

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

DEPARTMENT VISION

To provide a world class Mechanical Engineering education through innovation and excellence in Teaching and Research.

DEPARTMENT MISSION

- To impart high quality technical education and prepare Mechanical Engineers with all round knowledge of multi-disciplinary branches of Engineering and Technology.
- To foster skill sets required to be a global professional for industry, research and technology management.
- To provide consultancy to the neighborhood industries.
- To cultivate the spirit of entrepreneurship.

PEO I

To provide students with sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, analyze and solve engineering problems and to prepare them for graduate studies and for successful careers in industry.

PEO II

To impart students with skills for design, improvement and installation of Mechanical and allied integrated systems of men and material.

PEO III

To educate the students on designing the modern mechanical systems and expose them to industrial practices for better employability and adaptability.

PEO IV

To instill the values, skills, leadership and team spirit for comprehensive and wholesome personality, to promote entrepreneurial interest among students and to create a fervor for use of Engineering in addressing societal concerns.

Programme Outcomes (POs)

Engineering Graduates will be able to:

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 analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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3. **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.
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 need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
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 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.
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 leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize 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 (PSOs)

1. To innovate a Mechanical System which meets the desired specifications and requirements using CAE tools.
2. To explore alternate materials for automobile, manufacturing and process industries
3. To lead professional career in industries or an entrepreneur by applying Engineering and Management principles and practices.

**B.E. MECHANICAL ENGINEERING
REGULATIONS 2023
CURRICULUM AND SYLLABUS
(Choice Based Credit System)**

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	HS23111	Technical Communication I	HS	2	2	0	0	2
2	MA23112	Algebra and Calculus	BS	4	3	1	0	4
3	GE23111	Engineering Graphics	ES	6	2	0	4	4
4	EC23111	Basic Electronics Engineering	ES	3	3	0	0	3
5	GE23117	தமிழர் மரபு / Heritage of Tamils	HS	1	1	0	0	1
LAB INTEGRATED THEORY								
6	PH23131	Physics of Materials	BS	5	3	0	2	4
PRACTICALS								
7	GE23121	Engineering Practices - Civil and Mechanical	ES	2	0	0	2	1
NON-CREDIT - MANDATORY COURSE								
8	MC23112	Environmental Science and Engineering	MC	3	3	0	0	0
TOTAL				26	17	1	8	19

SEMESTER II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	HS23221/ HS23222	Technical Communication II / English for Professional Competence	HS	2	0	0	2	1
2	MA23212	Differential Equations and Complex variables	BS	4	3	1	0	4
3	GE23211	Engineering Mechanics	ES	3	2	1	0	3
4	GE23217	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	1	0	0	1
LAB INTEGRATED THEORY								
5	CY23233	Engineering Chemistry	BS	5	3	0	2	4
6	EE23132	Basic Electrical Engineering	ES	5	3	0	2	4
7	GE23233	Problem solving and Python Programming	ES	6	2	0	4	4
PRACTICALS								
8	GE23122	Engineering Practices- Electrical and Electronics	ES	2	0	0	2	1
NON-CREDIT - MANDATORY COURSE								
9	MC23111	Indian Constitution and Freedom Movement	MC	3	3	0	0	0
TOTAL				30	18	2	10	22

SEMESTER-III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	ME23311	Engineering Thermodynamics	PC	4	3	1	0	4
2	ME23312	Manufacturing Technology I	PC	3	3	0	0	3
3	ME23313	Kinematics of Machinery	PC	3	3	0	0	3
LAB INTEGRATED THEORY								
4	MA23331	Transforms and Statistics	BS	5	3	0	2	4
5	ME23331	Strength of Materials	PC	5	3	0	2	4
PRACTICALS								
6	ME23321	Manufacturing Technology Laboratory I	PC	2	0	0	2	1
7	CS23422	Python Programming for Machine learning	ES	4	0	0	4	2
TOTAL				26	15	1	10	21

SEMESTER-IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	ME23411	Engineering Materials and Metallurgy	PC	3	3	0	0	3
2	ME23412	Manufacturing Technology II	PC	3	3	0	0	3
LAB INTEGRATED THEORY								
3	ME23431	Dynamics of Machines	PC	5	3	0	2	4
4	ME23432	Fluid Mechanics and Machinery	PC	5	3	0	2	4
5	ME23433	Thermal Engineering	PC	5	3	0	2	4
PRACTICALS								
6	GE23421	Soft Skills - I	EEC	2	0	0	2	1
7	ME23421	Computer Aided Machine Drawing Laboratory	PC	4	0	0	4	2
8	ME23422	Manufacturing Technology Laboratory II	PC	4	0	0	4	2
TOTAL				31	15	0	16	23

