

RAJALAKSHMI ENGINEERING COLLEGE
(An Autonomous Institution Affiliated to Anna University Chennai)
DEPARTMENT OF BIOTECHNOLOGY
CURRICULUM AND SYLLABUS REGULATIONS – 2023
B. TECH –BIOTECHNOLOGY
CHOICE BASED CREDIT SYSTEM

VISION OF THE INSTITUTION

To be an institution of excellence in Engineering, Technology and Management Education & Research.

To provide competent and ethical professionals with a concern for society.

MISSION OF THE INSTITUTION

To impart quality technical education imbued with proficiency and humane values

To provide right ambience and opportunities for the students to develop into creative, talented and globally competent professionals

To promote research and development in technology and management for the benefit of the society

VISION OF THE DEPARTMENT

To be a department of academic excellence focused on education, research and development and to conquer the frontiers of biotechnology, benefitting the society.

MISSION OF THE DEPARTMENT

- To impart quality technical education
- To continuously enhance and enrich the teaching / learning process
- To provide an ambience for overall development of the students to be more creative, innovative and globally competent ethical professionals
- To promote research and develop technologies and products for the sustenance and wellbeing of the society

PROGRAM EDUCATIONAL OBJECTIVES

This program enables Biotechnology graduates

- I.** To apply knowledge across the disciplines and in emerging areas of biotechnology for higher studies, research, employability and product development
- II.** To develop communication skills, sense of responsibility to protect the environment and ethical conduct towards their profession and commitment to serve the society
- III.** To possess academic excellence, managerial skills, leadership qualities and understand the need for lifelong learning for a successful professional career

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems
2. **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design and 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.
4. **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.
5. **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.
6. **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.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
8. **Ethics:** Apply the ethical principles and commit to professional ethics and responsibilities and norms of engineering practices.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively in 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.
11. **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 a leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

1. To apply the knowledge and solve problems through clinical research and improve health related issues of the society
2. To design, develop processes and bioproducts for health care
3. Apply basic skills in Engineering to promote interdisciplinary research in Biotechnology

CURRICULUM

SEMESTER – I

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
THEORY & PRACTICALS								
1	HS23111	Technical Communication I	2	0	0	2	2	HS
2	MA23112	Algebra and Calculus	3	1	0	4	4	BS
3	CY23132	Chemistry for Technologists	3	0	2	5	4	BS
4	GE23111	Engineering Graphics	2	0	4	6	4	ES
5	GE23121	Engineering Practices- (Civil and Mechanical)	0	0	2	2	1	ES
6	BT23131	Microbiology	2	0	4	6	4	PC
7	MC23112	Environmental Science and Engineering	3	0	0	3	0	MC
8	GE23117	தமிழர்மரபு /Heritage of Tamils	1	0	0	1	1	HS
TOTAL			16	3	8	27	20	

SEMESTER – II

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
THEORY & PRACTICALS								
1	HS23221	Technical Communication II	0	0	2	2	1	HS
	HS23222	English for Professional Competence						
2	MA23212	Differential Equations and Complex Variables	3	1	0	4	4	BS
3	PH23231	Physics for Bioscience	3	0	2	5	4	BS
4	GE23231	Programming using Python	1	0	4	5	3	ES
	GE23212	Basic Civil and Mechanical Engineering	3	0	0	3	3	ES
5	BT23211	Biochemistry	3	0	0	3	3	PC
6	MC23111	Indian Constitution and Freedom Movement	3	0	0	3	0	MC
7	GE23217	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	1	0	0	1	1	HS
8	BT23221	Biochemistry Laboratory	0	0	4	4	2	PC
TOTAL			17	1	12	30	21	

SEMESTER –III

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
THEORY & PRACTICALS								
1	MA23311	Transforms and Applied Partial Differential Equations	3	1	0	4	4	BS
2	BT23311	Enzyme Technology and Biotransformations	3	0	0	3	3	PC
3	BT23312	Stoichiometry and Fluid Mechanics	3	1	0	4	3	ES
4	BT23313	Molecular Biology	3	0	3	3	3	PC
5	BT23314	Cell Biology	3	0	0	3	3	PC
6	BT23321	Basic Biotechnology Laboratory	0	0	2	2	1	ES
7	BT23331	Analytical Techniques in Biotechnology	2	0	2	4	3	ES
TOTAL			17	2	7	23	20	

SEMESTER –IV

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
THEORY								
1	MA23431	Probability, Statistics and Reliability	3	0	2	5	4	BS
2	BT23411	Food Biotechnology	3	0	0	3	3	ES
3	BT23412	Genetic engineering	3	0	0	3	3	PC
4	BT23413	Thermodynamics and Heat transfer	3	1	0	4	3	ES
5	BT23414	Basic Industrial Biotechnology	3	0	0	3	3	PC
PRACTICALS								
6	CS23422	Python Programming for Machine Learning	0	0	4	4	2	ES
7	BT23421	Chemical Engineering Laboratory for Biotechnologists	0	0	4	4	2	ES
8	BT23422	Molecular Biology and Genetic Engineering Laboratory	0	0	4	4	2	PC
9	GE23421	Soft skills - I	0	0	2	2	1	EEC
TOTAL			15	2	14	32	23	

SEMESTER – V

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
THEORY								
1	BT23511	Bioprocess Principles	3	0	0	3	3	PC
2	BT23512	Bioinformatics	3	0	0	3	3	PC
3	BT23513	Separation Process Principles	3	1	0	4	3	ES
4		Professional Elective I	3	0	0	3	3	PE
5		Professional Elective II	3	0	0	3	3	PE
6		Professional Elective III	3	0	0	3	3	PE
PRACTICALS								
7	BT23521	Bioprocess Laboratory- I	0	0	4	4	2	PC
8	BT23522	Bioinformatics Laboratory	0	0	4	4	2	PC
9	GE23521	Soft Skills-II	0	0	2	2	1	EEC
TOTAL			18	1	8	27	23	

SEMESTER – VI

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
THEORY								
1	BT23611	Bioprocess Technology	3	0	0	3	3	PC
2	BT23612	Chemical Reaction Engineering	3	0	0	3	3	ES
3		Professional Elective IV	3	0	0	3	3	PE
4		Professional Elective V					3	PE
5		Professional Elective VI					3	PE
6		Open Elective I	3	0	0	3	3	OE
PRACTICALS								
7	BT23621	Bioprocess Laboratory II	0	0	4	4	2	PC
8	BT23622	Innovation and Design Thinking for Biotechnologists	0	0	4	4	2	EEC
9	BT23623	Numerical Programming for Biotechnologists	0	0	2	2	1	PC
10	GE23622	Problem Solving Techniques	0	0	2	2	1	EEC
TOTAL			15	0	20	35	24	

SEMESTER – VII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
THEORY								
1	BT23711	Downstream Processing	3	0	0	3	3	PC
2	BT23712	Immunology	3	0	0	3	3	PC
3	BT23713	Protein Engineering	3	0	0	3	3	PC
4	BT23714	Comprehensive Course for Biotechnologists	2	0	0	2	2	PC
5		Open Elective II	3	0	0	3	3	OE
PRACTICALS								
6	BT23721	Downstream Processing Laboratory	0	0	4	4	2	PC
7	BT23722	Immunology lab	0	0	4	4	2	PC
8	BT23723	Artificial Intelligence and Machine Learning for Biotechnologist	0	0	4	4	2	PC
9	BT23724	Industry Training (2 weeks Training during vacation)	0	0	0	0	1	EEC
10	CR23P62	Microfluidics Laboratory	0	0	2	2	1	ES
TOTAL			17	0	14	28	22	

SEMESTER – VIII

Sl. No	COURSE CODE	COURSE TITLE	L	T	P	Total Hours	Total Credits	Category
PRACTICALS								
1	BT23821	Project Work	0	0	24	24	12	EEC
TOTAL					24	24	12	

TOTAL CREDITS: 165

PROFESSIONAL ELECTIVE VERTICAL LIST

VERTICAL I	VERTICAL II	VERTICAL III	VERTICAL IV	VERTICAL V	VERTICAL VI
Bioprocess & biochemical Technology	Biosciences	Medical Biotechnology	Animal Biotechnology	Computational Biotechnology	Agro and Marine Biotechnology
BT23A11 Bioprocess control and Instrumentation	BT23B21 Biosensors	BT23C31 Human Genetics	BT23D41 Fundamentals of Animal Biotechnology	BT23E51 Programming for Bioinformatics Applications	BT23F61 Plant Biotechnology
BT23A12 Food Processing and Preservation	BT23B22 Nano Biotechnology	BT23C32 Cancer Biology	BT23D42 Gene Therapy	BT23E52 Computer Aided Drug Design	BT23F62 Therapeutic Applications of Phytochemicals
BT23A13 Bioreactor Design and scale up process	BT23B23 Biomaterials Engineering	BT23C33 Biopharmaceutical Technology	BT23D43 Animal Cell Culture technology	BT23E53 Molecular Modelling	BT23F63 Marine Biotechnology
BT23A14 Bioreactor consideration for recombinant products	BT23B24 Genome Editing	BT23C34 Clinical Trials and Health Care Policies in Biotechnology	BT23D44 Developmental Biology	BT23E54 Fundamentals for algorithms for Bioinformatics	BT23F64 Transgenic Plants
BT23A15 Advances in Bioenergy and Biofuels	BT23B25 Personalized Medicine	BT23C35 Free radicals in Health and Diseases	BT23D45 Biosafety and Bioethics	BT23E55 Metabolomics and Metabolic engineering	BT23F65 Plant tissue culture and Transformation techniques
BT23A16 Environmental Biotechnology	BT23B26 Neurobiology and Cognitive Sciences	BT23C36 Medical Microbiology	BT23D46 Tissue Engineering	BT23E56 Data Mining and Machine Learning for Bioinformatics	BT23F66 Quality Management in Biotechnology

