Scheme of Instruction, Evaluation

and

Syllabi of

B.E. CIVIL ENGINEERING

With effect from Academic Year 2022-23

Estd. 1917

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING

(Autonomous)

Osmania University

Hyderabad – 500 007, TS, INDIA

Estd. 1929

INSTITUTION

The University College of Engineering is established in the prestigious Osmania Univresity, Hyderabad in the year 1929 having the distinction of being the 6th oldest Engineering College in the then British India. The college become autonomous in the year 1994. Over the decades, the UCE(A), OU has produced several illustrious alumni who brought laurels to the nation at world forums. The college is offering BE in eight branches viz., AI&ML, BME, CE, CSE, EEE, ECE, ME and Mining Engineering; ME in 22 specialisations with majority of them receiving NBA Accreditation. The college offers Ph.D. in all ME specialisations. The college has well established laboratories and research facilities and well placed in NIRF Rankings. The faculty members are well qualified and several of them received Best Teacher Award from Government of Telangana state. They are serving as expert members on several professional bodies. The faculty members authored several research publications, text/reference books and extend consultancy services.

Vision

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

Mission

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

DEPARTMENT

The Department of Civil Engineering was established in the year 1929 and was the first Department to commence the undergraduate programme at University college of Engineering, Osmania University. Over the years, the Department grew from strength to strength in terms of its academic achievements and infrastructure development. Currently, the Department offers BE in Civil Engineering; ME in Structural Engineering, Geotechnical Engineering, Water Resources Engineering and Transportation Engineering specializations and PhD programs. The Department also has the distinction of enrolling large number of foreign students both at UG and PG level.

The Department provides research and consultancy services to various organizations. Several faculty members have received prestigious awards including the Best Teacher awards of the State Government and the Best Publication awards reflecting their teaching abilities and the research contribution. Many of the faculty members are listed in several national and international biographical directories. The faculty has published over 1500 papers in various international and national journals and conferences besides text books and professional books.

Vision

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

Mission

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

Programme Educational Objectives (PEO):

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

PROGRAM OUTCOMES (POs)

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

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

MAPPING OF PEO'S WITH PO'S

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

Rubrix

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

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

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (CIVIL ENGINEERING) w.e.f. 2022-23

I – Semester

S. No.	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	MC 100 HS	Induction Program	3 weeks							
2	BS 101 MT	Engineering Mathematics-I	3	0	-	3	3	40	60	3
3	BS 101 CH	Engineering Chemistry	3	0	-	3	3	40	60	3
4	HS 101 EG	Communicative English	3	0	-	3	3	40	60	3
5	ES 101 CE	Engineering Mechanics-I	3	0	-	3	3	40	60	3
Practicals										
6	BS 151 CH	Engineering Chemistry Lab	-	-	3	3	3	25	50	1.5
7	HS 151 EG	Communicative English Lab	-	-	2	2	3	25	50	1
8	ES 151 CE	Engineering Graphics	2	-	4	6	3	25	50	4
9	ES 151 ME	Workshop Practice	-	-	6	6	3	25	50	3
		Total	**14**	**0**	**15**	**29**		**260**	**440**	**21.5**

Service Courses:

E.E.E. / Mining Engineering

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
1	ES 151 CE	Engineering Graphics	2		4	6	3	40	60	3

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (CIVIL ENGINEERING) w.e.f. 2022-23

II – Semester

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	BS 201 MT	Engineering Mathematics-II	3	0	-	3	3	40	60	3
2	BS 201 PH	Engineering Physics	3	0	-	3	3	40	60	3
3	ES 201 CS	Programming for Problem Solving	3	0	-	3	3	40	60	3
4	ES 201 CE	*Engineering Mechanics II*	3	0	-	3	3	40	60	3
5	PC 201 CE	*Building Materials & Construction*	3	0	-	3	3	40	60	3
6	ES 201 EE	*Basic Electrical Engineering*	3	0	-	3	3	40	60	3
Practicals										
7	BS 251 PH	Engineering Physics Lab	-	-	3	3	3	25	50	1.5
8	ES 251 CS	Programming for Problem Solving Lab	-	-	2	2	3	25	50	1
9	ES 251 CE	Computer Aided Civil Engineering Drawing	2	-	4	6	3	25	50	4
10	ES 252 CE	Engineering Mechanics Laboratory			2	2	3	25	50	1
		Total	**20**	**0**	**11**	**31**		**340**	**560**	**25.5**

Service Courses : CSE / AIML / ECE

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
1	ES 253 CE	Engineering Graphics	2		4	6	3	40	60	3

Service Course: B.M.E.

