-V:

Area Moments of Inertia: Introduction, Double Moment of Area - I, Polar Moment of Inertia - J, Radius of Gyration - k, Transfer Formulae. I of standard areas (Rectangle, Triangle, Complete, semi & quarter circles) by Integration. I of their composites.

Mass Moment of Inertia: Introduction, Radius of Gyration, Transfer Formula. Mass Moment of Inertia of Thin Plates, Cylinder, Sphere, Cone and their Composites.

Text Books

1. Engineering Mechanics S.S. Bhavikatti et al, New Age International Publishers, 2017
2. Engineering Mechanics: Principles of Statics and Dynamics, R. C. Hibbler, Pearson Education; Fourteenth edition, 2017
3. Engineering Mechanics - Statics and Dynamics, by N H Dubey, McGraw Hill Education, 2017

References/ Suggested Reading

1. Engineering Mechanics (In SI Units), by S.P. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill International, 5th edition, 2017
2. Singer's Engineering Mechanics Statics and Dynamics, by K. Vijay Kumar Reddy and J. Suresh Kumar, B.S. Publishers, 2011
3. Engineering Mechanics Statics and Dynamics, A. K. Tayal, 14th Edition, Umesh Publishers, 2010.

Course code	Course Title	Core/ Elective					
		Core					
6BS154HS	Engineering Chemistry Lab	L	T	P/D	Credits	CIE	SEE
		0	0	3	1.5	40	60

Prerequisite: Higher secondary level Physics

Course Objectives:

The objective of this course is to make the student

- Apply the theoretical knowledge in doing practical experiments.
- Acquire skills to handle instruments.
- Understand the behavior of semiconductors and opto-electronic devices.
- Analyze errors in experimental data.
- Plot graphs between different physical parameters.

Course Objectives:

After completion of the course, the student will be able to

- **CO1**.Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories.
- **CO2.** Understand the need for precise measurement practices for data recording.
- **CO3.** Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations.
- **CO4.** Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics
- **CO5.** Acquire knowledge in communication skills through working in groups in performing the laboratory experiments and by interpreting the results

List of Experiments

1. Introduction to Chemical Analysis and Techniques of Weighing.

Volumetric Analysis:

2. Preparation of Standard Mohr's salt solution, Standardization of KM estimation ferrous ion.

3. Preparation of Standard $K_2Cr_2O_7$ solution, Standardization of Mohrs and estimation of dichromate ion. ($Cr_2O_7^{2--}$)

Complexometry

4. Preparation of Standard Magnesium sulphate solution, standardizati and estimation of Total Hardness of water.

5. Preparation of Standard Sodium Carbonate Solution, Standardizatio Estimation of Carbonate and Bicarbonate Alkalinity of water sample.

Conductometry:

6. Estimation of HCl by conductometry. **Potentiometry**

7. Estimation of HCl by potentiometry(acid base titration)

8. Estimation of Fe^{2+} by potentiometry(redox titration)

P^H Metry:

9. Estimation of HCl by P^HMetry.

Colorimetry

10. Verification of Beers Law using potassium permanganate and estimation of amount of KMnO4 in the given sample solution.

List of Additional Experiments

1. To determine the viscosity of a given oil by Ostwalds Viscometer.

References **:**

1. B.D. Khosla, A. Gulati and V. Garg , ―Senior Practical Physical Chemistry‖, R. Chand & Co., Delhi, 2011.

2. K. K. Sharma and D.S. Sharma , ―An Introduction to Practical Chemistry‖, Vikas publishers, New Delhi, 1982.

Course code	Course Title	Core/ Elective					
6HS151HS	English Lab	Core					
		L	T	P/D	Credits	CIE	SEE
		0	0	2	1	40	60

Prerequisite: Understanding of the English Alphabet and the Corresponding Sounds

Course Objectives:

The objective of this course is to enable the student to :

- Learn the Sound Systems, Word Stress, Intonation of English
- Gain the knowledge of the appropriate use of Language and Body Language
- Acquire the Techniques to Participate in Group Discussions
- Hone their Participation and Presentation Skills
- Comprehend how Interviews are conducted and faced