SUMMARY

S.NO.	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	3	2							5
2.	BS	8	8	4	4					24
3.	ES	5	6	7	10	3	3	1		35
4.	PC	4	5	9	8	10	6	17		59
5.	PE					9	9			18
6.	OE						3	3		6
7.	EEC				1	1	3	1	12	18
8	MC	*	*							
Total		20	21	20	23	23	24	22	12	165

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
HS 23111	TECHNICAL COMMUNICATION I	Theory	2	0	0	2
Common to all branches of B.E/B. Tech programmes – First Semester						

Objectives:
• To facilitate students, develop their comprehension skills
• To enable students to improve their receptive skills
• To equip learners with better vocabulary and enhance their writing skills
• To aid students speak effectively in all kinds of communicative contexts.
• To improve the learners' basic proficiency in workplace communication

UNIT-I	DEVELOPING COMPREHENSION SKILLS	6
Listening: Introduction to Informational listening – Listening to Podcasts, News Reading: Intentional Reading - Short Narratives and Passages. Speaking: Introducing Oneself, Narrating a Story / Incident. Writing: Sequential Writing – connecting ideas using transitional words (Jumbled Sentences), Process Description Grammar: Verbs – Main & Auxiliary: Simple Tenses – Form, Function and Meaning. Vocabulary: Word formation – Prefix, Suffix, Compound Words.		
UNIT-II	LISTENING AND EXTENDED READING	6
Listening: Deep Listening – Listening to Talk Shows and Debates Reading: In-depth Reading - Scanning Passages Speaking: Describing Current Issues, Happenings, etc., Writing: Note Making, Note Taking – Paragraph Writing Grammar: Continuous Tenses, Prepositions, Articles Vocabulary: One Word Substitutes, Phrasal Verbs.		

UNIT-III	FORMAL WRITING AND VERBAL ABILITY	6
Listening: Listening to Lectures and Taking Notes Reading: Interpretation of Tables, Charts and Graphs Speaking: SWOT Analysis on Oneself Writing: Formal Letter Writing and Email Writing Grammar: Perfect Tenses, Phrases and Clauses, Discourse Markers Vocabulary: Verbal Analogy / Cloze Exercise		
UNIT-IV	ENHANCING SPEAKING ABILITY	6
Listening: Listening to eminent voices of one's interest (Martin Luther King, APJ Abdul Kalam, etc.) Reading: Timed Reading, Filling KWL Chart. Speaking: Just a Minute, Impromptu Writing: Check-list, Instructions. Grammar: 'Wh' Questions / 'Yes' or 'No' Questions, Imperatives Vocabulary: Synonyms, Antonyms, Different forms of the same words.		
UNIT-V	LANGUAGE FOR WORKPLACE	6
Listening: Extensive Listening (Audio books, rendering of poems, etc.) Reading: Extensive reading (Jigsaw Reading, Short Stories, Novels) Speaking: Short Presentations on Technical Topics Writing: Recommendations, Essay Writing Grammar: Impersonal Passive, Reported Speech, Concord Vocabulary: Informal Vocabulary and Formal Substitutes		
Total Contact Hours: 30		

Course Outcomes: On completion of the course students will be able to
<ul style="list-style-type: none"> ● Apply their comprehension skills and interpret different contents effortlessly ● Read and comprehend various texts and audio-visual contents ● Infer data from graphs and charts and communicate it efficiently in varied contexts ● Participate effectively in diverse speaking situations ● To present, discuss and coordinate with their peers in workplace using their language skills

SUGGESTED ACTIVITIES
<ul style="list-style-type: none"> ● Ice breaker ● Just A Minute ● Ship wreck ● Hot seat ● Vocabulary building ● Chinese whispers ● Case study

SUGGESTED EVALUATION METHODS
<ul style="list-style-type: none"> ● Assignment topics ● Quizzes ● Class Presentation/Discussion ● Continuous Assessment Tests

Text Book(s):
1. Effective Technical Communication by M. Ashraf Rizvi (Author) 2nd Edition Paperback 2017
2. Sylvan Barnet and Hugo Bedau, 'Critical Thinking Reading and Writing', Bedford/St. Martin's: Fifth Edition (June 28, 2004)
3. Meenakshi Upadhyay, Arun Sharma – Verbal Ability and Reading Comprehension.
4. Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine ChuenMeng Goh, Cambridge University Press

Reference Books(s) / Web links:
1. Basic Vocabulary in Use: 60 Units of Vocabulary Practice in North American English with Answers 2nd Edition by Michael McCarthy (Author), Felicity O'Dell (Author), John D. Bunting (Contributor)
2. Reading Development and Difficulties By Kate Cain
3. The 7 Habits of Highly Effective People by Stephen Covey, Simon and Schuster, UK
4. Everybody Writes: Your Go-To Guide to Creating Ridiculously Good Content Hardcover by Ann Handley (Author)

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS23111.1	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23111.2	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23111.3	-	1	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23111.4	-	-	-	2	-	-	-	-	1	3	-	-	-	-	-
HS23111.5	-	-	-	1	-	-	-	-	1	3	-	-	-	-	-
Average	-	1	-	1.2	-	-	-	-	1	3	-	-	-	-	-

Course Code	Course Title	Category	L	T	P	C
MA23112	ALGEBRA AND CALCULUS	BS	3	1	0	4
Common to I sem. B.E. - AERO, AUTO, MECH, MCT, R&A, CIVIL and B.Tech. - BT, FT & CHEM						

Objectives:
● To introduce the matrix techniques and to illustrate the nature of the matrix.
● To address data and synthesis of the information to provide valid conclusions.
● To explain techniques of calculus which are applied in the solutions of engineering problems.
● To analyse special types of integrals by analytical methods and numerical techniques.
● To practice the techniques of Integration in finding area and volumes.

UNIT-I	MATRICES	12
Matrices - Eigenvalues and eigenvectors - Diagonalization of matrices using orthogonal transformation - Cayley-Hamilton Theorem (without proof) -Quadratic forms- Reduction to canonical form using orthogonal transformation- Numerical computation of Eigen value using Power method		
UNIT-II	FUNCTIONS OF SEVERAL VARIABLES	12
Partial differentiation–Total derivative–Change of variables–Jacobians–Partial differentiation of implicit functions– Taylor’s series for functions of two variables–Maxima and minima of functions of two variables– Lagrange’s method of undetermined multipliers.		
UNIT-III	INTEGRAL CALCULUS	12
Integral Calculus: Definite Integrals as a limit of sums - Applications of integration to area, volume - Improper integrals: Beta and Gamma integrals - Numerical computation of integrals: Trapezoidal rule - Gaussian Two point quadrature		
UNIT-IV	MULTIPLE INTEGRALS	12
Double integrals – Change of order of integration – Area enclosed by plane curves–Triple integrals–Volume of solids– Numerical computation of double integrals: Trapezoidal rule.		
UNIT-V	REGRESSION	12
Scatter diagram - Karl Pearson coefficient of correlation for raw data –Spearman rank correlation coefficient -		

MA23112.1	3	2	1	-	-	-	-	-	-	-	1	-	-	-	-
MA23112.2	3	2	-	1	-	-	-	-	-	-	1	1	1	-	-
MA23112.3	2	2	-	-	-	-	-	-	-	-	1	1	-	-	-
MA23112.4	3	3	1	-	-	-	-	-	-	-	1	1	1	1	-
MA23112.5	2	2	-	-	-	-	-	-	-	-	-	-	1	1	-
Average	2.6	2.2	1	1	-	-	-	-	-	-	1	1	1	1	-

Subject Code	Subject Name	Category	L	T	P	C
CY23132	CHEMISTRY FOR TECHNOLOGISTS	BS	3	0	2	4
Common to B.TECH. - CHEMICAL ENGG., FT & BT						

Course Objectives:
<ul style="list-style-type: none"> To acquire knowledge on surface chemistry for industrial and domestic uses.
<ul style="list-style-type: none"> To impart the knowledge on principles of electrochemistry for engineering applications.
<ul style="list-style-type: none"> To provide an insight into the latest nanotechnology to pursue further research.
<ul style="list-style-type: none"> To appreciate the need for and importance of polymer materials and heterocyclic compounds.
<ul style="list-style-type: none"> To enhance the knowledge in line with the modern techniques for material analysis.