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
1	ES 211 CE	Applied Mechanics	3			3	3	40	60	3

B.E. CIVIL ENGINEERING

I SEMESTER

SYLLABUS

BS 101 MT	ENGINEERINGMATHEMATICS – I					
Pre-requisites	Mathematical Knowledge of 12th / Intermediate level		**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 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.

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

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

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

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, Jacobean 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, Stokes's theorem (without proofs) and their verification

Suggested Reading:

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

BS 101 CH	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	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 about different batteries, fuel cells and their applications of nonmaterials.

Articulation matrix of Course outcomes with PO's:

	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	1	1					2	3	3
CO2	3	3	2	1	1	1	1					1	3	3
CO3	2	2	1	1	1	1	-					1	2	2
CO4	2	2	2	1	1	1	-					1	2	2
CO5	2	2	2	2	1	1	-					2	2	2

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

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 sludge's 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 ELECTRO CHEMISTRY(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 – VI

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, Fibers 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 Nonmaterial's (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

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Nonmaterial's:
Introduction. Properties of nonmaterial's. Synthesis of nonmaterial-Top down, Bottom up approach and Sol-gel method. Applications of nonmaterial's.

Suggested Reading:

1.	Jain & Jain, Engineering chemistry, Dhanpat Rai publishing Co., 16th Edition.
2.	B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTELWeb-book)
3.	Prashanth Rath, 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.

HS 101 EG	COMMUNICATIVE ENGLISH					
Pre-requisites	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 an effective paragraphs and essay 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

Articulation matrix of Course outcomes with PO's:

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.	Languageand LifeASkillsApproach,OrientBlackSwan,2018
3.	MichaelSwan, PracticalEnglishUsage. 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.

ES 101 CE	ENGINEERING MECHANICS – I					
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 resolution of forces, equilibrium of force systems
2	Learn the analysis of forces in trusses and frames
3	Understand the concept of friction, centroid and area moment of inertia

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Determine the resultant and moment of a force system
CO-2	Apply the equations of equilibrium for a generalized force system
CO-3	Analyze the forces in trusses and frames
CO-4	Apply the concepts of friction in solving the engineering problems
CO-5	Determine the centroid and moment of inertia for 1D & 2D bodies

Articulation matrix of Course outcomes with PO's:

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

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

Unit - I
Force Systems: Resultant of collinear, parallel, coplanar and non-coplanar concurrent and non-concurrent force systems, resolving a planar or non-coplanar force system into different directions, moment of force and its applications, couples and wrench of a force system.

Unit - II
Equilibrium of Force Systems: Free body diagram, equations of equilibrium, equilibrium of Planner and spatial system.

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 and connected systems, belt friction and Wedge friction.

Unit - V
Centroid and Moment of Inertia: Centroid of lines and areas, areas and volumes of revolution, Pappu's theorems and their applications, area moment of inertia, product moment of inertia, Composite areas, radius of gyration.

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, Harper Collins International Edition.

BS 151 CH	ENGINEERING CHEMISTRY LAB					
Pre-requisites	Chemistry in Intermediate program		**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.	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.

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

Articulation matrix of Course outcomes with PO's:

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

Experiment - I
1.Estimation of HCL by Conductometry.

Experiment - II
Estimation of Acetic Acid by Conductometry.

Experiment – III
Estimation of HCL by Potentiometry.

Experiment - VI
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
Determination 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
Estimation of Permanent and Temporary hardness of water by Complexometry.

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

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

Suggested Reading:

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 Dhanpath Rai Publishing Co.,

HS 151 EG	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 use of 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, gds, 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 accent
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

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

Articulation matrix of Course outcomes with PO's

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

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:

1.	T.Balasubramanian. A TextbookofEnglishPhoneticsforIndianStudents. Macmillan,2008.
2.	J. Sethi et al., A Practical Course in English Pronunciation (with CD). PrenticeHallofIndia, 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

ES 151 CE	ENGINEERING GRAPHICS					
Pre-requisites			**L**	**T**	**P**	**C**
			2	-	4	4
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives : (3 to 5)	
The course is taught with the objectives of enabling the student to:	
1.	Introduction to fundamentals and need of AUTOCAD software drawings
2.	Knowledge about various 2D command of AUTOCAD drawing applicable for drawing and printing options.
3.	Inputs on basic concepts of engineering drawing, lettering formats for analyzing various topics via. Conic Sections, Involutes.
4.	Awareness towards the various types of projections and the drawings of 2D and 3D views.
5.	Introduction to fundamentals and need of AUTOCAD software drawings

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Knowledge on the fundamentals of AUTOCAD 2D commands.
CO-2	Application of basic principles of drawing and scales for representation of prototype Objects.
CO-3	Relate the logic of projections to points, straight lines and various views of 2D and 3D Objects.
CO-4	Capability to imagine and project the developed surface and truncated portion of 3D solids.
CO-5	Assimilation of visualization process to efficiently communicate ideas graphically and provide editable solutions.

