Scheme of Instruction, Evaluation

and

Syllabi of

B.E. MECHANICAL ENGINEERING

(I and II – Semesters)

With effect from the Academic Year 2022-23

Estd.1917

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

Estd.1929

UNIVERSITY COLLEGE OF ENGINEERING, OSMANIA UNIVERSITY

VISION OF THE INSTITUTE

The Vision of the Institute is to generate and disseminate knowledge through a harmonious blendingofScience,EngineeringandTechnology.Toservethesocietybydevelopingamodern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fosteringascientifictemperandpromotingprofessionalandtechnologicalexpertise.

MISSION OF THE INSTITUTE

- To achieve excellence in Teaching andResearch.
- To generate, disseminate and preserveknowledge.
- Toenableempowermentthroughknowledgeandinformation.
- AdvancementofknowledgeinEngineering,ScienceandTechnology.
- Promotelearninginfreethinkingandinnovativeenvironment.
- Cultivateskills,attitudestopromoteknowledgecreation.
- Renderingsociallyrelevanttechnicalservicesforthecommunity.
- Toimpartnewskillsoftechnologydevelopment.
- Toinculcateentrepreneurialtalentsandtechnologyappreciationprogrammes.
- Technology transfer andincubation.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION OF THE DEPARTMENT

To generate and disseminate knowledge in Mechanical Engineering and nurture professional, technicalandscientifictemperforservingtheneedsoftheindustry,researchorganizationsand society.

MISSION OF THE DEPARTMENT

- Create technically competent mechanical engineers to suit the changing needs of global industry andsociety.
- Tocultivateskills,attitudestopromoteknowledgecreationandtechnologydevelopment.
- Interact with prominent educational institutions and R&D organizations for enhancing teaching, research and consultancyservices.

DEPARTMENT OF MECHANICAL ENGINEERING

B.E (Mechanical Engineering)

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1	ToprovidetherequisitefundamentalsofvariedsubjectsrelatedtoMechanical Engineeringtoconceive,plan,model,design,construct,maintainandimprove systems to enhance humancomfort.
PEO 2	Toprovideknowledgeofexperimental,computational,analytical,simulationtools andtechniquesrequiretoaddressthechallengesinMechanicalEngineeringand other allied fields.
PEO 3	ToprovideknowledgetoapplyMechanicalEngineeringFundamentalstodesignand implement cost effective systems inmanufacturing.
PEO 4	To provide effective communication skills, creative methods, ethics and continuous learning techniques to fulfill their professional requirements and societal needs.

PROGRAM ARTICULATION MATRIX

S.No.	PEO Statement	M1	M2	M3
PEO 1	To provide the requisite fundamentals of varied subjectsrelatedtoMechanicalEngineeringtoconceive, plan,model,design,construct,maintainandimprove systems to enhance humancomfort.	3	3	3
PEO 2	Toprovideknowledgeofexperimental,computational, analytical,simulationtoolsandtechniquesrequireto addressthechallengesinMechanicalEngineeringand other allied fields.	3	3	3
PEO 3	ToprovideknowledgetoapplyMechanicalEngineering Fundamentalstodesignandimplementcosteffective systems in manufacturing.	3	3	3
PEO 4	To provide effective communication skills, creative methods,ethicsandcontinuouslearningtechniquesto fulfilltheirprofessionalrequirementsandsocietal needs.	2	2	2

PROGRAM OUTCOMES (POs):

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

POs	
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and anmechanicalengineering to the solution of complexengineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems related to mechanical engineering and allied fields 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 researchmethodsincludingdesignofexperiments,analysisandinterpretationofdata,and synthesisoftheinformationtoprovidevalidconclusions.
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 assesssocietal,health,safety,legalandculturalissuesandtheconsequentresponsibilities relevant to the Mechanical engineeringpractice.
PO7	**Environment and sustainability:** Understand the impact of the Mechanical engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:**Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesand norms of the mechanical 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 engineeringcommunityandwithsocietyatlarge,suchas,beingabletocomprehendand write effective reports and design documentation, make effective presentations, andgive and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the mechanicalengineeringandmanagementprinciplesandapplythesetoone'sownwork,as amemberandleaderinateam,tomanageprojectsandinmultidisciplinaryenvironments.
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	
PS01	Applytheprinciplesofcollaborativeandmultidisciplinaryapproachforsolvingproblems
PS02	Able to interact with industry and R&D institutions leading to start-ups/ budding entrepreneurs.

ABOUT THE INSTITUTE

UNIVERSITY COLLEGE OF ENGINEERING, OSMANIA UNIVERSITY (UCE, OU)

The University College of Engineering (UCE) has the distinction of being the oldest and the biggest among theEngineering Colleges of the State of erstwhile Andhra Pradesh. Established in the year 1929, eleven years afterthe formation of Osmania University, it was the 6th Engineering College to be established in the whole ofBritish India. The College moved to its present permanent building in the year 1947. Today it is the biggestamong 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 variousspecializations. The University College of Engineering (A) is the first Engineering College to get ISO: 9001Certification 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.