UNIT-I	SURFACE CHEMISTRY	9
Introduction – Adsorption- difference between adsorption and absorption - types of adsorptions - Factors influencing adsorption - Adsorption from solutions- Types of adsorption isotherms - Freundlich adsorption isotherm - Langmuir adsorption isotherm - Industrial applications of adsorption – Adsorption Chromatography - Role of adsorption in Catalysis - Enzyme catalysis-Michael’s Menten equation.		
UNIT-II	ELECTROCHEMISTRY	9
Terminology involved in electrochemistry – Types of Cells - Galvanic and concentration cells- Derivation of Nernst equation - Applications of Electrochemical series - Types of Electrodes - Hydrogen, Calomel, ion-selective electrode - Determination of pH using glass electrode - Determination of electrode potentials - Conductometric titrations - Potentiometric Titration-Redox titration.		
UNIT-III	NANO CHEMISTRY	9
Basic Definitions - Distinction between nanoparticles and bulk materials - size-dependent properties - Mechanical, Chemical, Optical, Electrical and Magnetic properties – Nanoparticles - nanoclusters, nanorods, nanotubes and nanowires - Synthesis of nanoparticles - Precipitation method - Hydrothermal synthesis - Solvothermal synthesis - Sonochemical synthesis - Chemical vapor deposition – Electrodeposition - biogenic synthesis - Applications of nanomaterials.		
UNIT-IV	POLYMERS AND HETEROCYCLES	9
Polymers – Introduction - Polymerization - Types of Polymerizations - Condensation, Addition, Coordination, Copolymerization - Mechanism of Polymerization - Free Radical Mechanism - Biopolymers - PLA and PHB - Synthesis properties and applications. Heterocyclic compounds - Synthesis and electrophilic and nucleophilic substitution reactions of pyrrole - furan - thiophene- pyridine- quinoline - isoquinoline.		
UNIT-V	ANALYTICAL TECHNIQUES	9
Electromagnetic spectrum - absorption of radiation - electronic, vibrational and rotational transitions - Thermal methods of analysis - TGA, DTA – Principle, instrumentation and applications - Spectro Analytical methods - Colorimetry, IR, UV-visible spectroscopy - Principles instrumentation and applications.		
Total Contact Hours:45		

Description of the Experiments	Total Contact Hours:30
1. Construction and determination of EMF of simple electrochemical cells and concentration cells	

2.	Estimation of acids by pH metry
3.	Determination of corrosion rate on mild steel by weight loss method
4.	Estimation of mixture of acids by conductometry
5.	Estimation of extent of corrosion of iron pieces by potentiometry
6.	Estimation of copper / ferrous ions by spectrophotometry
7.	Estimation of DO by using sensors
8.	Estimation of concentration of sulphate/ Chloride ions in the given sample solution.
9.	Determination of molecular weight of a polymer by viscometry method
10.	Synthesis of nanomaterials by simple precipitation method
11.	Verification of adsorption isotherms (acetic acid on charcoal)
12.	Determination of phase change temperature of a solid.

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

- Explore the applications of Surface Chemistry in domestic and industrial uses.
- Employ the basic principles of Electrochemistry in our daily life appliances.
- Synthesize Nano materials for modern engineering applications.
- Recognize the need of advanced polymer and heterocyclic compounds in industrial applications.
- Identify the structure of unknown/new compounds with the help of spectroscopy.

SUGGESTED ACTIVITIES

- Electroplating process can be done by a group of students.
- Determination of alkali content in the soap.
- Biogenic synthesis of nanomaterials

SUGGESTED EVALUATION METHODS

- Continuous assessment tests
- Assignments
- Model lab examination
- End semester examination

Text Book(s):

1. P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015
2. O.G.Palanna, "Engineering Chemistry", McGraw Hill Education (India) Pvt, Ltd, New Delhi, 2017
3. Shikha Agarwal "Engineering Chemistry-Fundamentals and applications", Cambridge University Press, New Delhi, 2015

Reference Books(s)

- A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
- B.K. Sharma, "Industrial chemistry", Krishna Prakashan Media (P) Ltd, Meerut, 2016.
- Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021.
- PradeepT, "A Text Book of Nanoscience and Nanotechnology", Tata McGraw Hill, New Delhi, 2012
- An Introduction to nanomaterials and nanoscience (PB 2020) : Asim K DAS, Mahua Das, CBS publishers and distributors Pvt. Ltd.
- Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co

Lab equipment required:

S. No	Name of the Equipment	Quantity
-------	-----------------------	----------

		Required
1.	pH meter	10
2.	Ion selective electrodes for various ions in solution	10
3	Spectrophotometer	4
4	Magnetic stirrer with hot plate	10
5	Shaker	5

SUGGESTED EVALUATION METHODS

- Experiment based viva
- Quizzes

Weblinks:

1. NPTEL course Elementary Electrochemistry course url
https://onlinecourses.nptel.ac.in/noc23_cy19/preview
2. For downloading text/reference books the weblink is given below can be used
<http://libgen.rs/>
3. <https://nptel.ac.in/courses/104/103/104103019>
4. <https://ndl.iitkgp.ac.in/>

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CY23132.1	2	1	1	-	-	-	1	1	-	-	-	-	-	2	-
CY23132.2	2	2	1	-	-	-	-	-	-	-	-	1	-	1	2
CY23132.3	3	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CY23132.4	2	2	1	-	-	-	1	1	-	-	-	-	2	1	-
CY23132.5	2	1	1	-	-	-	-	-	-	-	-	-	-	1	1
Average	2.2	1.6	1.2	-	-	-	1	1	-	-	-	1	1.5	1.2	1.3

Subject Code	Subject Name	Category	L	T	P	C
GE23111	ENGINEERING GRAPHICS	ES	2	0	4	4

Objectives:

- To understand the importance of the drawing in engineering applications
- To develop graphic skills for communication of concepts, ideas and design of engineering products
- To expose them to existing national standards related to technical drawings.
- To improve their visualization skills so that they can apply this skill in developing new products.
- To improve their technical communication skill in the form of communicative drawings

CONCEPTS AND CONVENTIONS (Not for Examination)

1

Importance of graphics in engineering applications–Use of drafting instruments– BIS conventions and specifications–Size, layout and folding of drawing sheets– Lettering and dimensioning. Basic Geometrical constructions.

UNIT-I

PLANE CURVES AND PROJECTION OF POINTS

5+12

Curves used in engineering practices: Conics–Construction of ellipse, parabola and hyperbola by eccentricity method – Cycloidal Curves–Construction of cycloid, epicycloid and hypocycloid – Construction of involutes of square and circle–Drawing of tangents and normal to the above curves.Principles of Projection and

Projection of points.			
UNIT-II	PROJECTION OF LINES AND PLANE SURFACES	6+12	
Projection of straight lines (First angle projection) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.			
UNIT-III	PROJECTION OF SOLIDS AND PROJECTION OF SECTIONED SOLIDS	6+12	
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method. Sectioning of solids in simple vertical position when the cutting plane is inclined to HP and perpendicular to VP – obtaining true shape of the section. Practicing three-dimensional modeling of simple objects by CAD software (Not for examination)			
UNIT-IV	DEVELOPMENT OF SURFACE AND ISOMETRIC PROJECTIONS	6+12	
Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones. Principles of isometric projection–isometric scale–Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders and cones. Model making of isometric projection of combination of solids as assignment (Not for End semester)			
UNIT-V	FREE HAND SKETCHING AND PERSPECTIVE PROJECTIONS	6+12	
Free Hand sketching: Freehand sketching of multiple views from pictorial views of objects - Freehand sketching of pictorial views of object from multiple views. Perspective projection of simple solids-Prisms, pyramids, cylinder and cone by visual ray method.			
Total Contact Hours:		(L=30; P=60) 90 Periods	: 90

Course Outcomes: The students will be able to	
•	To construct different plane curves and to comprehend the theory of projection
•	To draw the basic views related to projection of lines and planes
•	To draw the projection of simple solids and to draw the projection of development of surfaces of Sectioned solids in simple vertical position
•	To draw the orthographic projection from pictorial objects and Isometric projections of simple solids
•	To visualize Perspective view of simple solids

Text Book(s):	
1	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
2	Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2017.