Articulation matrix of Course outcomes with PO's:

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

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

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

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

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

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

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

Suggested Reading:

1.	Bhatt N. D. Panchal V. M. & Ingle P.R., (2014). *Engineering Drawing*, Charotar Publishing House
2.	Shah, M.B. & Rana B. C. (2008). *Engineering Drawing and Computer Graphics*, Pearson Education
3.	Agrawal B. & Agrawal C. M. (2012). *Engineering Graphics*, TMH Publication
4.	Jeyapoovan T. (2015). *Engineering Graphics Using Autocad*, Vikas Publishing House Pvt. Ltd., Noida, 7th Edition
5.	Lal S. N. *Engineering Drawing* (2018). M/s. Cengage Learning India Pvt. Ltd., Pratap Gunj, Delhi.

ES 151 ME	WORKSHOP PRACTICE					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	6	3
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To learn about different tools used in workshop
2	To understand the different manufacturing processes.
3	To learn about fabrication of components using different materials.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Study and practice on tools and their operations of different trades.
CO-2	Practiceonmanufacturingofcomponentsusingworkshoptradesincludingcarpentry,fitting, foundry, smithy, sheet metal &welding
CO-3	Selectsuitabletoolsformachiningprocessincludingfacing,turning&knurling
CO-4	Attain basic electrical knowledge for house wiring practice
CO-5	

Articulation matrix of Course outcomes with PO's:

	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	
CO5														

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

LIST OF EXPERIMENTS: **Carpentry shop:**
• Making of Cross lap joint with Wood • Making of End Lap / Tee Lap Joint with wood

Fitting shop
• Making of Step cut with Mild Steel flat • Making of semicircular and V-cut with Mild Steel flat

Sheet metal shop
• Making of Funnel with GI Sheet • Making of Rectangular box with GI Sheet

House wiring
• Making of Cleat wiring • Making of casing wiring

Welding shop
• Making of Butt joint using Arc Welding • Making of Lap Joint using Arc Welding

Machine shop
• Making of Step turning on MS cylindrical rod • Making of Taper turning on MS cylindrical rod

Foundry shop
• Preparation of casting using single piece pattern • Preparation of casting using core pattern.

Smithy shop
• Forging of square shape peg from cylindrical work piece • Forging of square shape L- bend peg from cylindrical work piece

Suggested Reading:

1.	HajraChoudhuryS.K.,HajraChoudhuryA.K.andNirjharRoyS.K.,"ElementsofWorkshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

B.E. CIVIL ENGINEERING

II SEMESTER

SYLLABUS

BS 201 MT	ENGINEERING MATHEMATICS–II					
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.	ToStudyMatrixAlgebraanditsuseinSolvingSystemofLinearEquationsandSolvingEigenValueProblems
2.	To Study the First Order Linear and Non-Linear Ordinary Differential Equations
3.	To Study the Higher Order Linear Ordinary Differential Equations with Variable and Constant Coefficients
4.	To Introduce the Concept of Functions of Complex Variable and their Properties
5.	To Study the Values of Improper Integers Using Residue Theorem.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Solve System of Linear Equations and Eigen 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:

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

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

Unit - I
Matrices: **Elementary row and column operations, Rank of a matrix, Echelon form, System of linearequations, 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, OrthogonalTrajectories ofagivenfamilyofcurves.

Unit - III
Differential Equations of Higher Orders : **Linear Independence and Dependence, Solutions of Second andHigher OrderLinear 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).**

Suggested Reading:

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. Rajnish Varma, higher Engineering Mathematics, S.Chand Technical 3rd Edition.

BS 201 PH	ENGINEERING PHYSICS					
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 nonmaterial 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 and ultrasonic 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 nonmaterial's and create desired properties by using various methods of synthesis processes.