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (Mechanical Engineering) w.e.f. AY2022-2023

I – Semester

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	**MC100HS**	Induction Program	3 weeks							
2	**BS101MT**	Engineering Mathematics-I	3	0	-		3	40	60	3
3	**BS101CH**	Engineering Chemistry	3	0	-		3	40	60	3
4	**HS101EG**	Communicative English	3	0	-		3	40	60	3
5	**ES101ME**	*Engineering Mechanics – Statics*	3	0	-		3	40	60	3
Practicals										
6	**BS151CH**	Engineering Chemistry Lab	-	-	3		3	25	50	1.5
7	**HS151EG**	Communicative English Lab	-	-	2		3	25	50	1
8	**ES151ME**	Engineering Drawing - I	2	-	4		3	25	50	4
9	**ES152ME**	Workshop Practice	-	-	6		3	25	50	3
		Total	**14**	**0**	**15**			**260**	**440**	**21.5**

Note: In I-Semester (**ES152ME**)**Workshop Practice(3 Credits [6hours per week])**is offered by Mechanical Engineering Department to **BE(Mech/Civil/BME/Mining)**

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (Mechanical Engineering) w.e.f. AY2022-2023

II – Semester

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	**BS201MT**	Engineering Mathematics-II	3	0	-		3	40	60	3
2	**BS201PH**	Engineering Physics	3	0	-		3	40	60	3
3	**ES201CS**	Programming for Problem Solving	3	0	-		3	40	60	3
4	**ES201ME**	*Engineering Mechanics – Dynamics*	3	0	-		3	40	60	3
5	**ES201EE**	Basic Electrical Engineering	3	0	-		3	40	60	3
Practicals										
6	**BS251PH**	Engineering Physics Lab	-	-	3		3	25	50	1.5
7	**ES251CS**	Programming for Problem Solving Lab	-	-	2		3	25	50	1
8	**ES251ME**	Engineering Drawing - II	2	-	4		3	25	50	4
9	**ES251EE**	Basic Electrical Engineering Lab	-	-	2		3	25	50	1
		Total	**17**	**0**	**11**			**300**	**500**	**22.5**

Note: In II-Semester (**ES252ME**) **Workshop Practice(3 Credits [6hours per week])** is offered by Mechanical Engineering Department to **BE(CSE/ECE/EEE/AIML)**

BS 101 MT	**ENGINEERINGMATHEMATICS–I (Common to all Branches) I Year I Semester**					
Pre-requisites	Mathematical Knowledge of 12th / Intermediate level		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40Marks	

CourseObjectives:	
Thecourseistaughtwiththeobjectivesofenablingthestudentto:	
1	To Introduce the Concepts of Sequences, Series and their Properties.
2	To Study the Concepts of Mean Value Theorems.
3	To Introduce the Concepts of Functions of Several Variables and its Applications.
4	To Introduce the Concepts of Multiple Integrals and its Applications
5	To Study Vector Differential and Integral Calculus.

CourseOutcomes:	
Oncompletionofthiscourse,thestudentwillbeableto:	
CO-1	Find the Nature of Sequences and Series
CO-2	To Apply the Mean Value Theorem and to Find the Roots of Continues Functions
CO-3	To find the Maximum and Minimum Values of Multiple Variable Functions.
CO-4	Use the Knowledge of Multiple Integrals in Finding the Area and Volume of any Region Bounded by Given Curves
CO-5	Apply the Knowledge of Vector Calculus to Find Line, Surface and Volume Integrals.

Articulation matrix of Course outcomes with PO's:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	1	1	1	-	-	1	-	-	2	-	-
CO 2	3	2	1	2	2	2	-	-	1	-	-	2	-	-
CO 3	3	2	2	3	2	2	-	-	1	-	-	2	-	-
CO 4	3	2	1	1	1	2	-	-	1	-	-	2	-	-
CO 5	3	2	2	3	1	2	-	-	1	-	-	2	-	-

Correlationrating: Low/Medium/High: 1/2/3respectively.

Unit–I
Sequences and Series: Sequences,Series,General properties of series, Series of positive terms, Comparison tests, P- test, tests of Convergence, D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Integral test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence .

Unit – II
Calculus of one variable: Rolle's Theorem, Lagrange's, Cauchy's mean value theorems (without proof) Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes

Unit – III
Multi variable 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 values of functions two variables ,Lagrange's method of multipliers.

Unit – IV
Multi variable Calculus (Integration): Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals and applications- areas and volumes, Beta and Gamma functions.

Unit –V
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

SuggestedReadings:

1	R. K. Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publications, 4th Edition 2014.
2	Erwin Kreyszi, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.
3	B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition, 2014.
4	G.B. Thomas, Maurice Weirand Joel Hass, Thomas Calculus, Peterson, 12th Edition, 2010.
5	B.V .Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
6	N.P. Bali and M.Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
7	H.K. Dass, Er. RajnishVarma, higher Engineering Mathematics, S.Chand Technical 3rd Edition.

BS101CH	**ENGINEERING CHEMISTRY**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	**60 Marks**	**CIE**		**40 Marks**	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Understand the fundamentals of application of water chemistry in industry and applications of principles of corrosion to minimize corrosion and associated problems.
2	Gain the knowledge of application of Electrochemical principles to construct the electrodes for various purposes and the criterion for determination of feasibility of processes.
3	Analyze and interpret the structure of molecules by applying basic principles of spectroscopy.
4	Acquire knowledge of biopolymers used for medical purposes with various applications .
5	Grasp the latest application of nanotechnology in various industries and manufacturing different kinds of batteries.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-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 and throws light on prevention of corrosion
CO-2	Rationalize bulk properties and processes using thermodynamic considerations.
CO-3	A Distinguishes the ranges of electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
CO-4	Analyze the basic methods of reactions of organic molecules and study their properties.
CO-5	Knowing the about different batteries, fuel cells and their applications of nanomaterials.