Reference Book(s):	
1	Varghese P I., “Engineering Graphics”, McGraw Hill Education (I) Pvt.Ltd., 2013.
2	V.B Sikka “Civil Engineering Drawing”, S.K Kataria & Sons, New Delhi.
3	Venugopal K. and PrabhuRaja V., “Engineering Graphics”, New Age International(P)Limited, 2008.
4	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2017.
5	Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill Publishing Company Limited, New Delhi, 2018

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE23111.1	3	2	2	1	-	1	-	2	2	2	-	2			
GE23111.2	3	2	2	1	-	1	-	2	2	2	-	2			
GE23111.3	3	2	2	1	-	1	-	2	2	2	-	2			
GE23111.4	3	2	2	1	-	1	-	2	2	2	-	2			
GE23111.5	3	2	2	1	-	1	-	2	2	2	-	2			

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE23121	ENGINEERING PRACTICES – Civil& Mechanical	ES	0	0	2	1

Objectives:							
●	To provide exposure to the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering						
List of Experiments							
CIVIL ENGINEERING PRACTICE							
1.	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.						
2.	Preparation of basic plumbing line sketches for wash basins, water heaters, etc.						
3.	Hands-on-exercise: Basic pipe connections – Pipe connections with different joining components.						
Carpentry Works:							
4.	Study of joints in roofs, doors, windows and furniture.						
5.	Hands-on-exercise: Woodwork, joints by sawing, planning and chiselling.						
MECHANICAL ENGINEERING PRACTICE							
6.	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.						
7	Gas welding practice.						
Basic Machining:							
8	Simple Turning and Taper turning						
9	Drilling Practice						
Sheet Metal Work:							
10	Forming & Bending:						
11	Model making – Trays and funnels						
12	Different type of joints.						
Machine Assembly Practice:							
13	Study of centrifugal pump						
14	Study of air conditioner						
					Total Contact Hours	:	30

Course Outcomes:	
●	Able to perform plumbing activities for residential and industrial buildings considering safety aspects while gaining clear understanding on pipeline location and functions of joints like valves, taps, couplings, unions, reducers, elbows, etc.
●	Able to perform wood working carpentry activities like sawing, planning, cutting, etc. while having clear understanding of the joints in roofs, doors, windows and furniture.
●	Able to produce joints like L joint, T joint, Lap joint, Butt joint, etc. through arc welding process while acquiring in depth knowledge in the principle of operation of welding and other accessories
●	Able to perform operations like Turning, Step turning, Taper turning, etc. in lathe and Drilling operation in drilling machine
●	Able to perform sheet metal operations like Forming, Bending, etc. and fabricating models like Trays, funnels, etc.

TOTAL: 30 PERIODS

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE23121.1	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.2	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.3	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.4	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1
GE23121.5	1	1	1	-	-	2	1	-	2	-	-	2	-	2	1

Subject Code	MICROBIOLOGY	Category	L	T	P	C
BT23131		PC	2	0	4	4

Objectives:	
●	To inculcate knowledge on fundamentals of microorganisms and microscopy
●	To learn the structural organization, morphology and reproduction of microbes
●	To acquire knowledge on basic principles of microbial culture, growth and its metabolism
●	To understand the principles of sterilization technique and chemotherapeutic agents
●	To gain knowledge on various applications of microbes in biotechnology

UNIT-I	INTRODUCTION TO MICROBIOLOGY	6
History of Microbiology- Spontaneous generation conflict - Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner and Winogradsky. Microbial Taxonomy- Classification and Nomenclature of microorganisms- Whittaker's Five Kingdom concept. Microscopy: Bright field, Dark field, Phase contrast, Fluorescent Microscopy and Electron microscope.		
UNIT-II	STRUCTURE OF BACTERIA AND VIRUS	6
Structural organization and multiplication of Bacteria. Stains and Staining techniques: Simple staining, Differential staining (Gram's & Acid fast), Special staining (Capsule & Endospore). Virus- Structure, Classification & Multiplication (Lytic and Lysogenic cycle).		
UNIT-III	STRUCTURE AND REPRODUCTION OF FUNGI AND ALGAE	6
Fungi - General structure and its reproduction (Aspergillus & Penicillium). Algae - General structure and its economic importance. Actinomycetes - Features & its biotechnological importance.		
UNIT-IV	MICROBIAL NUTRITION, GROWTH AND METABOLISM	6
Nutritional requirement and classification of microorganisms based on physiological factors, Culture media (defined, complex, selective, differential, and enriched). Growth: Definition, Growth curve. Quantification of microbial growth: (Direct and Indirect methods).		
UNIT-V	CONTROL OF MICROORGANISMS	6
Sterilization (Physical and Chemical) – Definition, Types, Mode of action, Sterility control and its applications. Antimicrobial chemotherapy – Antibiotics (Antibacterial, antifungal and antiviral agents) and its mode of action – Antibiotic Resistance - Antibiotic Sensitivity tests		
Total Contact Hours		: 30

Course Outcomes: The students will be able to	
●	Gain the knowledge on the principles of microscopes
●	Understand and differentiate the microorganisms based on its morphology
●	Apply the knowledge in identification of fungi, algae & actinomycetes
●	Formulate and design the culture media for the growth of microorganisms
●	Analyze and apply the appropriate sterilization technique to control the microorganisms

	http://www.who.int/en/ World Health Organization http://www.microbes.info/news/ Microbiology News http://www.nlm.nih.gov/ Library of medicine http://www.fda.gov/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/default.htm
2	http://www.microbiologybytes.com/video/Gram.html
3	http://www.mansfield.ohio-state.edu/~sabedon/biol2025.htm
4	http://nt.ars-grin.gov/sbmlweb/fungi/index.cfm

Subject Code	Subject Name												Category	L	T	P	C
MC23112	ENVIRONMENTAL SCIENCE AND ENGINEERING												MC	3	0	0	0
	Non Credit Course - Common to B.E. /B.Tech all branches except CSBS																
	PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
	CO																
	BT23131.1	2	1	2	3	3	2	2	2	3	3	2	2	3	2	2	
	BT23131.2	2	2	2	3	3	2	3	2	3	3	2	3	3	3	2	
	BT23131.3	1	2	2	3	3	2	3	2	3	3	2	3	2	3	2	
	BT23131.4	2	2	1	3	2	2	3	2	3	3	2	3	3	2	2	
	BT23131.5	2	2	3	3	3	3	3	3	3	3	3	3	2	3	2	
	Average	1.8	1.8	2.0	3.0	2.8	2.2	2.8	2.2	3.0	3.0	2.2	2.8	2.6	2.8	2.0	

Objectives:
<ul style="list-style-type: none"> To develop the understanding of environmental and associated issues To develop an attitude of concern for the environment To promote enthusiasm in participating environmental protection initiatives To nurture skills to solve environmental degradation issues To develop the knowledge about the environmental laws

UNIT-I	AIR AND NOISE POLLUTION	9
Definition –sources of air pollution –chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, ozone depletion, particulate pollutants-Air quality standards-Air quality indices - control of particulate air pollutants-gravitational settling chambers,cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP)-catalytic converters. Noise pollution –sources - health effects - standards- measurement and control methods.		
UNIT-II	WATER POLLUTION AND ITS MANAGEMENT	9
Definition-causes-effects of water pollution-point and nonpoint sources of wastewater-marine pollution - thermal pollution - Control of water pollution by physical, chemical and biological methods – wastewater treatment-primary, secondary and tertiary treatment-sources and characteristics of industrial effluents- zero liquid discharge.		
UNIT-III	SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT	9
Solid waste – types- municipal solid waste management: sources, characteristics, collection, and transportation-sanitary landfill, recycling, composting, incineration, energy recovery options from waste - Hazardous waste – types, characteristics, and health impact - hazardous waste management: neutralization, oxidation reduction, precipitation, solidification, stabilization,incineration and final disposal. E-waste-definition-sources-effects on human health and environment- E-waste management- steps involved - Role of E-waste management within the initiatives of the Govt. of India- Swachh Bharat Mission.		
UNIT-IV	SUSTAINABLE DEVELOPMENT	9
Sustainable development- concept-dimensions-sustainable development goals - value education- gender equality – food security - poverty – hunger - famine - Twelve principles of green chemistry - Green technology - definition, importance - Cleaner development mechanism - carbon credits, carbon trading, carbon sequestration, eco labeling-International conventions and protocols-Disaster management.		

UNIT-V	ENVIRONMENTAL MANAGEMENT AND LEGISLATION	9
Environmental Management systems - ISO 14000 series- Environmental audit-Environmental Impact Assessment- life cycle assessment- human health risk assessment - Environmental Laws and Policy-Objectives - Polluter pays principle, Precautionary principle - The Environment (Protection) Act 1986 - Role of Information technology in environment and human health.		
Total Contact Hours:45		

Course Outcomes:
On completion of the course, the students will be able to
<ul style="list-style-type: none"> Associate air and noise quality standards with environment and human health. Illustrate the significance of water and devise control measures for water pollution. Analyze solid wastes and hazardous wastes. Outline the goals of sustainable development in an integrated perspective. Comprehend the significance of environmental laws.