SEMESTER-V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	GE23511	Economics for Engineers	HS	3	3	0	0	3
2	ME23511	Machine Design	PC	3	3	0	0	3
3		Professional Elective-I	PE	3	3	0	0	3
4		Open Elective - I	OE	3	3	0	0	3
LAB INTEGRATED THEORY								
5	ME23531	Heat and Mass Transfer	PC	5	3	0	2	4
6	ME23532	Metrology and Measurements	PC	5	3	0	2	4
PRACTICALS								
7	GE23521	Soft Skills - II	EEC	2	0	0	2	1
8	ME23521	Component Modeling Laboratory	PC	4	0	0	4	2
9	ME23522	Industrial Training Internship	EEC	2	0	0	2	1
TOTAL				30	18	0	12	24

SEMESTER-VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	ME23611	Additive Manufacturing	PC	3	3	0	0	3
2	ME23612	Design of Transmission systems	PC	3	3	0	0	3
3	ME23613	Finite Element Analysis	PC	3	3	0	0	3
4	ME23614	Total Quality Management	PC	3	3	0	0	3
5		Professional Elective II	PE	3	3	0	0	3
6		Open Elective – II	OE	3	3	0	0	3
LAB INTEGRATED THEORY								
7	ME23631	Robotics Laboratory	PC	3	1	0	2	2
PRACTICALS								
8	GE23621	Problem Solving Techniques	EEC	2	0	0	2	1
9	ME23622	Simulation and Analysis Laboratory	PC	3	0	0	3	2
10	ME23623	Innovation and Design thinking for Mechanical Engineer	EEC	3	0	0	3	2
TOTAL				29	19	0	10	25

SEMESTER-VII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	ME23711	Process Planning and Cost Estimation	PC	3	3	0	0	3
2		Professional Elective III	PE	3	3	0	0	3
3		Professional Elective IV	PE	3	3	0	0	3
LAB INTEGRATED THEORY								
4	ME23731	Artificial Intelligence for Mechanical Engineers	PC	6	2	0	4	4
5	ME23732	Mechatronics	PC	5	3	0	2	4
PRACTICALS								
6	ME23721	Comprehension	EEC	2	0	0	2	1
7	ME23723	Project Phase I	EEC	2	0	0	2	1
TOTAL				24	14	0	10	19

SEMESTER-VIII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1		Professional Elective V	PE	3	3	0	0	3
PRACTICAL								
2	ME23821	Project work	EEC	18	0	0	18	9
TOTAL				21	3	0	18	12

Total Credits : 165

Summary of Credits:

CATEGORY	I	II	III	IV	V	VI	VII	VIII	Credits	(%)
BS	8	8	4						20	12%
HS	3	2			3				8	5%
ES	8	12	2						22	13%
PC			15	22	13	16	11		77	47%
PE					3	3	6	3	15	9%
EEC				1	2	3	2	9	17	10%
OE					3	3			6	4%
Non-Credit*/(Mandatory)	0	0							0	0%
TOTAL	19	22	21	23	24	25	19	12	165	100%

SEMESTER I

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
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

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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	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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.		

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UNIT-V	REGRESSION	12
Scatter diagram - Karl Pearson coefficient of correlation for raw data –Spearman rank correlation coefficient - Lines of regression - Regression equation X on Y and Y on X- Curve fitting by Principle of least squares - Fitting a straight line $y = ax+b$ and a parabola $y = ax^2 + bx + c$.		
Total Contact Hours:60		

Course Outcomes:
On completion of the course students will be able to
<ul style="list-style-type: none"> ● Demonstrate the matrix techniques in solving the related problems in engineering and technology. ● Analyse and interpret data, and synthesize information to provide valid conclusions. ● Interpret the problems in Engineering and Technology using the principles of mathematical calculus. ● Apply the analytical methods and numerical techniques to solve the related engineering problems. ● Evaluate multiple integrals to conduct investigations of complex problems.

Text Book(s):	
1.	Grewal B.S., “ Higher Engineering Mathematics ”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Gupta S.C. and Kapoor V.K.”Fundamentals of Mathematical Statistics”, Sultan and Sons 10 th Edition,2000.
3.	T Veerarajan, Engineering Mathematics –I , Mc Graw Hill Education, 2018.
4.	I.R. Miller, J.E. Freund and R. Johnson , ”Probability and Statistics for Engineers “,4th Edition, Pearson, 2018.
5.	A. Goon, M. Gupta and B.Dasgupta , ”Fundamentals of Statistics “,Vol. I & Vol. II, World Press, 2019.