Articulation matrix of Course outcomes with PO's:

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

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 Ultrasonic's - Production of ultrasonic waves by converse Piezoelectric method – Detection of ultrasonic waves - Piezoelectric detector — Wavelength of Ultrasonic's 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, and 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 Age International.
3.	R.K. Gour and S.L. Gupta – Engg. Physics, Dhanpat Rai Publications.
4.	B.K. Pandey and S.Chaturvedi – Engineering Physics, Cengage Learning.
5.	A.K Bhandhopadhya - Nano Materials, New Age International.
6.	S.K. Sharma, et al., Hand book of Material Characterization – Springer.

ES 201 CS	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 :	
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

Articulation matrix of Course outcomes with PO's:

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

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

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

ES 201 CE	ENGINEERING MECHANICS – II					
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 concepts of centre of gravity, mass moment of inertia and virtual work
2	Study the motion of rigid bodies and its causes
3	Learn the principle of work-energy and impulse-momentum

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Determine the centre of gravity and mass moment of inertia for solids
CO-2	Apply the concepts of rectilinear and curvilinear motion in plane
CO-3	Analyze the motion of a rigid body and its causes
CO-4	Apply the principle of work-energy for bodies in translation
CO-5	Solve the problems of elastic impact using impulse-momentum theorem

Articulation matrix of Course outcomes with PO's:

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

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

Unit - I
Centre of Gravity and Mass Moment of Inertia: Centre of gravity and mass moment of inertia for solid and composite bodies, radius of gyration. **Virtual Work:** Principle of virtual work and its application to simple systems.

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 and as a rigid body in translation, fixed axis rotation, rolling bodies and plane motion.

Unit - IV
Work-Energy: Principles of work-energy, and its applications to bodies in translation, particle motion and connected systems, fixed axis rotation and plane motion.

Unit - V
Impulse-Momentum: Linear impulse-momentum, conservation of momentum, elastic impact and plane motion.

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, Harper Collins International Edition.

PC 201 CE	BUILDING MATERIALS AND CONSTRUCTION					
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	Study about the basic building materials
2	Know the smart building materials
3	Understand the construction of form work

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Differentiate between various building materials i.e. both conventional and smart building materials
CO-2	Describe the role of aggregates in concrete preparation and have knowledge of mix design methods of concrete
CO-3	Demonstrate the importance of energy conservation, damp proof course and fire protection and crack propagation in buildings
CO-4	Analyze different type of plasters, paints, varnish and distempers and their constituents.
CO-5	Describe different materials used and construction of various form works and scaffoldings

Articulation matrix of Course outcomes with PO's:

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

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

Unit - I

Introduction: Uses of stones as building materials, classification, characteristics, dressing and polishing of stones, methods of quarrying and construction.

Bricks: Methods of manufacturing bricks. Classification and methods of construction.

Timber: Timber as a building material and its uses. Methods of seasoning and preservation laminates and their uses, defects in Timber.

Cement: Introduction to cement, different grades, IS specifications and OPC and PPC Cements (blended cements).

Mortar and Sand: Characteristics of good mortar making sand, availability of sand ant its classification, bulking of sand, manufacturing methods of mortar. Different types of mortars- preparation, setting and curing.

Unit - II

Coarse and fine Aggregate: Characteristics of good coarse and fine aggregates for manufacture of concrete, Significance and application of coarse and fine aggregate for the production of good quality concrete.

Concrete: Introduction to Nominal mix and Design mix, Stages involved in preparation of concrete

Unit - III

Type of joints in Concrete - Construction, expansion, contraction, and isolation joints.

Cracks in Buildings- Type of cracks in buildings, principal causes-moisture movement, thermal variations, elastic deformation, creep, chemical reaction.

Smart building Materials: Energy conservation in buildings- use of recycled materials, regional materials and industrial waste products as means of sustainable development. Green Building Materials

Unit - IV

Plastering and Pointing: Different types of plasters and plastering process, defects in plastering.

Paints, Varnish and Distemper: Constituents, characteristics of good paints, bases, vehicles, thinners and coloring pigments. Painting of different types of surfaces varnish and its types, application. Distemper, dry and oil bound, and application of distemper

Unit - V

Form work- Types of Form work, types of materials used in form work

Scaffoldings- Types of Scaffoldings, Scaffolding Erection & dismantling, Scaffolding Inspection.

Fire protection in structures- Classification of fire, general causes of fire, detection of fire, methods for fire control, Analysis for structural components for fire resistance (wood, steel, concrete and masonry).