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Enhance Pronunciation, Stress, Intonation and Articulation Skills
- **CO2.**Speak the Language coherently, with a lesser MTI
- **CO3.**Employ Language and Body Language intelligibly
- **CO4.**Engage in Group Discussions efficiently
- **CO5.**Prepare and Produce Decent Presentations ,To Fare, Well in Interviews

LIST OF EXPERIMENTS

1. **Ice-Breaking Session**
2. **Introduction to English Phonetics :** Organs of Speech **:** Speech Mechanism
3. **Sounds of English :** Introduction to International Phonetic Alphabet, Classification and Description of English Phonetic Sounds – Vowel Sounds & Consonant Sounds; Minimal Pairs; The Syllable
4. **Word Stress :** Primary Stress, Secondary Stress, Functional Stress, Rules of Word Stress
5. **Intonation :** Major Patterns of Intonation in English
6. **Speaking Activity: JAM** : an impromptu speech where the speaker is supposed to express the idea (s) on the given topic, within the duration of a **minute**.
7. **Role Play:** Use of dialogues in a variety of situations and settings
8. **Group Discussion:** Initiating, continuing and concluding a GD, Components and Types of GDs,
9. **Power-Point Presentation: (General Topics)** Making effective presentations, Expressions which can be used in presentations, Use of non-verbal communication, Coping with stage fright, Handling

questions and answer session

10. **Interview Skills:** Facing interviews confidently, Use of suitable expressions during interviews; Mock interviews

Text Books :

T1. E. Suresh Kumar. *A Handbook for English Language Laboratories (with CD).* Revised edition, Cambridge University Press India Pvt. Ltd. 2014

Reference / Suggested Reading :

R1. T. Balasubramanian. *A Text book of English Phonetics for Indian Students.* Macmillan, 2008.
R2. Edgar Thorpe. *Winning at Interviews*. Pearson Education, 2006.
R3. J. Sethi et al., A *Practical Course in English*
R4. Pronunciation (with CD). PrenticeHall of India,2005.
R5.Hari Mohan Prasad. *How to Prepare for Group Discussions and Interviews.* TataMcGraw Hill,2006.

Course code	Course Title	Core/ Elective					
6ES152ME	Engineering Workshop Practice	Core					
		L	T	P/D	Credits	CIE	SEE
		0	0	4	2	40	60

Prerequisite: Practical skill

Course Objectives:

The objective of this course is to make the student

- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To gain basic knowledge on various manufacturing processes used for the production of various engineering products.
- To gain hands on exposure on computer hardware and working knowledge on computers and software.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Identify and demonstrate the usage of different tools to be used in various manufacturing trades with safety measures.
- **CO2.**Apply the skills developed to undertake the jobs connected to various engineering workshop trades including fitting, carpentry, sheet metal, house wiring, welding, and foundry.
- **CO3.**Demonstrate the knowledge of various machine tools and their operations such as machining, injection moulding, casting and 3D printing and basic electronics lab instruments.
- **CO4.**Illustrate the advanced machining processes like CNC, rapid prototyping.
- **CO5.**Apply the basic knowledge of computers to assemble and disassemble various components of computer and able to install various operating systems such as windows or Linux.

LIST OF EXPERIMENTS

A. TRADES FOR EXERCISES:

At least two exercises to be done from each trade.

1. **CARPENTRY:** Sawing and Grooving, T-lap joint, Dove-tail Joint.
2. **FITTING:** Step Cutting & Filing, Drilling & Tapping, V-Fitting
3. **HOUSE WIRING**: Parallel & Series, Two-Way Switch, Tube light Connections.
4. **SHEET METAL WORKING:** Open Scoop, Funnel, Rectangle Tray.
5. **BLACK SMITHY:** Upsetting, Fullering, S-Hook
6. **WELDING:** Lap joint, Single V-butt joint, Corner joint
7. **PLUMBING:** Practice of Internal & External Pipe Threading, Pipe Fitting, Tap and Shower connections.