Course outcome		Program Outcome										
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3	2	1	1	1	1					2
CO-2	3	3	2	1	1	1	1					1
CO-3	2	2	1	1	1	1	-					1
CO-4	2	2	2	1	1	1	-					1
CO-5	2	2	2	2	1	1	-					2

Unit – I

WATER CHEMISTRY AND CORROSION (10L):

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 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

THERMODYNAMICS AND ELECTROCHEMISTRY(10L):

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-Numerical.

Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes-Calomel, Quinhydrone and Glass electrodes. 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 to electrode potential and emf of cells. Numericals.

Principles and applications of Potentiometric titrations.

Unit – III

MOLECULAR STRUCTURES AND SPECTROSCOPY (10L):

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. 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). Principle and applications of IR Sensors.
NMR Spectroscopy: Principle of H^1-NMR Spectroscopy. Multiplicity, Chemical Shift. Principle and Applications of MRI.

Unit - IV

Organic Reactions: Introduction to 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

Unit – V

Energy Sources and Nanomaterials (8L)
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 Reading:

1	Jain & Jain, *Engineering chemistry*, DhanpatRai publishing Co.,16th Edition.
2	B.L.Tembe,Kamaluddin and M.S.Krishnan, Engineering Chemistry(NPTELWeb-book)
3	PrashanthRath, Engineering Chemistry, Cengage Learning.
4	M.J.Sienko and R.A.Plane, Chemistry: Principles and Applications, MGH Publishers.
5	B.H.Mahan, University Chemistry, Pearson Publishing Co., 4th Edition.
6	C.N. Banwell, *Fundamentals of Molecular Spectroscopy*, TMH

HS101EG	**COMMUNICATIVE ENGLISH**					
Pre-requisite	English proficiency above B1 level as per the CEFR (Common European Framework of Reference) for languages		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Communicate clearly, accurately and appropriately using correct grammar and vocabulary
2	Write effective paragraphs and essays using devices of coherence & cohesion
3	Write business letters and emails
4	Demonstrate the ability to employ a range of critical to inferential reading.
5	Employ active and passive voice in engineering and scientific contexts to compile technical reports

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Heighten the awareness of correct usage of English grammar and vocabulary in writing and speaking besides improving their fluency and comprehensibility
CO-2	Develop their ability as critical readers and writers and will produce paragraphs independently on any context with coherence
CO-3	Draft effective business letters and emails
CO-4	Exercise critical reading skills by enhancing the quality of life and to support lifelong learning.
CO-5	Will produce short reports using the drafting process

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	SO 1	SO 2
O 1	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO 2	-	-	-	-	-	-	-	-	1	3	-	3	-	-
O 3	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	1	3	-	3	-	-

O 5	-	-	-	-	-	-	-	-	1	3	-	3	-	-

Unit – I
Importance of listening, Importance of reading, Importance of communication, types of communication, Discourse markers & linking words, Homonyms, Homophones, Homographs , Concord

Unit – II
Types of listening, Reading skills-skimming, scanning, intensive and extensive reading, Communication barriers, Paragraph & Precise writing, One word substitutes, Tenses
Unit – III
Dos and don'ts of listening, Types of comprehension questions, Styles of communication Essay writing, Root words, Active and Passive voice
Unit – IV
Listening for specific purposes, Critical reading passages, Proverb expansion through JAM, Letter writing, Email writing, Synonyms, Antonyms, Common errors-I
Unit – V
Listening to various texts –contd . . . (in language laboratory), Inferential reading passages, Effective presentations, Report writing , Idioms & Phrases, Common Errors-II

Suggested Reading

1	Ashraf, M Rizvi. Effective Technical Communication. Tata McGraw-Hill, 2006
2	Language and LifeASkillsApproach,OrientBlackSwan,2018
3	Michael Swan, Practical English Usage. OUP,1995.
4	Meenakshi Raman and Sangeetha Sharma. Technical Communication: Principles and Practice 2nd Edition, Oxford University Press, 2011
5	Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, Harper Collins International Edition.

ES101ME	ENGINEERING MECHANICS - STATICS					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:

- To understand the resolution of forces, equilibrium and compatibility conditions of static loads
- To determine the various forces in the members, and analyze the sections using various methods
- To obtain friction, centroid, and moment of Inertia for various regular and irregular bodies

Course Outcomes:

By the end of the course, students must be able to:

- A basic understanding of the laws and principles of mechanics.
- The ability to draw Free Body Diagram and label the reactions on it.
- The ability to analyze and solve simple problems in mechanics.
- The ability to analyze and find area moment of inertia.
- An understanding of the assumptions and limitations of the approaches used

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-

UNIT - I

Force Systems: Resultant coplanar concurrent forces, Components of forces in space, moment of force and its applications. Couples and Resultant of Force Systems.

UNIT - II

Equilibrium of Force Systems: Free body diagrams. Equations of Equilibrium. Equilibrium of planar systems and Spatial Systems.

UNIT - III

Analysis of structures: Analysis of trusses by Method of Joints and Method of Sections. Analysis of Frames by Method of Members.

UNIT - IV

Friction: Laws of friction. Application to simple systems. Connected systems and Belt friction. Types of friction – limiting friction, static and dynamic frictions, motion of bodies – wedge, screw, screw-jack.

UNIT - V

Centroid and Moment of Inertia: Centroids for lines, Area and Composite areas. Moment of Inertia for areas, Composite areas. Polar moment of inertia. Radius of gyration.transfer theorem, moment of inertia of composite figures, product of inertia, transfer formula for product of inertia.