Damp Proof Course-Causes of dampness, effects of dampness, methods of damp proofing

Suggested Reading:

1.	VN. Vazirani, and S.P. Chandola(1993), *Engineering Materials*, Khanna Publishers.
2.	Sushil Kumar(1992), Building Construction, Standard Publishers.
3.	S.P. Arora and S.P. Bindra(1999), *Text book on Building Construction*, Dhanpath Raj Publications.
4.	M.S.Shetty(2012), *Concrete Technology*, S.ChandPublishers.
5.	Gurucharan singh(2019), *Building materials and construction*, 17th Edition,Standard bookhouse.

ES 201 EE	BASIC ELECTRICAL ENGINEERING					
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 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.

Articulation matrix of Course outcomes with PO's:

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

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

Unit - I
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
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: 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: 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
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.	Abhijit Chakrabarti, Sudipta Nath, 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.

BS 251 PH	ENGINEERING PHYSICS LABORATORY					
Pre-requisites			**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.

Articulation matrix of Course outcomes with PO's:

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

Suggested Reading:

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

ES 251 CS	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 :	
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

Articulation matrix of Course outcomes with PO's:

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

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

List of Programs:

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.

Suggested Reading:

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.

ES 251 CE	COMPUTER-AIDED CIVIL ENGINEERING DRAWING					
Pre-requisites			**L**	**T**	**P**	**C**
			2	-	4	4
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To prepare you to design a system, component, or process
2	To meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health, safety,
3	To prepare you to design a system for its manufacturability and sustainability

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Understand isometric basics and principles, create drawings of AUTOCAD
CO-2	Able to understand symbols and sign conventions
CO-3	Detailing of Masonry bonds
CO-4	Understand terms, elements, and methods of building drawing.
CO-5	Establish fundamentals of Isometrics, building Information Modeling (BIM)

Articulation matrix of Course outcomes with PO's:

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

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

Unit - I
ISOMETRIC PROJECTIONS covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids, Draw the sectional orthographic views of geometrical solids.
AutoCAD: Setting up and use of Layers, layers to create drawings.

Unit - II
SYMBOLS AND SIGN CONVENTIONS: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards.

Unit - III
MASONRY BONDS: English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall.

Unit - IV
BUILDING DRAWING: Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing, Site plan, floor plans, elevation and section drawing of small residential buildings, Foundation plan, Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity

Unit - V
PICTORIAL VIEW: Principles of isometrics and perspective drawing, Perspective view of building, Fundamentals of Building Information Modeling (BIM)

Suggested Reading:

1.	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2.	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3.	N. Kumara Swamy (Author), A. Kameswara Rao (Author), Building Planning and Drawing, **Charotar Publishing House Pvt. Ltd. - Anand**
4.	S. S. Bhavikatti (Author), M. V. Chitawadagi (Author),Building Planning and Drawing (2014). **I K International Publishing House Pvt. Ltd**

ES 252 CE	ENGINEERING MECHANICS LAB					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	40 Marks	**CIE**		60 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Experience the interaction of forces
2	Understand the concepts of center of gravity
3	Learn by experience the Lami's theorem

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Gain experiential understanding of Simple machines
CO-2	Solve force polygon with greater understanding
CO-3	Determine the CG and MI of irregular bodies with competence
CO-4	Understand concepts related to frictional factor
CO-5	Apply Lami's theorem

Articulation matrix of Course outcomes with PO's:

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

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

List of Experiments
1. Study of Simple Machines **2.** Polygon Law of Coplanar Forces **3.** Centre of gravity of Irregular Shaped Bodies **4.** Simple/Compound Pendulum **5.** Inclined Plane(To determine coefficient of friction) **6.** Moment of Inertia of a Fly Wheel **7.** Simple Screw Jack **8.** Lami's theorem **9.** Application of Spreadsheet Programs

Suggested Reading:

1.	S.S Bhavakatti, Engineering Mechanies, New age International publishers
2.	R.S Khurmi, A Textbook of Engineering Mechanies, S. Chand Publications.
3.	Ferdinand L. Singer, Engineering Mechanics, Collins, Singapore, 1975.
4.	R.K Bansal, A Textbook of Engineering Mechanics, Laxmi Publications.
5.	Junarkar, S.B. and H.J. Shah., Applied Mechanics, Publishers, 2001.
6.	Reddy Vijay Kumar K. and K. Suresh Kumar, Singer's Engineering Mechanics, 2010.