SUGGESTED EVALUATION METHODS
<ul style="list-style-type: none"> Continuous assessment tests Assignments Case studies, class room presentations (or) site visit

Text Book(s):
<ul style="list-style-type: none"> Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016 Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publisher, 2018. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi

Reference Books(s) / Web links:
<ul style="list-style-type: none"> R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. Edition 2010. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001. Fowler B, Electronic Waste – 1 st Edition (Toxicology and Public Health Issues), 2017 Elsevier NPTEL course url https://onlinecourses.nptel.ac.in/noc19_ge22/ NPTEL https://news.mit.edu/2013/ewaste-mit

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO															
MC23112.1	1	2	3	1	-	2	2	2	1	1	1	2	1	-	-
MC23112.2	1	2	3	1	-	2	2	2	1	1	1	2	1	-	-
MC23112.3	-	-	3	1	-	2	3	2	1	-	1	2	1	-	-
MC23112.4	-	1	2	1	1	3	3	2	1	1	1	2	-	-	-
MC23112.5	-	1	2	-	-	2	2	2	1	2	2	2	-	-	-
Average	0.4	1.2	2.6	0.8	0.2	2.2	2.4	2	1	1	1.2	2	0.6	-	-

<ul style="list-style-type: none"> For downloading text/reference books the weblink is given below can be used http://libgen.rs/

GE23117

தமிழர் மரபு

L T P C

1 0 0 1

அலகு I மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் புகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழிக் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

TOTAL : 15 PERIODS

EXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருளை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr. S. Singaravelu)(Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi – ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
HS 23221	TECHNICAL COMMUNICATION II	Theory	0	0	2	1
Common to all branches of B.E/B. Tech programmes –Second Semester						

Course Objectives:
• To facilitate students to improve their vocabulary for a better communication
• To enable learners to understand and reproduce language
• To aid students to write technical reports in a convincing manner
• To expose students to different sentence structures
• To equip learners to present their ideas in an efficient manner

UNIT-I	VOCABULARY FOR BETTER COMMUNICATION	6
Listening: Telephonic Conversations and TV News Reading: Newspapers and Magazines Speaking: Conversational Practice: Speaking in a given situation, asking permission and requesting etc., Writing: Job Application Letter and Resume Grammar: Reference words: pronouns and determiners Vocabulary: Guessing meanings of words in different contexts.		
UNIT-II	FUNCTIONAL LANGUAGE ASPECTS	6
Listening: Motivational listening – listening to real life challenges Reading: Articles and Technical reports Speaking: Using Polite Expressions, Indirect Questions Writing: Paraphrasing a Text, Poem Grammar: Purpose Statements, Cause and Effect Expressions Vocabulary: Neologisms.		
UNIT-III	TECHNICAL REPORTWRITING	6
Listening: Empathetic Listening – Giving Solutions to Problems Reading: Inferential Reading Speaking: Dialogues – Interviewing Celebrities / Leaders / Sportspersons, etc., Writing: Report Writing Grammar: Functional Usage of Expressions – used to, gone / been, etc., Vocabulary: Words Often Confused		
UNIT-IV	STRUCTURAL GRAMMAR	6
Listening: Comprehension (IELTS practice tests) Reading: Intensive Reading for specific information Speaking: Pick and Talk Writing: Proposals Grammar: Sentence Structures – Simple, Compound, Complex Sentences Vocabulary: Replacing dull words with vivid ones		
UNIT-V	PRESENTATION SKILLS	6
Listening: Discriminative listening – sarcasm, irony, pun, etc.,		

<p>Reading: Practice of chunking – breaking up reading materials</p> <p>Speaking: Mini presentation on some topic</p> <p>Writing: Minutes of the meeting</p> <p>Grammar: Correction of Errors</p> <p>Vocabulary: Advanced vocabulary – fixing appropriate words in the given context.</p>
Total Contact Hours: 30

Course Outcomes:
On completion of the course students will be able to
<ul style="list-style-type: none"> • Communicate effectively using appropriate vocabulary • Use the acquired language skills to comprehend various types of language contents • Evaluate different texts and write effective technical content • Use appropriate sentence structures to convey their thoughts in varied contexts • Present their concepts and ideas in an effective manner

SUGGESTED ACTIVITIES
<ul style="list-style-type: none"> • Story Lines • One truth and two lies • Hang Man • Pictionary • Word Scramble • Case study

SUGGESTED EVALUATION METHODS
<ul style="list-style-type: none"> • Assignment topics • Quizzes • Class Presentation/Discussion • Continuous Assessment Tests

Text Book(s):
5. Raymond Murphy, “Intermediate English Grammar,” Second Edition, Cambridge University Press, 2018
6. Meenakshi Raman & Sangeeta Sharma, “Technical Communication” Third Edition, Oxford University Press, 2015
7. Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine ChuenMeng Goh, Cambridge University Press
Reference Books(s) / Web links:
1. Michael McCarthy (Author), Felicity O'Dell (Author), John D. Bunting (Contributor), “Basic Vocabulary in Use: 60 Units of Vocabulary Practice in North American English with Answers” 2nd Edition
2. Dale Carnegie, “The Art of Public Speaking,” Insight Press
3. Jack C. Richards & Theodore S. Rodgers, “Approaches and Methods in Language Teaching, Second Edition, Cambridge University Press

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS23221.1	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-
HS23221.2	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221.3	-	2	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221.4	-	-	-	1	-	-	-	-	2	3	-	-	-	-	-
HS23221.5	-	-	-	1	-	-	-	-	2	2	-	-	-	-	-
Average	-	2	-	1	0	0	0	0	2	2.6	-	-	-	-	-

Subject Code	Subject Name	Category	L	T	P	C
HS 23222	ENGLISH FOR PROFESSIONAL COMPETENCE Common to all branches of B.E/B. Tech programmes – Second Semester	HS	0	0	2	1

Objectives:	
•	To facilitate the learners in acquiring listening and reading competence
•	To enable the learners to communicate effectively through written and oral medium
•	To assist the learners in preparing for competitive examinations
•	To train the students in acquiring corporate skills
•	To inculcate professional standards among the students and make them realize their responsibility in addressing the challenges

UNIT-I	RECEPTIVE SKILLS	6
Listening – Comprehensive Listening – Watching the news – Listening to a peer giving presentation, etc. – Critical Listening – Watching a televised debate, listening to poems – Reading – Extensive Reading – Short stories and One-act Plays – Intensive Reading – Articles or Editorials in Magazines, Blog posts on topics like science and technology, arts, etc.		
UNIT-II	PRODUCTIVE SKILLS	6
Speaking – Demonstrative Speaking – Process description through visual aids – Persuasive Speaking – Convincing the listener with the speaker’s view – Writing – Descriptive Writing - Describing a place, person, process – Subjective Writing – Autobiography, Writing based on personal opinions and interpretations		
UNIT-III	ENGLISH FOR COMPETITIVE EXAMS	6
An introduction to International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Graduate Record Examination (GRE) – Civil Service, Indian Economic Service Examination, Indian Statistical Service Examination, Combined Defence Services Examination, Staff Selection- (Language Related) – Aptitude tests.		
UNIT-IV	CORPORATE SKILLS	6
Critical Thinking and Problem Solving – Case Study, Brainstorming, Q & A Discussion – Team work and Collaboration – Activities like Office Debates, Perfect Square, Blind Retriever, etc. – Professionalism and Strong Work Ethics – Integrity, Resilience, Accountability, Adaptability, Growth Mind set		
UNIT-V	PROJECT WORK	6
Case Study based on the challenges faced by the employers and the employees – Devise Plan, Provide Solution		
Total Contact Hours		30

Course Outcomes:

On completion of the course, students will be able to

- Interpret and respond appropriately in the listening and reading contexts.
- Express themselves effectively in spoken and written communication
- Apply their acquired language skills in writing the competitive examinations
- Exhibit their professional skills in their work place
- Identify the challenges in the work place and suggest strategies solutions

SUGGESTED ACTIVITIES

- Online Quizzes on Vocabulary
- Online Quizzes on grammar
- Communication Gap Exercises
- Presentations
- Word Building Games
- Case study

SUGGESTED EVALUATION METHODS

- Assignment topics
- Quizzes
- Class Presentation/Discussion
- Continuous Assessment Tests

Reference Books

1	How to Read Better & Faster, Norman Lewis, Goyal Publishers
2	Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine Chuen Meng Goh, Cambridge University Press
3	The Official Cambridge Guide To IELTS by Pauline Cullen, Cambridge University Press
4	The 7 Habits of Highly Effective People by Stephen Covey, Simon and Schuster, UK

Reference Books(s) / Web links:

1. Board of Editors. Sure Outcomes. A Communication Skills Course for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad, 2013.
2. Hartley, Mary. "The Power of Listening," JaicoPublishing House; First Edition (2015).
3. Chambers, Harry. "Effective Communication Skills for Scientific and Technical Professionals," Persues Publishing, Cambridge, Massachusetts, 2000.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
HS23222.1	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222.2	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222.3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
HS23222.4	-	-	-	-	-	-	2	2	-	3	-	-	-	-	-
HS23222.5	-	-	1	-	-	-	2	-	-	3	-	-	-	-	-
Average	0	1	1	0	0	0	2	2	0	3	0	0	-	-	-

Subject Code	Course Title	Category	L	T	P	C
MA23212	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES	BS	3	1	0	4
Common to II Sem. B.E. –AERO, AUTO, BME, CIVIL, EEE, ECE, MECH, MCT, R&A and B. Tech. - BT, FT & CHEM						

Objectives:

- To provide students with an introduction to the theory of ordinary differential equations through applications, methods of solution, and numerical approximations.
- To introduce students to how to solve linear Partial Differential with different methods.
- To enable the students to study the Laplace Transforms, properties of Laplace Transform, inverse Laplace Transform and some applications to solve the differential equations and integral equations.
- To explain the concept of a vector integration in a plane and in space.
- To describe basic properties of complex variables and to have the ability to compute complex integrals.