B. TRADES FOR DEMONSTRATION AND EXPOSURE:

1. Machines (lathe and drilling)
2. Injection Moulding
3. Mould making and Casting
4. Basic Electronics Lab Instruments
5. 3D Printing

C. PRESENTATIONS AND VIDEOS LECTURES:

1. Manufacturing Methods
2. Glass Cutting
3. 3D Printing
4. CNC Lathe

D. IT-WORKSHOP: Computer hardware, Identification of parts, disassembling and assembling of computer to working condition. Operating System Installation

Text Book:

1. P. Kannaiah, K.L.Narayana "Workshop Manual" Scitech Publications; 2nd Edition.

References:

1. Venugopal,K, "Workshop Manual", Anuradha Publications; 2012th edition.
2. K.C.John, "Mechanical Workshop" 2nd Edition, PHI, 2010.
3. Hajra Choudhury, "Elements of Workshop Technology" Vol.1, Asian Publishers, Edu., 2010.

Course code	Course Title	Core/ Elective					
		Core					
6BS202HS	Engineering Mathematics – II	L	T	P/D	Credits	CIE	SEE
		3	1	0	4	40	60

Prerequisite: Basics of Differentiation, Integration and Trigonometric results.

Course Objectives:

The objective of this course is to make the student

- Study the concepts of sequences, series, and their properties.
- Provide the over view of ordinary differential equations of first order and their application to mathematical problems.
- Solving higher order ordinary differentiation by various mathematical methods.
- Evaluate improper integrals using Beta and Gamma functions
- Study Laplace transforms and its applications to differential equations.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**To Test for the convergence and divergence of infinite series using the comparison test, Ratio test, Cauchy's n'th root test, Leibnitz's test, and also analyzing the nature of series.
- **CO2.**Solve the ordinary differential equations of first order and their physical and geometrical applications.
- **CO3.**Solve the ordinary differential equations of second and higher with constant and variable coefficient by different methods. Solution of non-homogeneous equations, Euler-Cauchy equation. Method of variation of parameters.
- **CO4.**Evaluate the improper integrals using beta and gamma functions. Solution of Legendre polynomials.
- **CO5.**Evaluate Laplace Transforms, Inverse Laplace Transforms of functions and their applications to ordinary differential equations.

Unit-I (10Hrs)

Sequence and series: Sequences—General properties of series, Series of positive terms, Comparison test,tests of convergence-D'Alembert's Ratio test, Cauchy's nth root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence, and Conditional convergence.

Unit-II (10Hrs)

Differential Equations of First Order: Exact Differential Equations, Integrating Factors, Linear differential Equations, Bernoulli's Equation,

Riccati's and Clairaut's differential equations, Orthogonal Trajectories of a Given Family of Curves, Applications of differential equations-L-C,L-R circuit.

Unit-III (12Hrs)

Differential Equations of Higher Order: Solutions of second and higher order linear Homogenous Equations with Constant Coefficients, Solutions of non-homogeneous linear differential equations, Method of Variation of Parameters, solution of Euler-Cauchy Equation, Applications of differential equations-L-CR circuit.

Unit-IV (8Hrs)

Special functions: Gamma Function, Beta Function, Relation between Gamma and Beta Functions, Error Function, Power Series Method, Legendre's Differential Equations and Legendre's Polynomial Pn(x), Orthogonal property of Legendre's Polynomial Rodrigue's Formula (with proof).

Unit-V (10Hrs)

Laplace Transforms: Laplace Transforms, Inverse Laplace Transforms, Properties of Laplace Transformsand inverse Laplace Transforms, Convolution Theorem (without proof). Solution of ordinary differential Equations using Laplace Transforms**.**

TEXT BOOKS:

T1. Dr.B.S. Grewal, Higher. Engineering Mathematics, Khanna Publications, 43rd Edition,2014. (Unit 1-5)

T2. Advance Engineering Mathematics by Jain and Iyengar,5th Edition, Narosa Publications (Unit 1-5)

T3.B. V. Ramana, Higher Engineering Mathematics,3rd Edition 2015. (Unit 1-5)

REFERENCES/ SUGGESTED READING:

R1. M.D Raisinghania, Ordinary Differential Equations, 11th Revised Edition

R2. S.S. Sastry, Engineering mathematics, 3rd Edition, Paperback

R3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.

R4. Peter. V. O' Neil, Advance Engineering Mathematics,' Publisher, Global Engineering 7th Edition, 2012

Course code	Course Title	Core/ Elective					
6BS205HS	Engineering Physics	Core					
		L	T	P/D	Credits	CIE	SEE
		3	1	0	4	40	60

Prerequisite: Basics of Oscillations, Crystals, magnetic materials.