Suggested reading

1	Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.
2	Bhavikatti S S. (2019). *Engineering Mechanics*, 7th Edition, New Age International.
3	Hibbeler R C. (2017). *Engineering Mechanics Statics and Dynamics*, Pearson.
4	Khurmi R S and Khurmi N. (2018). *A Textbook of Engineering Mechanics,* 22nd Edition,S Chand, New Delhi.
5	Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, HarperCollins International Edition.

BS151CH	ENGINEERING CHEMISTRY LAB					
	(CORE - I)					
Pre-requisites			L	T	P	C
			3	-	-	1.5
Evaluation	SEE	50 Marks	CIE		25 Marks	

Course Objectives:	
The course taught with objectives of enabling the student to:	
1	Determination of hardness of water by Complexometry.
2	Estimation of HCL by conductometry and Potentiometry.
3	Verification of Beers law and estimation of $KMnO_4$ by colorimetry.
4	To determine the rate constant of reactions from concentration as a function of Time
5	Synthesis of organic compounds.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Estimate the strength of acids and ions present in unknown solution by conductometry and potentiometry.
CO-2	Estimate the concentration of ions present in unknown solution from the absorbance by colorimetric analysis.
CO-3	Conduct experiment to estimate hardness of industrial water.
CO-4	Estimate the rate constants of reactions from concentration of reactants/products as a function of time.
CO-5	Synthesize small drug molecules.

Course outcome	Program Outcome											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	2	2	1	1	1	-						2
CO-2	2	2	1	1	1	-						2
CO-3	2	2	2	1	-	-						2
CO-4	2	2	2	1	1	-						2
CO-5	1	1	2	1	-	1						1

Correlation rating : Low / Medium / High : 1 / 2 / 3 respectively.

SYLLABUS:

Experiment - I
Estimation of HCL by Conductometry.

Experiment – II
timation of Acetic Acid by Conductometry.

Experiment - III
timation of HCL by Potentiometry.

Experiment - IV
Estimation of $KMnO_4$ by Potentiometry.

Experiment –V
Verification of Beer's law.and Estimation of $KMnO_4$ by colorimetry.

Experiment – VI
Verification of Beer's law.and Estimation of $CuSO_4$by colorimetry.

Experiment - VII
termination of Partition Coefficient of Acetic acid in BuOH and water.

Experiment - VIII
Synthesis of Acetyl Salicylic Acid (Aspirin).

Experiment - IX
Estimation of Total hardness of water by Complexometry.

Experiment –X
timation of Permanent and Temporary hardness of water by Complexometry.

Experiment - XI
Determination of Chloride content of water by Precipitation method.

Experiment - XII
termination of Order of Acid catalysed Hydrolysis of Methyl acetate reaction.

Suggested Readings:

1. Senior practical Physical chemistry by BD Khosla, A.Ghulati, VC.Garg., ,R.Chand and Co., New Delhi 10^{th} ed. 2001.
2. Laboratory Manual in Engineering Chemistry, S.K. Bhasin and Sudha Rani DhanpathRai Publishing Co.,

HS151EG	COMMUNICATIVE ENGLISH LABORATORY					
Pre-requisites	English proficiency above B1 level as per the CEFR (Common European Framework of Reference) for languages.		**L**	**T**	**P**	**C**
			2	-	-	1
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to	
1	Learn IPA and the transcription; using dictionary to decode phonetic transcription; overcome the difficulties with sounds of English; self learning through CALL
2	Demonstrate and use English speech sounds, stress and intonation in day-to-day situations/conversations/interactions
3	Introducing oneself in various contexts : Social, Academic and Professional
4	Improve listening and understand various accents – GIE, RP and GenAm
5	Learn to participate in various contexts – extempore, group discussions, and presentations

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Sensitize the nuances of English speech sounds with computer-assisted individualized and independent language learning
CO-2	Use better pronunciation and right accent and intonation
CO-3	Use functional English
CO-4	Listen and speak effectively by understanding various accents
CO-5	Increase possibilities of job prospects and communicate confidently

Program outcomes

	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	-	-	-	-	-	-	-	-	1	3	-	3	-	-

CO 2	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO 3	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO 5	-	-	-	-	-	-	-	-	1	3	-	3	-	-

Unit - I

English Sound system: Sounds of English, Vowels, Consonants, using dictionary to decode phonetic transcription, transcription exercises with the help of CALL (Computer Aided Language Lab)

Unit - II

Stress and Intonation: Syllable, Word stress and its importance, Intonation-falling and rising tone

Unit – III

Introductions and Presentation skills: In social, formal, academic and professional contexts; JAM, Picture description/perception; Role plays: use of dialogues in various situations and settings; Occasions to give various presentations with emphasis on visual aids and body language.

Unit – IV

Listening Comprehension: Listening to various accents, listening practice and exercises

Unit – V

Group Discussions: Types of group discussions; case studies; dos and don'ts of group discussion-intensive practice.

Suggested Reading/Software:

1	T.Balasubramanian.A Textbook of English Phonetics for Indian Students. Macmillan,2008.
2	J. Sethi et al., A Practical Course in English Pronunciation (with CD). Prentice Hall of India, 2005.
3	Hari Mohan Prasad. How to Prepare for Group Discussions and Interviews. TataMcGraw Hill, 2006
4	English for Engineers and Technologists (Combined edition , Vol. 1 and 2) Orient Blackswan 2010.
5	**Software:** 1. Sky Pronunciation Suite 2. Study Skills 3. English Pronunciation Dictionary –CALD

ES151ME	ENGINEERING DRAWING - I					
Pre-requisites			**L**	**T**	**P**	**C**
			2	-	4	4
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

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

CO1: Apply BIS standards and conventions while drawing Lines, printing Letters and showing Dimensions.