UNIT-I	ORDINARY DIFFERENTIAL EQUATIONS	12
Second and higher order Linear differential equations with constant coefficients - Method of variation of parameters – Legendre’s linear equations – Numerical solution of ODE - Single Step methods: Taylor’s series method, Euler’s method.		
UNIT-II	PARTIAL DIFFERENTIAL EQUATIONS	12
Formation of partial differential equations - Classification of PDE – Solutions of standard types of first order partial differential equations - Lagrange’s linear equation –Linear homogeneous partial differential equations of second and higher order with constant coefficients.		
UNIT-III	LAPLACE TRANSFORM	12
Laplace transform –Basic properties – Transforms of derivatives and integrals of functions - Transforms of unit step function and impulse functions, periodic functions. Inverse Laplace transform – Problems using Convolution theorem – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques		
UNIT-IV	VECTOR CALCULUS	12
Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.		
UNIT-V	COMPLEX VARIABLES	12
Analytic functions — Construction of analytic function - Bilinear transformation –Singularities – Cauchy’s integral		

theorem (without proof) - Residues – Residue theorem (without proof) - Simple problems - Contour integral over $|z|=1$.

Total Contact Hours: 60

Course Outcomes: On completion of the course students will be able to

- Apply the methods as a potent tool in the solution of a variety of problems in the natural sciences and technology.
- Develop specific methodologies, techniques and resources in Partial differential equations to conduct research and produce innovative results in the area of specialisation.
- Use Laplace transform and inverse transform techniques to solve the complex problems in engineering and technology.
- Apply the concepts in multivariable analysis, including space curves; directional derivative; gradient; multiple integrals; line and surface integrals; vector fields; divergence, curl; the theorems of Green and Stokes, and the divergence theorem in different fields of engineering.
- Demonstrate the concept of Analytic functions, conformal mapping and complex integration in solving Engineering problems.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Activity Based Learning

SUGGESTED EVALUATION METHODS

- Problem solving in Tutorial sessions
- Assignment problems
- Quizzes and class test
- Discussion in classroom

Text Book(s):

- | | |
|-----|---|
| 6. | Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014. |
| 7. | Veerarajan. T, Engineering Mathematics –II, Mc Graw Hill Education, 2018. |
| 8. | Erwin Kreyszig, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016. |
| 9. | Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011. |
| 10. | Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5 th Edition, New Delhi, 2017. |

Reference Books(s) / Web links:

- | | |
|----|---|
| 1. | Ramana. B.V., "Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016. |
| 2. | T Veerarajan, Transforms and Partial Differential Equations, Third Edition, 2018. |

3.	Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 4 th Edition 2006.
4.	Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23212.1	3	2	1	-	-	-	-	-	-	-	-	1	1	1	1
MA23212.2	3	2	1	-	-	-	-	-	-	-	-	1	1	1	1
MA23212.3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
MA23212.4	2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
MA23212.5	3	2	1	-	-	-	-	-	-	-	-	1	1	-	1
Average	2.8	2	1	-	-	-	-	-	-	-	-	1	1	1	1

Subject Code	PHYSICS FOR BIOSCIENCE	Category	L	T	P	C
PH23231	Common to - B.E. – Biomedical Engineering and B.Tech – Bio Technology & Food Technology	BS	3	0	2	4

Course Objectives:

•	To enhance the fundamental knowledge of oscillations, Ultrasonic wave properties and its applications.
•	To strengthen the basic information of semiconducting materials, characteristic and its applications.
•	To study the behaviour of superconducting materials and optical fibres for medical applications.
•	To understand the properties of nuclear radiation and elementary particles.
•	To study the advanced analytical techniques.

UNIT-I	WAVES AND ULTRASONICS	9
Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation – Fundamentals of sound– generation of ultrasound – magnetostriction and piezo-electric method – properties - acoustical grating- velocity of Ultrasonics- Non-destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays.		
UNIT-II	PHYSICS OF SEMICONDUCTORS	9
Fundamentals of semiconductors– Intrinsic semiconductor– carrier concentration in an intrinsic semiconductor – variation of Fermi level with temperature – band gap determination-Extrinsic semiconductor- carrier concentration of N-type and P-type –variation of Fermi level with temperature and impurity concentration –Hall effect – Determination of Hall coefficient – Formation of PN junction -LED and Solar cells.		
UNIT-III	MATERIALS FOR MEDICAL APPLICATIONS	9
Introduction to Superconductivity - Properties of Superconductors - BCS theory (qualitative) – Type-I and Type II Superconductors - Applications-Cryotron-Josephson devices- SQUID-MRI scan and Magnetic Levitation. Magnetism in materials - magnetic field and magnetic induction –permeability - susceptibility–types of magnetic materials – Dia, Para, Ferro, anti-ferro and ferrites-hysteresis. Fiber optics –Total internal reflection, Numerical aperture and acceptance angle - types of fibers -Temperature and displacement sensors- endoscopy.		

UNIT-IV	NUCLEAR AND PARTICLE PHYSICS	9
Radioactivity - characteristics of radioactive material – isotopes - probing by isotopes, reactions involved in the preparation of radioisotopes, the Szilard-Chalmer’s reaction – radiochemical principles in the use of tracers - nuclear medicines – Interaction of charged particles with matter –Specific ionization, Linear energy transfer, range, Bremsstrahlung, Annihilation. Gamma-Ray Spectrometry- Liquid Scintillation Counters-Characteristics of Counting Systems-Gamma Well Counters.		
UNIT-V	ADVANCED ANALYTICAL TECHNIQUES	9
Theory, Instrumentation and Applications of: Thermogravimetric Analysis - Differential Thermal Analysis - Differential Scanning Calorimetry. Surface analysis – Electron microscope-magnification-resolving power- Scanning electron microscope, atomic force microscope - Transmission electron microscope, –Principle, instrumentation and applications		
		Contact Hours : 45

List of Experiments		
1	Determination of Velocity of ultrasound and compressibility of given liquid – Ultrasonic interferometer.	
2	Determination of wavelength of diode laser and angular divergence.	
3	Determination of Band gap of given semiconducting material.	
4	Determination of Hall coefficient of the given semiconducting material.	
5	Determination of solar cell characteristics.	
6	Determine the energy loss of material by using B-H curve set up.	
7	Determination of free space permeability using Helmholtz coil.	
8	Determination of Numerical aperture and angle of acceptance of the optical fiber cable.	
9	Spectrometer – Wavelength of Hg spectrum by diffraction grating.	
10	Spectrometer – Determine refractive index of a prism.	
		Contact Hours : 30
		Total Contact Hours : 75

Course Outcomes:
On completion of the course, the students will be able to
<ul style="list-style-type: none"> • Apply the knowledge of oscillating particles and generation of waves in real time applications. • Comprehend the principles of semiconductors and their device fabrication. • Make use the properties of superconductors and optical fibre in engineering and technology. • Apply the characteristics of nuclear and elementary particles to develop innovative instruments. • Utilize the concepts of advanced analytical techniques.

Suggested Activities
<ul style="list-style-type: none"> • Problem solving sessions
Suggested Evaluation Methods
<ul style="list-style-type: none"> • Quizzes • Class Presentation / Discussion

Text Book(s):
1 Kasap, S.O. “Principles of Electronic Materials and Devices”, McGraw-Hill Education, 2017.

2	Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2014.
3	Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.
4	B.H Brown, R.H.Smallwood, D.C Barber . P.V Lawford Medical physics and Biomedical Engineering, CRC Press 1998.

Reference Books(s) / Web links:

1	S. O. Pillai, Solid state Physics (Multi colour Edition), New Age International Publisher, 2018.
2	Arthur Besier and S. Rai Choudhury, Concepts of Modern Physics (SIE), 7 th Edition, 2017.
3	B.L.Theraja, Modern Physics, 16th edition, S.Chand, 2018.
4	J.B.Rajam, Atomic Physics, 7th edition, S.Chand, 2010.
5	Charles Kittel, Introduction to Solid State Physics, 8th Edition, Willey India Pvt.Ltd, 2012.
6	Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.