Course Objectives:

The objective of this course is to make the student

- understand the basics concepts of waves and oscillations
- The knowledge of different types of crystal systems, to analyze the crystal parameters and to classify the defects present in the crystal.
- Understand the properties of Magnetic and superconducting materials.
- Know the construction of lasers and optical fibers and apply their basic principles to various laser systems and optical fibers
- Acquire knowledge of acoustics and Ultrasonics

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Solve engineering problems using the concept to waves and oscillations
- **CO2**.Classify Crystal's systems and acquire the knowledge of various imperfections.
- **CO3.** Have exposure on magnetic and dielectric materials.
- **CO4.**Explain the lasing action in lasers, propagation of light in optical fibers and compile their applications different fields.
- **CO5.** knowledge about acoustics, ultrasonic's and its applications

Unit – I (12 Hrs)

Waves and Oscillations: Simple Harmonic Oscillators- Complex number notation and phasor representation of simple harmonic representation - damped Harmonic oscillator- heavy damping, critical damping, weak damping, Energy decay in damped Harmonic oscillator – Quality factor – Forced Oscillations- steady state solution, resonance - power absorbed by a forced oscillator.

UNIT II (10 Hrs)

Crystallography: Introduction, Types of crystal systems, Space Lattice, Bravais lattices, Lattice planes and Miller Indices (Cubic system), Inter planar'd' spacing (Cubic system), Bragg's law, Powder diffraction method.

Crystal Defects: Classification of point defects, Concentration of Schottky defects in metals and ionic crystals, Concentration of Frenkel defects, Line defects, Screw and Edge dislocations, Burger's vector

UNIT III (10 Hrs)

Magnetic materials: Introduction, Classification of magnetic materials – Dia, para,

ferro, antiferro and ferri magnetic materials their properties and ferrites applications, Weiss molecular field theory of ferro magnetism, Domain theory, Hysteresis curve, Soft and hard magnetic materials and their applications.
Superconductivity: Introduction, General properties of superconductors, Meissner effect, BCS theory (qualitative), Type I and Type II superconductors, Applications of superconductors

Unit – IV (9 Hrs)

Lasers: Characteristics of Lasers – monochromatic, directionality, coherence, divergence, Basic concepts of transitions - absorption, spontaneous and stimulated emissions, Einstein's theory of matter and radiation interaction A & B coefficients), Concepts of meta stable states, population inversion and pumping, Components of lasers, Types of lasers- Ruby laser, He-Ne laser, Semiconductor laser and Applications of laser.

Fiber optics: Introduction to Optical fiber, structure of an optical fiber, Basic principle – total internal reflection, Concept of Numerical Aperture(NA) and acceptance angle, Derivation of Numerical Aperture, Types of optical fibers – Step Index and Graded Index fibers(w.r.t to refractive index and mode of propagation), Fiber drawing process (Double crucible method), Applications of optical fibers.

Unit - V (9 Hrs)

Acoustics and Ultrasonics: **Acoustics:** Reverberation, reverberation time, Sabine's formula (qualitative), absorption coefficient, measurement of absorption coefficient, factors affecting acoustics of an auditorium and their remedies; **Ultrasonics:** Introduction; Generation of ultrasonic waves; Magnetostriction method, piezoelectric method, properties, applications.

Text Books:

T1. N. Subrahmanyam and Brij Lal, Waves and Oscillations, 2nd Revised edition, S.Chand, Jan 2018, Paperback (Unit 1)

T2. B.K.Pandey and S.Chaturvedi, Engineering physics, Cengage Publications, 2012, 1st Edition. (Unit 1-5)

T3. M.N.Avadhanulu, P.G. Kshirsagar and TVS Arun Murthy, A Text Book Engineering Physics, 11th Edition, S.Chand, 2018.(Unit 1-5).

References/ Suggested Reading

R1. R. Murugeshan and Kiruthiga Sivaprasath, Modern Physics, S. Chand Publications, 2014.