Reference Books(s) / Web links:	
1.	Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
2.	T Veerarajan ,Fundamentals of Mathematical Statistics , yesdee publications, 2017.
3.	Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
4.	Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5.	N. Draper & H. Smith, ”Applied Regression Analysis” III edition, Wiley, 1998.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	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	-	-	-
MA23112.5	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
Average	2.6	2.2	1	1	-	-	-	-	-	-	1	1	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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

COURSE OUTCOMES:

After learning the course, the students should be able

- 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

CO PO PSO MAPPING

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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 BOOKS(S) / WEB LINKS:

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.

Course Code	Course Title (Theory course)	Category	L	T	P	C
EC23111	BASIC ELECTRONICS ENGINEERING	ES	3	0	0	3
Common to	Mechanical and Automobile Engineering					

Objectives: The Student should be made
<ul style="list-style-type: none"> • To study the operation of semiconductor devices and their characteristics. • To understand the concepts of operational amplifiers with its applications. • To acquire knowledge about the operation of timing circuits and Oscillators. • To gain knowledge about digital logic circuits. • To introduce the basics of electronic communication systems.

UNIT-I	SEMICONDUCTOR DEVICES AND APPLICATIONS	9
Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers. Zener diode and its characteristics, Zener diode as voltage regulator. Introduction to BJT and its input and output characteristics, BJT as a single stage CE amplifier.		
UNIT-II	OPERATIONAL AMPLIFIER AND APPLICATIONS	9
Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, Op-amp with negative feedback, study of practical Op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.		
UNIT-III	TIMING CIRCUITS AND OSCILLATORS	9
RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen criteria for oscillation, R-C phase shift and Wein bridge oscillator.		
UNIT-IV	DIGITAL ELECTRONICS FUNDAMENTALS	9
Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K-map, half and full adder/subtractor, multiplexers, de-multiplexers, flipflops, shift registers, counters, Block diagram of 8086 microprocessor and 8051 microcontroller and their applications.		
UNIT-V	MODERN WIRELESS COMMUNICATION SYSTEMS	9
The elements of communication system, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.		
Total Contact Hours: 45		

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Course Outcomes: On completion of course, students will be able to
• Demonstrate the characteristics of the diode and transistors.
• Design suitable amplifiers for simple applications.
• Analyze the timing circuits and design oscillators.
• Construct simple digital logic circuits.
• Develop a high degree of familiarity with the Electronic Communication Systems.

Text Book(s):
• Floyd, “Electronic Devices” Pearson Education, 9th edition, 2012.
• R.P. Jain, “Modern Digital Electronics”, Tata Mc Graw Hill, 3rd Edition, 2007.
• Frenzel, “Communication Electronics: Principles and Applications”, Tata Mc Graw Hill, 3rd Edition, 2001

Reference Books(s) / Web links:
1. Donald .A. Neamen, Electronic Circuit Analysis and Design – 2nd Edition, Tata McGraw Hill, 2009
2. David A., “Bell Electronic Devices and Circuits”, Oxford Higher Education Press, 5th Edition, 2010
3. M. Morris Mano, “Digital Design”, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
4. Simon Haykin, Communication Systems, John Wiley & sons, NY, 4th Edition, 2001.
5. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, “Electronic Devices and circuits”, Third Edition, Tata McGraw- Hill, 2008

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EC23315.1	3	3	3	3	3	2	1	2	2	2	1	2	2	2	2
EC23315.2	3	3	3	3	3	2	1	2	2	2	1	2	3	3	3
EC23315.3	3	3	3	3	3	2	1	2	2	2	1	2	3	3	3
EC23315.4	3	3	3	3	3	2	1	2	2	2	1	2	3	3	3
EC23315.5	3	3	3	3	3	2	1	2	2	2	1	2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

அலகு I மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் 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 திருவள்ளூர் 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 அச்சு வரலாறு.

TOTAL : 15 PERIODS

TEXT-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. பொருறை - 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)