List of Equipment Available
(Common to B.E. BME and B.Tech. - Bio –Tech. and Food Tech.)

S. No	Name of the equipment	Quantity Required	Quantity Available	Deficiency
1	Young's modulus by Uniform bending method Travelling Microscope	6	13	-
2	Young's modulus by non-Uniform bending method Travelling Microscope	6	13	-
3	Rigidity Modulus - Torsional Pendulum Setup	6	19	-
4	Band gap of a semiconductor Setup	6	19	-
5	Determination of Plank's constant - Rheostat, Multimeter, LED	6	10	-
6	B-H curve Setup and CRO	6	7	-
7	Determination of permeability of free space - Helmholtz coil setup	5	5	-
8	Refractive index of Prism – Spectrometer	6	12	-
9	LCR circuit kit	6	7	-
10	Wavelength of Laser and Characteristics -Laser source and grating	6	12	-

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PH23231.1	3	2	1	-	-	-	-	-	-	-	-	-	1	1	-
PH23231.2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
PH23231.3	3	1	2	-	-	-	-	-	-	-	-	-	1	1	-
PH23231.4	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-
PH23231.5	3	2	2	-	1	-	-	-	-	-	-	-	1	-	-
Average	3	1.6	1.4	-	0.2	-	-	-	-	-	-	-	0.6	0.4	-

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE23231	PROGRAMMING USING PYTHON Common to all branches of B. E. / B.Tech program (Except–CSE, CSBS, CSD, IT, AI/ML, CYBER SECURITY, AI/DS)	ES	1	0	4	3

Course Objectives:	
•	To understand computers, programming languages and their generations and essential skills for a logical thinking for problem solving.
•	To write, test, and debug simple Python programs with conditionals, and loops and functions
•	To develop Python programs with defining functions and calling them
•	To understand and write python programs with compound data-lists, tuples, dictionaries
•	To search, sort, read and write data from /to files in Python.

List of experiments			
1.	Study of algorithms, flowcharts and pseudocodes.		
2.	Introduction to Python Programming and Python IDLE/Anaconda distribution.		
3.	Experiments based on Variables, Data types and Operators in Python.		
4.	Coding Standards and Formatting Output.		
5.	Algorithmic Approach: Selection control structures.		
6.	Algorithmic Approach: Iteration control structures.		
7.	Experiments based on Strings and its operations.		
8.	Experiments based on Lists and its operations.		
9.	Experiments based on Tuples and its operations.		
10.	Experiments based on Sets and its operations.		
11.	Experiments based on Dictionary and its operations.		
12.	Functions: Built-in functions.		
13.	Functions: User-defined functions.		
14.	Functions: Recursive functions.		
15.	Searching techniques: Linear and Binary.		
16.	Sorting techniques: Bubble and Merge Sort.		
17.	Experiments based on files and its operations.		
Contact Hours		:	75

Course Outcomes:	
On completion of the course, students will be able to:	
•	Understand the working principle of a computer and identify the purpose of a computer programming language and ability to identify an appropriate approach to solve the problem.
•	Write, test, and debug simple Python programs with conditionals and loops.
•	Develop Python programs step - wise by defining functions and calling them.
•	Use Python lists, tuples, dictionaries for representing compound data.
•	Apply searching, sorting on data and efficiently handle data using flat files.

Text Books:	
1.	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python3, Shroff/ O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2.	Guido Van Rossum and Fred L. Drake Jr, An Introduction to Python-Revised and updated for Python3.2, Network Theory Ltd., 2011.

Reference Books:	
1.	John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd, 2016.
3.	Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
4.	Kenneth A. Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2012.
5.	Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6.	Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python3, Second edition, Pragmatic Programmers, LLC, 2013.

Platform needed: Python3 interpreter for Windows/Linux

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE23231.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
GE23231.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
GE23231.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
GE23231.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
GE23231.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2
Average	1.8	1.6	2.2	1.6	1.8	0.0	0.0	0.0	0.2	0.2	1.4	1	2.4	2.4	2

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
GE 23212	BASIC CIVIL AND MECHANICAL ENGINEERING	ES	3	0	0	3

Objectives:	
•	To impart basic knowledge on Civil Engineering and to familiarize the measurements used in Civil Engineering.
•	To provide the exposure on the fundamental elements of civil engineering structures and different types of foundation.
•	To familiarize the materials used in Civil Engineering and to impart basic knowledge on Mechanical Engineering
•	To understand the working principle of power plant units, IC engines.
•	To understand the working principle of Refrigeration & AC system.

UNIT-I	SCOPE OF CIVIL ENGINEERING AND SURVEYING	9
<p>Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society –Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering.</p> <p>Surveying: Objective – classification – principles – measurements of distances: Chain surveying– measurements of angles: Compass surveying – leveling: Reduction of levels–Height of instrument method & Rise and fall method – contouring – determination of areas– examples and basic problems.</p> <p>Content beyond syllabus (Not for Examination): Discussion related to civil engineering constructions of Ancient Monuments</p>		
UNIT-II	BUILDING COMPONENTS AND STRUCTURES	9
<p>Foundations: Essential Requirements and function of good foundation – Types of Foundations – Shallow foundations and Deep foundations.</p> <p>Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring –plastering – Types of Bridges and Dams – Rain water harvesting - introduction to high way and rail way</p> <p>Content beyond syllabus (Not for Examination): Making of model for Building Components</p>		
UNIT-III	CONSTRUCTION MATERIALS AND SCOPE OF MECHANICAL ENGINEERING	9
<p>Construction Materials: Properties, characterization and types of Bricks – stones– sand – cement – concrete – steel– modern materials. Overview of Mechanical Engineering- Interdisciplinary concepts in Civil and Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Manufacturing, Automotives, Energy Engineering- Mechanical Properties. Content beyond syllabus (Not for Examination): Case studies</p>		
UNIT-IV	ENERGY AND AUTOMOTIVES ENGINEERING	9
<p>Energy engineering: Introduction-Classification: Conventional and Non-conventional -Layout and working principle of Thermal, Hydro, Nuclear, Solar and Wind Power Plants–working principle of Boilers: Cochran boiler, Babcock and Wilcox boiler, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps. Automotives: IC Engine – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Emission Standards and regulations – Introduction to Alternate fuels for IC Engines and Electric Vehicle.</p>		
UNIT-V	REFRIGERATION AND AIR-CONDITIONING SYSTEMS	9
<p>Terminology of Refrigeration and Air Conditioning– Characteristics and requirements of good refrigerant – Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.</p> <p>Content beyond syllabus (Not for Examination): Discussion related to types of refrigerants</p>		
		Total Contact Hours : 45

Course Outcomes: Upon completion of the course students should be able to:	
•	Able to explain the specialized sub disciplines of civil engineering. And they can Measure distances and area by surveying.
•	Able to explain building components, structures and various types of foundations.
•	Able to explain the usage of construction materials and they can explain the specialized sub disciplines of mechanical Engineering.
•	Able to explain the working principles of internal combustion engines and power plant cycle.
•	Able to explain the components of refrigeration and Air conditioning cycle.

Text Books:	
1	Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, 2018
2	Rameshbabu V, “Basic Civil and Mechanical Engineering”, VRB publishers Pvt. Ltd., 2018.

Reference Books(s) / Web links:	
1	Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2	RamamruthamS., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd.2013.
3	Sadhu Singh., "Basic Mechanical Engineering", S.Chand Publication 2009
4	Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai,2000.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE 23202.1	3	1	2	-	1	1	-	-	-	-	1	2	-	-	-
GE 23202.2	3	-	2	-	1	-	-	-	-	-	2	2	-	-	-
GE 23202.3	3	-	2	-	1	1	1	-	-	-	2	2	-	-	-
GE 23202.4	3	-	2	-	1	-	1	-	-	-	1	2	-	-	-
GE 23202.5	3	-	2	-	1	-	-	-	-	-	1	2	-	-	-
Average	3	-	2	-	1	0.4	0.4	-	-	-	0.46	2	-	-	-

Subject Code	BIOCHEMISTRY	Category	L	T	P	C
BT23211		PC	3	0	0	3

Course objectives:	
This course will enable the students to understand	
•	The chemical basis of life which involves the importance of water, biological buffers
•	The structure, properties of carbohydrates and lipids.
•	The structure, properties of proteins and nucleic acids.
•	Intermediary metabolic reactions and their regulation.
•	Energy production from biomolecules