R2. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition Paperback – 1 January 2019

R3. V. Raghavan, Materials Science and Engineering, Prentice Hall India Learning Private Limited 6th Revised Edition, 2015Publications (unit 1-5)

Course code	Course Title	Core/ Elective					
6ES202ME	Engineering Mechanics-II	Core					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

Prerequisite: Engineering Mechanics 1

Course Objectives:

The objective of this course is to make the student

- Kinematics of rigid bodies modeled as particles: Rectilinear and curvilinear motion
- Concepts of dynamic equilibrium and applications to problems on dynamic motion of rigid bodies
- Work-energy principle for solving unknown kinematic and dynamic parameters in rigid body motion.
- Impulse and Momentum principle to solve problems involving collisions
- Concepts of simple harmonic motion and mechanical vibration
- Concepts of simple harmonic motion and mechanical vibration

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.Solve** for the kinematic parameters of rectilinear and curvilinear translations of rigid bodies modeled as particles
- **CO2.Solve** for the unknown forces and kinetic parameters for particles and connected bodies using dynamic equilibrium equations
- **CO3.Apply** the work-energy principle for solving problems on dynamics for particles and connected bodies
- **CO4.Apply** the linear impulse momentum principle for the problems involving impact and collisions of rigid bodies
- **CO5.Formulate** dynamic equations and **solve** for unknown parameters in simple harmonic motion of solid bodies

Unit-I:

Kinematics: Equations of motion for Rectilinear & Rotational Bodies with uniform acceleration, Application on Projectiles - Path, Range, Max Height & Time of Flight. Centripetal, Tangential & Angular Accelerations. Motion Analysis of Non Uniform Motion using Derivatives of Displacement.

Unit-II:

Kinetics: Laws of Motion, D' Alembert's Principle, Applications on Bodies involving Inertia & Centrifugal Forces, Angle of Banking.

Unit-III:

Work, Power & Energy: Work done by a Force & Torque, Potential Energy,

Kinetic Energy**,** Translating & Rotating Bodies. Work-Energy Relation & its application on Connected Systems of Translating & Rotating Objects. Power in Mechanical, Hydraulic & Electrical Systems.

Unit-IV:

Virtual Work: Introduction, Application in Single & Connected System of Bodies.

Impulse-Momentum: Introduction, Impulse-Momentum relation & application on Connected System of Bodies, Principle of Conservation of Momentum and its Applications. Types of Impacts, Coefficient of Restitution.

Unit-V:

Mechanical Vibrations: Introduction to Free, Forced & Damped Vibrations, Simple Harmonic Motion, Amplitude, Time Period, Frequency, Equivalent Stiffness for different configurations, Applications on Spring & Simple Pendulum.

Text Books

1. Engineering Mechanics S.S. Bhavikatti et al, New Age International Publishers, 2017
2. Engineering Mechanics - Statics and Dynamics, by N H Dubey, McGraw Hill Education, 2017

References

1. Engineering Mechanics (In SI Units), by S.P. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill International, 5th edition, 2017
2. Singer's Engineering Mechanics Statics and Dynamics, by K. Vijay Kumar Reddy and J. Suresh Kumar, B.S. Publishers, 2011
3. Engineering Mechanics Statics and Dynamics, A. K. Tayal, 14th Edition, Umesh Publishers, 2010.
4. Engineering Mechanics: Principles of Statics and Dynamics, R. C. Hibbler, Pearson Education; Fourteenth edition, 2017

Course code	Course Title	Core/ Elective					
6ES202EE	Elements of Electrical and Electronics Engineering	Core					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

Prerequisite: Basics of Oscillations, Crystals, magnetic materials.

Course Objectives:

The objective of this course is to make the student

- Familiarize with electrical networks, circuits and different Laws used to solve electrical circuits.
- Understand various network reduction techniques to analyze electrical circuits.
- Understand the concept of network theorems for reducing complex networks.
- Understand the characteristics of diodes and transistor configurations.
- Understand the design concepts of biasing of BJT and FET.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Understand the concepts of electrical circuits and Analyze complex electrical circuits with the help of different network theorems.
- **CO2.**Understand the basic concepts of Electrical DC Machines.
- **CO3.**Understand the basic concepts of transformers and three phase induction motors.
- **CO4.**Analyze the rectifiers and regulator circuits.
- **CO5.**Analyze the performance of BJTs, FETs on the basis of their operation and working

Unit-I: (08 Hrs)

Introduction to Electrical Circuits: Circuit Concept, R-L-C Parameters, Voltage and Current Sources, Source Transformation, Voltage – Current relationship for Passive Elements, Ohm's Law, Kirchhoff's Laws, Series, Parallel, Series Parallel Combinations, Superposition, Thevenin's, Norton's theorems.