CO2: Classify the systems of projection with respect to the observer, object and the reference planes.

CO3: Construct orthographic views of an object when its position with respect to the reference planes is defined.

CO4:Analyse the internal details of an object through sectional views.

CO5: Construct 2D (orthographic) views in CAD environment.

CO-PO ATRICULATION MATRIX

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

Unit 1:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Auto-CAD practice: Introduction to Auto-CAD, DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES tool bar, Standard Tool bar, LAYERS

Unit II

Orthographic Projection: Principles of Orthographic projection, Four Systems of Orthographic

Projection. **Projection of Points:** Projections of points when they are situated in different quadrants. **Projections of Lines:** Projections of a line parallel to one of the reference planes and inclined to the other, line inclined to both the reference planes, Traces.

Unit III

Projections of Planes: Projections of a plane perpendicular to one of the reference planes and inclined to the other, Oblique planes.

Unit IV

Projections of Solids: Projections of solids whose axis is parallel to one of the reference planes and inclined to the other, axis inclined to both the planes.

Unit V

Section of Solids: Sectional planes, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section.

Suggested Reading:

1. BhattN.D., Panchal V.M.& Ingle P.R.,(2014), Engineering Drawing, Charotar Publishing House
2. Shah,M.B.&RanaB.C.(2008),EngineeringDrawing and ComputerGraphics,PearsonEducation
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 (Corresponding set of) CAD Software Theory and User Manuals
5. Sham Tickoo (2015), AutoCAD 2015 for Engineers and Designers, Dreamtech Press

ES152ME

WORKSHOP PRACTICE

Credits: 3

Instructions:(6P)hrsperweek *DurationofSEE:3hours*

CIE:25Marks *SEE: 50Marks*

Course Objectives:

- Tolearnaboutdifferenttoolsusedinworkshop
- To understand the different manufacturingprocesses.
- Tolearnaboutfabricationofcomponentsusingdifferentmaterials.

Course Outcomes

Upon successful completion of this course, the student shall be able to

- Studyandpracticeontoolsandtheiroperationsofdifferenttrades.
- Practiceonmanufacturingofcomponentsusingworkshoptradesincludingcarpentry,fitting, foundry, smithy, sheet metal &welding
- Selectsuitabletoolsformachiningprocessincludingfacing,turning&knurling
- Attainbasicelectricalknowledgeforhousewiringpractice

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

LIST OF EXPERIMENTS:

1. **Carpentry shop**
    - Making of Cross lap joint withWood
    - MakingofEndLap/TeeLapJointwithwood
2. **Fittingshop**
    - MakingofStepcutwithMildSteelflat
    - MakingofsemicircularandV-cutwithMildSteelflat

3. **Sheet metalshop**
    - Making of Funnel with GISheet
    - Making of Rectangular box with GISheet

4. **Housewiring**
    - Making of Cleatwiring
    - Making of casingwiring

5. **Weldingshop**
    - Making of Butt joint using ArcWelding
    - MakingofLapJointusingArcWelding

6. **Machine shop**
    - MakingofStepturningonMScylindricalrod
    - MakingofTaperturningonMScylindricalrod

7. **Foundry shop**
    - Preparation of casting using single piecepattern
    - Preparation of casting using corepattern

8. **Smithy shop**
    - Forging of square shape peg from cylindrical workpiece
    - Forging of squareshape L- bend pegfrom cylindrical workpiece

Suggested Text/Reference Books:

(i) HajraChoudhuryS.K.,HajraChoudhuryA.K.andNirjharRoyS.K.,"ElementsofWorkshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers privatelimited, Mumbai.

BS201MT	ENGINEERINGMATHEMATICS–II (Common to all Branches) I Year II Semester					
Pre-requisites	Mathematical Knowledge at Pre Universities Level		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40Marks	

CourseObjectives:	
Thecourseistaughtwiththeobjectivesofenablingthestudentto:	
1	ToStudyMatrixAlgebraanditsuseinSolvingSystemofLinearEquationsandSolvingEigenValueProblems
2	To Study the First Order Linear and Non-LinearOrdinaryDifferentialEquations
3	ToStudy the Higher Order Linear Ordinary Differential Equations with Variable and Constant Coefficients
4	ToIntroducetheConceptofFunctionsofComplexVariableandtheir Properties
5	To Study the Values of Improper Integers Using Residue Theorem.

CourseOutcomes:	
Oncompletionofthiscourse,thestudentwillbeableto:	
CO-1	SolveSystemofLinearEquationsandEigen Value Problems
CO-2	Find the Solution of First Order Ordinary Differential Equations
CO-3	Identify the Solution of Higher Order Ordinary Differential Equations
CO-4	Determine the Analyticity and Integrals of Complex Functions
CO-5	Evaluate Complex and Real Integrals Using Residue Theorem

Articulation matrix of Course outcomes with PO's:
Subject : Engineering Mathematics II

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	1	1	2	-	-	1	-	-	2	-	-
CO 2	3	2	1	2	2	1	-	-	1	-	-	2	-	-
CO 3	3	2	3	1	1	2	-	-	2	-	-	2	-	-
CO 4	3	2	1	2	1	2	-	-	1	-	-	2	-	-
CO 5	3	2	2	1	2	1	-	-	1	-	-	2	-	-

Correlationrating: Low/Medium/High: 1/2/3respectively.

Unit – I
Matrices: Elementaryrowandcolumnoperations,Rankofamatrix, Echelonform, Systemoflinearequations, Linearly dependence and independence of vectors, Linear transformation, Orthogonaltransformation, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem,Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form byorthogonaltransformation,Natureofquadraticforms.