UNIT I	INTRODUCTION TO BIOMOLECULES	9
Basic principles of organic chemistry - role of carbon - types of functional groups - overview of biomolecules and biochemical reactions - chemical nature of water - pH-Henderson & Hasselbalch equation and biological buffers.		
UNIT II	CARBOHYDRATES AND LIPIDS	9
Carbohydrates: (mono, di – oligo & polysaccharides) - mutarotation, glycosidic bond - epimers, anomers and asymmetric nature of carbon - reactions of monosaccharides and reducing sugars. Lipids: Classification- structure and properties- fatty acids – glycerol – saponification – iodination – hydrogenation – phospholipids – glycolipids – sphingolipids – cholesterol – steroids		
UNIT-III	STRUCTURE AND PROPERTIES OF PROTEINS AND NUCLEIC ACIDS	9
Proteins: Structure and properties of amino acids - hierarchy of structural organization of proteins- primary, secondary, tertiary and quaternary structures of proteins. Nucleic acids: Introduction to nucleic acids - purines pyrimidines, nucleoside and nucleotide - primary structure of DNA - chemical and structural qualities of 3',5'- phosphodiester bond - secondary structure of DNA - Watson & Crick model - physicochemical properties of DNA - Chargaff's rule – RNA – types and		

structure - difference between DNA and RNA.			
UNIT-IV	INTERMEDIARY METABOLISM AND ITS REGULATION		9
Introduction to enzymes and metabolism -glycolysis - gluconeogenesis - pentose phosphate shunt - β oxidation of fatty acid- TCA cycle - reactions of amino acids - deamination, transamination and decarboxylation - urea cycle - interconnection of pathways and their regulation.			
UNIT-V	BIOENERGETICS		9
Structure of mitochondria - general concept of oxidation and reduction - electronegative potential - high energy compounds - ATP/ADP cycle - electron transport chain - oxidative phosphorylation - uncouplers- inhibitors - bioenergetics of glucose and palmitic acid oxidation.			
			Total Contact Hours : 45

Course outcomes:	
Upon completion of the course, the students will be able to	
•	Understand the chemical basis of life which involves the importance of water and biological buffers.
•	Comprehend the structure and functions of carbohydrates and lipids.
•	Recognize the structure and functions of proteins and nucleic acids.
•	Gain more knowledge about the different metabolic pathways.
•	Compute the bioenergetics of various oxidative pathways and understand the importance of ATP.

Text books:	
•	Hames D, Hooper N., BIOS Instant notes - Biochemistry. 4 th edition, Garland Science, Taylor and Francis group, New York and London, 2011.
•	Emine Ercikan Abali, Susan D. Cline, David S. Franklin and Susan M. Viselli. Lippincott's Illustrated Reviews, Biochemistry, Eighth Edition, Lippincott Williams & Wilkins 2021.
•	Peter Kennelly, Kathleen Botham, Owen McGuinness, Anthony Weil and Rodwell V.W. Harpers Biochemistry. Appleton and Lange, Stanford, Connecticut, 32 nd Edition, McGraw Hill Education, February 2022.

Reference books:	
•	Nelson D.L. and Cox M.M. Lehninger Principles of Biochemistry, 8 th edition, WH Freeman & Co, 2021.
•	Burtis & Ashwood W.B. Tietz Textbook of Clinical chemistry, Volume 564, Saunders Company, 1999.
•	Jeremy Berg, Gregory Gatto Jr, Justin Hines, John L. Tymoczko, Lubert Stryer. Biochemistry, 10 th Edition McMillan Publishers, 2023.
•	Donald Voet & Judith G. Voet. Biochemistry, 4 th Edition, John Wiley and Sons, Inc., 2010.
•	Rama Rao, A.V.S.S., A Textbook of Biochemistry, 11 th Edition, 2009.
•	A.C Deb. Fundamentals of Biochemistry, 10 th Edition, 2023.

Web links:	
•	https://nptel.ac.in/courses/102105034
•	https://nptel.ac.in/courses/102106087

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BT23211.1	3	3	3	3	1	3	3	1	1	3	1	3	3	3	3
BT23211.2	3	3	3	3	1	3	3	1	2	3	2	3	3	3	3
BT23211.3	3	3	3	3	3	3	3	1	2	3	2	3	3	3	3
BT23211.4	3	3	3	3	2	3	3	3	1	3	1	3	3	3	3
BT23211.5	3	3	3	3	3	1	1	1	3	1	3	3	3	3	3
Average	3	3	3	3	2	2.6	2.6	1.4	1.5	2.6	1.5	3	3	3	3

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC23111	Indian Constitution and Freedom Movement	Theory	3	0	0	0
Non Credit Course - Common to all branches of B.E/B. Tech programmes – First / Second/third Semester						

Objectives:
<ul style="list-style-type: none"> To apprehend the sacrifices made by the freedom fighters. To inculcate the values enshrined in the Indian constitution. To instill a sense of responsibility as the citizens of India. To familiarise about the functions of the various levels of Government. To be informed about Constitutional and Non- Constitutional bodies.

UNIT-I	INDIAN FREEDOM MOVEMENT	9
British Colonialism in India-Colonial administration till 1857- Revolt of 1857- Early Resistance to British Rule-Rise of Nationalism in India- Indian Freedom Struggle under Mahatma Gandhi -Non- Cooperation Movement-Civil Disobedience Movement- Quit India Movement-British Official response to National movement- Independence of India Act 1947-Freedom and Partition.		
UNIT-II	CONSTITUTION OF INDIA	9
Historical Background – Indian Constitution: Constitution’ meaning of the term, Sources and constitutional history, Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.		
UNIT-III	STRUCTURE AND FUNCTIONS OF CENTRAL GOVERNMENT	9
Union Government – Structure of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.		
UNIT-IV	STRUCTURE AND FUNCTION OF STATE GOVERNMENT AND LOCAL BODY	9
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts- Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati Raj: Introduction, Elected officials and their roles, Village level: Role of Elected and Appointed officials.		
UNIT-V	CONSTITUTIONAL FUNCTIONS AND BODIES	9
Indian Federal System – Centre – State Relations – President’s Rule – Constitutional Functionaries – Assessment of working of the Parliamentary System in India- CAG, Election Commission, UPSC, GST Council and other Constitutional bodies-. NITI Aayog, Lokpal, National Development Council and other Non –Constitutional bodies.		
Total Contact Hours: 45		

Course Outcomes: Upon completion of the course, students will be able to:
<ul style="list-style-type: none"> ● Appreciate the sacrifices made by freedom fighters during freedom movement.
<ul style="list-style-type: none"> ● Be responsible citizens and abide by the rules of the Indian constitution.
<ul style="list-style-type: none"> ● Be aware of the functions of the Indian government.
<ul style="list-style-type: none"> ● Be knowledgeable about the functions of the state Government and the Local bodies.
<ul style="list-style-type: none"> ● Apply the knowledge on constitutional functions and role of constitutional bodies and non-constitutional bodies.

SUGGESTED ACTIVITIES
<ul style="list-style-type: none"> ● Famous speeches from around the world relating to independence ● Case study ● Quiz on Portfolio and Cabinet ● Discussions on International Associations like the UN, BRICS, QUAD ● Presentation on issues around the world

SUGGESTED EVALUATION METHODS
<ul style="list-style-type: none"> ● Assignment topics ● Quizzes ● Class Presentation/Discussion ● Continuous assessments (CAT)

Text Book(s):
8. M. Laxmikanth , “Indian Polity:, McGraw-Hill, New Delhi.
9. Durga Das Basu, “Introduction to the Constitution of India “, Lexis Nexis, New Delhi. 21 st ed 2013.
10. P K Agarwal and K N Chaturvedi, PrabhatPrakashan, New Delhi, 1 st ed , 2017.

Reference Books(s) / Web links:
1. Sharma, Brij Kishore, “Introduction to the Constitution of India, Prentice Hall of India, New Delhi.
2. U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar
3. Bipan Chandra, India’s Struggle for Independence, Penguin Books, 2016.
4. Maciver and Page, “Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.2 nd ed, 2014.
5. Bipan Chandra, History of Modern India, Orient Black Swan, 2009.

Department of BIOTECHNOLOGY, REC

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MC23111.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.3	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
MC23111.4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
MC23111.5	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
Average	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-

GE23217

தமிழரும் தொழில்நுட்பமும்

L T P C

1 0 0 1

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: 3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கல்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ் : 3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணிணித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils – The Classical Period (Dr. S. Singaravelu)(Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi – ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

BT23211	BIOCHEMISTRY LABORATORY	Category	L	T	P	C
		PC	0	0	4	2
Course objectives:						
	<ul style="list-style-type: none"> • To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules 					

List of Experiments	
1	Preparation of buffers of biological importance
2	Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
3	Glucose estimation by DNS method
4	Extraction of lipids and analysis by TLC
5	Estimation of rancidity, iodine number and acetyl number of lipids
6	Quantitative estimation of aminoacids using Ninhydrin-distinguishing amino from imino group.
7	Protein estimation by Bradford method.
8	Protein estimation by Folin Lowry method.
9	Estimation of Creatinine in given sample and its significance.
10	Estimation of DNA
Contact Hours	
: 60	