Unit-II: (08 Hrs)

DC Machines: Principle of operation of Generator and Motor-construction of DC machine- EMF equation-Torque equation- Armature circuit equation for motoring and generation, Types of field excitations. Open circuit characteristic of separately excited DC generator. Speed control methods, Losses and Efficiency.

Unit-III: (09 Hrs)

Introduction to AC fundamentals, Transformers: Principle of operation, construction and operation of single-phase transformers, ideal and practical transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency. Autotransformers - construction, principle of operation applications, Three-phase transformer - construction, types of connection and their comparative features.

Three-phase induction motors: Three-phase induction motors–Construction,

types, production of a rotating magnetic field-principle of operation. Losses and efficiency.

Unit-IV: (07 Hrs)

P-N Junction Diode: Characteristics, Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TUF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications.

Unit-V: (07 Hrs)

Transistors: BJT construction and working, modes of operation, configurations of BJT (CB, CE, CC), small signal h-parameter model of CE, CE amplifier analysis. Construction and working of JFET, V-I characteristics of JFET.

Introduction to Oscillators: LC oscillators, RC oscillators (Qualitative Treatment only).

Text Books:

T1. Electrical Circuit Analysis, William H Hayt and Jack Kemmerly , 8th Edition, 2014 (Unit 1-3)

T2. Electronic Devices, Floyd, Pearson Publications, Seventh Edition, 2019**.** (Unit 4-5)

References/ Suggested Reading:

R1. "Basic Electrical Engineering", N. K. De, Universities Press, 2015.

R2. "Fundamentals of Electrical Engineering and Electronics", J.B. Gupta, S. K. Kataria& Sons Publications, 2002.

R3. "Electronic Devices and Circuits", Theodore F Bogart, Pearson Publications,2004.

R4. "Electronics Devices and Circuits", J B Gupta, Katson Educational Series, 6th Edition.

R5. Circuit Theory Analysis and Synthesis by Abhijit Chakrabarti ,Dhanpat Raj & Co., 2018.(Unit 1-3).

Course code	Course Title	Core/ Elective					
		Core					
6MC201CE	Environmental Science	L	T	P/D	Credits	SEE	CIE
		2	0	0	0	40	60

Prerequisite: -

Course Objectives:

The objective of this course is to make the student

- Describe various types of natural resources available on the earth surface.
- Explain the concepts of an ecosystem and the biotic and abiotic components of various aquatic ecosystems.
- Identify the values, threats of biodiversity, endangered and endemic species of India along with the conservation of biodiversity.
- Explain the causes, effects and control measures of various types of environmental pollutions.
- Describe the methods for water conservation, the causes, effects of global warming, climate change, acid rain, ozone layer depletion, population explosion.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Describe the various types of natural resources.
- **CO2.**Differentiate between various biotic and abiotic components of ecosystem.
- **CO3.**Examine the values, threats of biodiversity, the methods of conservation, endangered and endemic species of India.
- **CO4.**Illustrate causes, effects, control measures of various types of environmental pollutions.
- **CO5.**Explain the methods of water conservation, causes, effects of climate change, global warming, acid rain and ozone layer depletion, population explosion.

Unit-I: (08 Hrs)

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness.

Natural Resources: Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources –Use and over exploitation, deforestation & its effect on tribal people. Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification**.** Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

Unit-II: (06 Hrs)

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains,

ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

Unit-III: (06 Hrs)

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.

Unit-IV: (07 Hrs)

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management.

Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation

Unit-V: (06 Hrs)

Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India.

Field Work:

- Visit to a local area to document environmental
- Visit to a local polluted area- market/slum area/Industrial area/traffic area

Text Books:

T1. Deswal S. and Deswal A., A Basic Course on Environmental studies, Dhanpat Rai & Co Pvt. Ltd. 2018. (Unit 1-5)

T2. Perspectives In Environmental Studies, Anubha Kaushik & C.P Kaushik, New Age International Publishers, 6th Edition 2018). (Unit 1–5).

References/ Suggested Reading

R1. Benny Joseph, ―Environmental Studies", Tata McGraw Hill (3rd Edition, 2017).