Unit - II
FirstOrderOrdinaryDifferentialEquations: ExactFirstOrderDifferentialEquations,Integratingfactors,LinearFirstOrderEquations,Bernoulli's,Riccati'sandClairaut'sDifferentialEquations, OrthogonalTrajectoriesofagivenfamilyofcurves.

Unit - III
Differential Equations of Higher Orders : Linear Independence and Dependence, Solutions of Second andHigherOrderLinear Homogeneous Equations with Constants Coefficients,Method of Reduction of orderforthe Linear Homogeneous Second Order Differential Equations with Variable Coefficients , Solutions of Non- Homogeneous Linear Differential Equations, Method of Variation of Parameters, Solution of Euler-CauchyEquation, Simultaneous Linear Differential Equations.

Unit - IV
Functions of a Complex Variable: Limits and Continuity of a Function, Differentiability and Analyticity,Elementary Analytic Functions, Necessary and Sufficient Conditions for a Function to be Analytic, Cauchy-Riemann Equations in Polar form, Harmonic Functions, Complex Integration, Cauchy's Integral Theorem, ExtensionofCauchy'sIntegralTheoremformultiplyconnectedregions,Cauchy'sIntegral Formula, Cauchy's Formula for Derivatives.

Unit - V
Residue Calculus: Power Series, Taylor's Series, Laurent's Series, Zeros and Singularities, Residues, ResidueTheorem, Evaluation of Real Integrals Using Residue Theorem, Bilinear Transformations (All Theorems without Proof).

SuggestedReadings:

1	R. K. Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publications, 4th Edition 2014 (Text Book).

2	Erwin Kreyszi, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.
3	B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition, 2014.
4	Dr.M.D. Raisinghania,*OrdinaryandPartialDifferentialEquations*,S.CHAND,17thEdition2014
5	JamesBrown,R.VChurchill,*ComplexVariablesandapplications*,McGrawHill9thEdition2013
6	N.P. Bali and M.Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
7	H.K. Dass, Er. RajnishVarma, higher Engineering Mathematics, S.Chand Technical 3rd Edition.

BS201PH	Engineering Physics					
(Basic Science)						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	understand the basic concepts of Waves, Oscillations and Acoustics.
2	understand the different types Magnetic materials and Dielectric materials with their origin of evolution.
3	understand the formation of energy bands and classification of the solids based on the band theory. To understand the concept of semiconductors, ultrasonic and its wide applications.
4	understand implications of basic laws of electricity and magnetism to know the significance of techniques of Modern Optics.
5	sensitize towards nanomaterial and appraise the various characterization techniques.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	enrich and understand concepts and real time applications of waves, acoustics andultrasonic properties.
CO-2	apply the dielectric properties, magnetic properties, semiconducting properties of materials.
CO-3	analyze basics laws of electricity, magnetism and concepts of modern optics.
CO-4	evaluate the different material characterization techniques.
CO-5	appreciate significance of nanomaterials and create desired properties by using various methods of synthesis processes.

Course outcome	Program Outcome											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3		2		2	1						
CO-2	3	3	1	1	3	1						
CO-3	3	2	1	1	2	2						
CO-4	3		3	1	2	1	1					
CO-5	3	2	1	2	3	3						

Unit – I

Oscillations in Physical Systems: Simple harmonic oscillations–Damped harmonic oscillator – Heavy, critical and light damping – Energy decay in a damped harmonic oscillator – Quality factor – Forced oscillators – Resonance – forced oscillator and LCR circuit analogy.

Acoustics: Classification of sounds- Sound intensity level, Reverberation, Reverberation time- - Absorption coefficient – Sabine's formula for reverberation time – Factors effecting Acoustics of building and their remedies.

Unit – II
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 - Applications of Ferroelectrics.
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.

Unit – III
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, Zener diode, Light Emitting Diode and their I-V characteristics – Thermistor and its characteristics - Hall effect and its applications.
Ultrasonics: Introduction to Ultrasonic waves - Properties of Ultrasonics - Production of ultrasonic waves by converse Piezoelectric method – Detection of ultrasonic waves - Piezoelectric detector — Wavelength of Ultrasonics by Debye-Sears method (Liquid grating) – Applications.

Unit – IV
Electromagnetic theory: Basic laws of electricity and magnetism - Maxwell's equations in integral and differential forms - Conduction and displacement current – Relation between Displacement current (**D),** Electric Intensity (**E)** and Polarization (**P)** - Electromagnetic waves: Equation of plane wave in free space – Poynting theorem.
Modern Optics: Interference – Newton's Rings by reflected light – Experimental arrangement – Types of diffraction – diffraction grating (Conditions of maxima and minima) – Resolving power of grating –Types of polarized light – Polarization by reflection – Malus law – Double refraction – Nicol's Prism. – Optical activity and polarimeter.

Unit – V
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 Diposition method), Top-down methods (e.g., Ball milling method) - Basic ideas of carbon nanotubes – Applications of nanomaterials and their health hazards.
Techniques for Characterization: Morphological studies of materials – X-ray Diffraction(XRD), Scanning Electron Microscopy (SEM). Spectroscopic studies of materials – Fourier Transform Infrared (FTIR), Beer's law, UV-Visible and Raman spectroscopy.

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 AgeInternational.
3	R.K. Gour and S.L. Gupta – Engg. Physics, DhanpatRai Publications.
4	B.K. Pandey and S.Chaturvedi – Engineering Physics, Cengage Learning.
5	A.K Bhandhopadhya - Nano Materials, New Age International.
6	S.K. Sharma, et al., Hand book of Material Characterization – Springer.

ES201CS	PROGRAMMING FOR PROBLEM SOLVING					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To introduce the basic concepts of Computing environment, number systems and flowcharts
2	To familiarize the basic constructs of C language – data types , operators and expressions
3	To understand modular and structured programming constructs in C
4	To learn the usage of structured data types and memory management using pointers
5	To learn the concepts of data handling using files

Course Outcomes :	
On completion of this course, the student will be able to implement	
CO-1	Explain various functional components in computing environment
CO-2	Develop algorithmic solutions to problems and draw the flow charts
CO-3	Explain and use basic constructs of C in writing simple programs
CO-4	Use standard library functions in C and develop modular programs using user defined functions and structured data types

UNIT – I
Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. **Number Systems**: Binary, Octal, Decimal, 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 Goto 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
5	

ES201ME	ENGINEERING MECHANICS - DYNAMICS					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:

- To understand the mass moment of inertia analysis for the different bodies.
- To know basic concepts of dynamic loads, their behavior, analysis and motion bodies
- To determine the work energy principles and impulse momentum theory

Course Outcomes:

Students who successfully complete the course will demonstrate the following outcomes by tests, homework, and written reports:

- An understanding of the analysis of distributed loads.
- Aknowledge of internal forces and moments in members.
- An ability to calculate mass moments of inertia.
- A knowledge of kinematic and kinetic analyses and energy and momentum methods for particles and systems of particles.
- Knowledge of kinematic and kinetic analyses and energy and momentum methods for rigid bodies.

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	-	-	-	-	-	2	-	-
CO2	3	3	2	-	-	1	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	1	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	-	-	-	-	-	1	-	-
CO5	3	3	2	-	-	1	-	-	-	-	-	2	-	-

UNIT - I

Centre of Gravity and Moment of Inertia : Centre of gravity and Mass moment of inertia for Volumes and Composite bodies. Radius of gyration.

Virtual work : Basic concepts and principles of virtual work method and its applications.

UNIT - II

Kinematics : Rectilinear motion, curvilinear motion. Velocity and Acceleration. Types of rigid body motion and its analysis in a plane.

UNIT - III

Kinetics : Analysis as a particle. Analysis as a rigid body in translation, Force motion. Fixed axis rotation. Rolling bodies. Plane motion.

UNIT - IV

Work – Energy : Principle of work-energy and it's application to translation, Particle motion and connected systems. Fixed axis rotation and plane motion.

UNIT - V

Impulse Momentum : Linear impulse momentum. Conservation of momentum. Elastic impact. Plane motion.

Mechanical Vibrations: Definition, concepts, simple harmonic motion, vibrations, simple pendulum, compound pendulum.

Suggested reading:

1	Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.
2	Bhavikatti S S. (2019). *Engineering Mechanics*, 7th Edition, New Age International.
3	Hibbeler R C. (2017). *Engineering Mechanics Statics and Dynamics*, Pearson.
4	Khurmi R S and Khurmi N. (2018). *A Textbook of Engineering Mechanics,* 22nd Edition,S Chand, New Delhi.
5	Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, HarperCollins International Edition.

ES201EE	BASIC ELECTRICAL ENGINEERING					
Pre-requisite			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To understand the fundamentals of DC and AC electrical circuits.
2	To understand the working principles of DC motor, DC generator, Transformers and single phase induction motors.
3	To understand working principles of protection devices used in electrical circuits.

Course Outcomes:	
On completion of this course, the student will be able to :	
CO-1	Analyze the performance of simple electrical circuits exciting with DC and AC excitations.
CO-2	Apply different theorems to solve complicated electrical circuits to obtain the current, voltage and power.
CO-3	Understand the main components, characteristics, applications of different DC and AC electrical machines used in industry.
CO-4	Understand the importance of protective devices and their rating used in electrical circuits.
CO-5	Obtain the overall understanding of basic electrical circuits and appliances required for any industry.

Unit - I : DC Circuits
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton 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 and 3-ph Induction Motors

Transformers : Electromagnetic induction, Faradays laws, Statically induced emf, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections.
Three Phase Induction motor: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications

Unit - IV : Single-phase induction motor & DC Machines

Single-phase induction motor: Construction and principle of operation, Capacitor start & capacitor run motor, applications
DC Generators: Dynamically induced emf, Flemming's Right hand and Left hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC 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 Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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	AbhijitChakrabarti, SudiptaNath, Chandan Kumar Chanda, "Basic Electrical Engineering" Tata McGraw Hill, Publications, 2009
4	Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Wesley Longman Inc., 1995.

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	-	-	-	-	-	-	-	-	-	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**

BS251PH	Engineering Physics Lab					
(Basic Science)						
Pre-requisites	Strength of Materials		L	T	P	C
			-	-	3	1.5
Evaluation	SEE	50 Marks	CIE		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	demonstrate an ability to make physical measurements and understand the limits of precision in measurements.
2	demonstrate the ability to use experimental statistics to determine the precision of a series of measurements.
3	demonstrate the ability to understand optical / Semiconducting / dielectric properties of materials.
4	demonstrate the ability to understand the construction and working of different experiments.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	recognize the transformation concepts into practicals. .
CO-2	use a best fit to create a graph from a series of data points. Students can extrapolate and interpolate.
CO-3	appreciate the mathematical abilities to meaningful physical conclusions.
CO-4	develop skills to impart practical knowledge in real time solution and learn to design new instruments with practical knowledge.
CO-5	understand the link between theory and practicals.