R2. Suresh K. Dhameja, Environmental Studies, S.K. Kataria & Sons, 2010.

R3. Rajagopalan R., Environmental Studies, Second Edition, Oxford University Press, 2013.

R4. V.K. Sharma, Disaster Management, National Centre for Disaster Management, IIPE, 1999.

R5. Environmental studies by Erach Bharucha 2005, University Grants Commission, University Press.

Course code	Course Title	Core/ Elective					
6BS252HS	Engineering Physics Lab	Core					
		L	T	P/D	Credits	CIE	SEE
		0	0	3	1.5	40	60

Prerequisite: Higher secondary level Physics

Course Objectives:

The objective of this course is to make the student

- Apply the theoretical knowledge in doing practical experiments
- Acquire skills to handle instruments.
- Understand the behavior of semiconductors and opto-electronic devices.
- Analyze errors in experimental data.
- Plot graphs between different physical parameters.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Develop analytical/experimental skills and impart prerequisite hands on experience for engineering laboratories.
- **CO2.**Understand the need for precise measurement practices for data recording
- **CO3.**Understand the principle, concept, working and applications of relevant technologies and comparison of results with theoretical calculations.
- **CO4.**Analyze the techniques and skills associated with modern scientific tools such as lasers and fiber optics.
- **CO5.**Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results

LIST OF EXPERIMENTS

1. Determination of wavelength of laser using diffraction grating.
2. Determination of Numerical Aperture (NA) and Acceptance angle of an optical fiber
3. To find the dielectric constant of a given material
4. To draw the I-V characteristics of solar cell and to calculate fill factor.
5. To draw the I-V characteristics of P-N junction diode and to evaluate series resistance in forward and reverse bias conditions.
6. To determine the rigidity modulus of the material of the given wire using Torsional Pendulum.
7. To study the Thermistor characteristics, determine the constants A and B.
8. To draw the curve between the magnetizing field and Intensity of magnetization for a given specimen and to find out Coercivity, Retentivity and Hysteresis loss of the specimen.
9. Compound Pendulum – Determination of Acceleration due to gravity
10. Determination of carrier concentration, mobility and Hall co-efficient in a

semiconductor using Hall Effect experiment.

Note: A minimum of eight experiments to be done.

References:

R1. S.L.Gupta and Dr.V.Kumar, "Practical physics with viva voice", Pragati Prakashan Publishers, Revised Edition, 2009

R2. M.N.Avadhanulu, A.A.Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand & Co,2008

Course code	Course Title	Core/ Elective					
6ES252EE	Elements of Electrical and Electronics Engineering Lab	Core					
		L	T	P/D	Credits	CIE	SEE
		0	0	2	1	40	60

Prerequisite Basics of networks, circuits, and Semiconductors devices.

Course Objectives:

The objective of this course is to make the student

- Apply the theoretical knowledge in doing practical experiments and acquire skills to handle instruments.
- Understand the behavior of semiconductors and electronic devices.
- Understand the performance of DC and AC machines.
- Understand the practical verification of different laws and theorems.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1.**Explain common electrical components and their ratings.
- **CO2.**Analyze performance of DC and AC electrical circuits.
- **CO3.**Analyze performance of electrical machines
- **CO4.**Design diode circuit and understand application of zener diode.
- **CO5.**Analyze characteristics of BJTs and FETs.

1. CRO- applications, measurements of R, L, C using LCR meter, color coding method.
2. Verification of KVL, KCL, Superposition Theorem.
3. Verification of Thevenin's and Norton's theorem.
4. Loading of transformer- measurement of primary and secondary voltages and currents and power.
5. Three phase transformers- star and delta connections. Voltage and current relations.
6. OCC characteristics of DC Generator.
7. Load test on DC shunt Motor.
8. Measurement of phase voltage/ current, line voltage/current and power in a balanced three phase circuit connected in star and delta.
9. V-I Characteristics of silicon and Germanium diodes and measurement of static and dynamic resistances.
10. V-I Characteristics of silicon and Germanium diodes of Zener diode and measurement of static and dynamic resistances.

11. Zener diode application as regulator.
12. Input and output Characteristics of BJT in CB configuration.
13. Input and output V-I Characteristics of BJT in CB configuration.
14. Transfer Characteristics of JFET in CS configuration**.**
15. Hartley and Collpits oscillator (LC Oscillator).
16. RC Phase shift oscillator (RC oscillator).