Course outcome	Program Outcome											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3	3										
CO-2	3	3	1									
CO-3	3	3	3									
CO-4	3	3	2	1	3	1						
CO-5	3	1										

Correlation rating : Low / Medium / High : 1 / 2 / 3 respectively.

Experiment - I
To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT).

Experiment - II

termination of Velocity of ultrasonic waves in a given liquid by Debye-Sears method.

Experiment - III
To draw the I-V Characteristics of P-N Junction diode and to evaluate the value of potential barrier of the diode.

Experiment - IV
To find the values of Electrical conductivity and energy gap of Ge crystal by Four probe method.

Experiment - V
Determination of rigidity of modulus of Torsion pendulum.

Experiment - VI
To study V-I characteristics of Light Emitting Diode.
Experiment - VII
Determination of carrier concentration, Mobility and Hall Coefficient of Ge Crystal using Hall Effect Experiment.

Experiment - VIII
Verification of Beer's law.

Experiment - IX
To Estimate Radius of curvature of given lens by forming Newton's rings.

Experiment –X
determine resolving power of plane grating.

Experiment - XI
To determine the constants of A, B and α of given Thermistor.

Experiment - XII
To determine specific rotatory power of a given solution by using Laurent's Half shade polarimeter.

ES251CS	Programming for Problem Solving Lab					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To use tools available under LINUX for C programming
2	To gain hands-on experience on basic constructs of C programming
3	To formulate problems and implement algorithmic solutions in C
4	To write modular programs in C using structure programming techniques and data files.

Course Outcomes :	
On completion of this course, the student will be able to implement	
CO-1	Write, compile and debug C programs in Linux environment
CO-2	Write simple programs using control structures, user defined functions and data manipulation using arrays
CO-3	Use standard C library functions to develop modular programs in C

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 .

ES251ME	ENGINEERING DRAWING - II					
Pre-requisites			**L**	**T**	**P**	**C**
			2	-	4	4
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

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

CO1: Draw the Development of surfaces for regular solids

CO2: Draw the Intersection of surfaces for prism, cylinder and cone

CO3: Construct Isometric views of an object from 2D orthographic view and vice versa

CO4: Construct 2D (orthographic) and 3D (Isometric) views in CAD environment

CO5: Execute a simple team project.

CO-PO ATRICULATION MATRIX

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

Unit I

Development of Surfaces: parallel line development, Radial line development, Development of surfaces for Prisms, Cylinders, Pyramids and Cones.

Unit II

Intersection of Surfaces: line method and cutting plane method- Intersection of prisms, prisms and pyramids, cylinders, cylinders and prisms, cylinder and cone

Unit III

Isometric views: Isometric axis, Isometric Planes, Isometric scale, Isometric projection, Isometric views – simple objects.

Reading a Drawing, transformation of projections: Conversion of isometric Views to Orthographic Views.

Unit IV

3D modelling using Auto CAD

Modeling of parts and assemblies. Parametric and non- parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models.

Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling. Plotting drawings and template drawings.

Unit V

Demonstration of a simple team design project: Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels

Suggested Readings:

1. BhattN.D., Panchal V.M.& Ingle P.R.,(2014), Engineering Drawing, Charotar Publishing House

2. Shah,M.B.&RanaB.C.(2008),EngineeringDrawing and ComputerGraphics,PearsonEducation

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 (Corresponding set of) CAD Software Theory and User Manuals

5. Sham Tickoo (2015), AutoCAD 2015 for Engineers and Designers, Dreamtech Press

ES251EE	BASIC ELECTRICAL ENGINEERING LAB					
Pre-requisite			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To understand the fundamentals of DC and AC electrical circuits.
2	To understand the working principles of DC motor, DC generator, Transformers and single phase induction motors.
3	To understand working principles of protection devices used in electrical circuits.

Course Outcomes:	
On completion of this course, the student will be able to :	
CO-1	Get an exposure to common electrical components and their ratings. Make electrical connections by wires of appropriate ratings.
CO-2	Understand the usage of common electrical measuring instruments.
CO-3	Analyze the performance of AC and DC circuits with appropriate operating conditions.
CO-4	Understand the basic characteristics of transformers and electrical machines.
CO-5	Obtain the overall understanding of basic electrical circuits and appliances required for any industry.

Suggested List of Laboratory Experiments/Demonstrations:

I - Cycle

Demonstration: Basic safety and precautions - Introduction and use of measuring instruments

Exp 1. Verification of Kirchhoff's Laws

Exp 2. Verification of Thevenin's& Norton's Theorems

Exp 3. Steady-state and transient time-response of R-C circuit to a step change in voltage.

Exp 4. Sinusoidal steady state response of R-L and R-L-C circuits- impedance calculation and verification

Exp 5. Measurement of three-phase power in balanced three-phase circuits using Two-Wattmeter method

II - Cycle

Demonstration: cut-out sections of machines: DC machine, induction machine, synchronous machine and single-phase machine

Exp 6. Load test on single phase transformer: Measurement of primary and secondary voltages, currents and power

Exp 7. Three-phase Transformer: Star and Delta connections. Voltage and current relationship

Exp 8. Torque-speed characteristics of separately excited DC motor

Exp 9.Synchronous speed of two-pole and four-pole, three-phase induction motor, Speed reversal by change of phase-sequence

Exp 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	AbhijitChakrabarti, SudiptaNath, Chandan Kumar Chanda, "Basic Electrical Engineering" Tata McGraw Hill, Publications, 2009
4	Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Wesley Longman Inc., 1995.

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	-	-	-	-	-	-	-	-	-	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