Note: A minimum of ten experiments to be done.

References:

R1. J.B. Gupta, ―Fundamentals of Electrical Engineering and Electronics‖ S.K. Kataria & Sons Publications, 2002.

R2. Satish Kumar Peddapelli, G. Sridhar, ―Electrical Machines – A Practical Approach‖, De Gruyter Publications, 2020.

R3. Hughes, ―Electrical Technology", VII Edition, International Student -on, Addison Welsey Longman Inc., 1995

R4. Maheshwari and Anand, Laboratory Experiments and PSPICE Simulations in Analog Electronics, 1st edition, Prentice Hall of India, 2006.

R5. David Bell A., Laboratory Manual for Electronic Devices and Circuits, Prentice Hall of India, 2001.

Course code	Course Title	Core/ Elective					
6ES251ME	Engineering Graphics Lab	Core					
		L	T	P/D	Credits	CIE	SEE
		1	0	4	3	40	60

Prerequisite: NIL

Course Objectives:

The objective of this course is to make the student

- Different methods to draw Engineering Curves like Conics, Involutes & Cycloids.
- Engineering scales & different types of views like isometric, orthographic, dimetric, trimetric, oblique etc.
- True & Apparent lengths & inclinations of lines & planes.
- Orthographic Projections of Solids & true shapes of sectional faces.
- Development of surfaces & Visualising 3D models from 2D Orthographic Views.

Course Outcomes:

After completion of the course, the student will be able to

- **CO1**. **Draw** different curves like conics, involutes & cycloids using suitable methods.
- **CO2. Develop** Suitable Scales & Orthographic Projections of Objects from their 3D views as per conventions.
- **CO3**. **Determine** the True & Apparent Angles / Lengths of Lines & Planes using Orthographic Projections.
- **CO4**. **Draw** the Orthographic Projections of Right Regular Solids, their sections & use auxiliary projection for True Shapes
- **CO5**. **Develop** Right Regular Solids into 2D Sheet Surfaces & Draw Isometric Views/Projections of stacked right regular solids with truncations.

Unit-I:

Engineering Curves: INVOLUTES - Triangular, Square, Pentagonal, Hexagonal & Circular.
CYCLOIDS, Epicycloid & Hypocycloid.
CONICS - Parabola, Hyperbola & Ellipse using General / Eccentricity Method, Oblong Method & Method of Arcs. Lettering

Unit-II:

Engineering Scales: Engineering Ratios, Representative Fraction, Plain Scale, Diagonal Scale, Vernier Scale, Scale of Chords.

Orthographic Projections: Introduction, Conventions, 1st Angle & 3rd Angle Projections. Orthographic Projection of Points in all Quadrants. Orthographic Projections of Compound Solids from their Isometric, Oblique, Dimetric or

Trimetric Views.

Unit-III:

Orthographic Projection of Lines with five Positional Inputs - Parallel to Both Planes, One Plane & Inclined to Both Planes. True & Apparent Lengths & Angles.

Orthographic Projections of Planes - Triangular, Quadrilateral, Regular Pentagonal & Hexagonal, Circular & Semi Circular Planes.

Unit-IV:

Orthographic Projections of Right Regular Solids - Prisms & Pyramids with Triangular, Square, Regular Pentagonal & Hexagonal Cross Sections, Cylinders & Cones.

Orthographic Projections of Sectioned Right Regular Solids when the Cutting Plane is Perpendicular to one of the Reference Planes. Auxiliary Projections for True Shapes of Cut Sections.

Unit-V:

Development of Surfaces of Simple & Sectioned Right Regular Solids - Prisms & Pyramids with Triangular, Square, Regular Pentagonal & Hexagonal Cross Sections, Cylinders & Cones.

Isometric Projections: Isometric Scale, Isometric Views & Projections of Stacked Right Regular Solids with & without Truncations.

Text Books

1. Engineering Drawing, ND Bhatt, Charotar Publishers
2. Engineering Graphics by C M Agrawal & Basant Agrawal, Tata McGraw Hill

References

1. Engineering Drawing by KL Narayana & P Kannaya, Scitech publications
2. Engineering Drawing Graphics & AutoCAD by K Venugopal, New Age International