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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	Category	L	T	P	C	
PH23131	PHYSICS OF MATERIALS Common to I sem. B.E. - Aero, Auto, Civil, Mech, MCT and R&A	BS	3	0	2	4	
Objectives:							
<ul style="list-style-type: none"> • To enhance the fundamental knowledge of elasticity and its applications relevant to engineering streams. • To become proficient in crystal growth and crystal systems. • To introduce the essential of phase transformation in materials. • To impart knowledge on the structure, properties, treatment, testing and applications of metals and alloys. • To familiarize students with thermal properties and applications. 							
UNIT-I	PROPERTIES OF MATTER					9	
Elasticity–Hooke’s law–stress–strain–modulus of elasticity–stress-strain diagram–Poisson’s ratio–rigidity modulus–twisting couple on a cylinder–moment of inertia - torsional pendulum method. Bending of beams -bending moment–cantilever depression–theory and experiment - Young’s modulus determination–uniform and non-uniform bending-I–shape girders. Viscosity–flow of motion–Reynolds number.							
UNIT-II	THERMAL PHYSICS					9	
Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation –rectilinear heat flow – thermal conductivity - Forbe’s and Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.							
UNIT-III	PHASE DIAGRAMS					9	
Solid solutions - Hume-Rothery’s rules –Gibb’s phase rule – unary phase diagram- binary phase diagrams - isomorphous systems - tie-line and lever rule - eutectic, eutectoid, peritectic, peritectoid, monotectic and syntectic systems - formation of microstructures-homogeneous and non-homogenous cooling – nucleation (Qualitative)– iron-carbon phase diagram - eutectoid steel – hypo-eutectoid and hyper-eutectoid steel – diffusion - Fick’s laws – T-T-T diagrams.							
UNIT-IV	CRYSTAL PHYSICS					9	
Basis – lattices – unit cell-crystal systems – Bravais lattices –number of atoms, atomic radius, co-ordination number and packing fraction - SC, BCC, FCC, HCP lattices and diamond structure - polymorphism and allotropy-graphite structure - Miller indices – determination of d-space-crystal growth techniques-solution growth –melt growth–Bridgmann and Czochralski - crystal defects.							
UNIT-V	ADVANCED MATERIALS & TESTING					9	
Metallic glasses – preparation, properties and applications - Composites – types and properties - Shape memory alloys – properties and applications - Nano-materials – top down and bottom up approaches –sol-gel method-pulsed laser deposition-ball milling- properties-applications - Tensile strength – Hardness – Fatigue - Impact strength – Creep - Fracture – types of fracture.							
Contact Hours						:	45
List of Experiments							
1	Determination of Young’s modulus of given material by non-uniform bending method.						
2	Determination of moment of inertia of a disc and rigidity modulus of a given wire using Torsional pendulum.						
3	Determination of Young’s modulus of given beam by cantilever method.						
4	Determination of viscosity of the given liquid using Poiseuille’s method.						
5	Determination of Thermal conductivity of a bad conductor – Lee’s Disc method.						
6	Determination of Velocity of ultrasound and compressibility of given liquid – Ultrasonic interferometer.						
7	Determination of the wavelength of Laser and particle size of given powder.						
8	Determination of the Hysteresis loss of ferromagnetic material by B-H curve experiment.						
9	Find the thickness of a given thin wire – Air wedge method.						
10	Study the characteristics of solar cell parameters.						
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 elastic nature of materials and determine the elastic moduli of different materials. • apply the basic knowledge of crystal structure in solids. 							

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•	analyse and measure the properties of alloys.
•	analyse various material testing methods and use them in suitable applications.
•	understand the concepts of heat transfer in various applications.
Text Book(s):	
1	Bhattacharya, D.K. & Poonam, T. “ <i>Engineering Physics</i> ”. Oxford University Press, 2018.
2	Gaur, R.K. & Gupta, S.L. “ <i>Engineering Physics</i> ”. Dhanpat Rai Publishers, 2018.
3	Raghavan, V. “ <i>Physical Metallurgy: Principles and Practice</i> ”. PHI Learning, 2019.
Reference Books(s) / Web links:	
1	Balasubramaniam, R. “ <i>Callister's Materials Science and Engineering</i> ”. Wiley India Pvt. Ltd., 2017
2	Resnick, R., Halliday, D., & Walker, J. “ <i>Principles of Physics</i> ”, Wiley India Pvt., 2018.
3	Raghavan, V. “ <i>Materials Science and Engineering: A First course</i> ”. PHI Learning, 2019.
4	https://nptel.ac.in/courses/113104068
5	https://archive.nptel.ac.in/courses/115/105/115105099/

List of Equipment Available (Common to B.E. Aero, Auto, Civil, Mechanical, Mechatronics Engineering and R&A)

S. No	Name of the equipment	Quantity Required	Quantity Available	Deficiency
1	Young's modulus by Non - Uniform bending method Travelling Microscopes, Meter scale etc.,	6	13	-
2	Rigidity Modulus - Torsional Pendulum Setup	6	19	-
3	Velocity of sound and compressibility of liquid – Ultrasonic Interferometer	6	14	-
4	Wavelength of Laser and Characteristics -Laser source And grating plate	6	15	-
5	B-H curve Setup and CRO	6	7	-
6	Thermal conductivity of bad conductor- Lee's Disc setup	6	16	-
7	LCR circuit kit	6	7	-
8	Thickness of a thin wire-Air wedge method – Travelling microscope	6	13	-
9	Solar cell parameters setup	6	8	-
10	Poiseuille's method set up	6	10	-

CO - PO – PSO matrices of course

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE23121	ENGINEERING PRACTICES – Civil and 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

List of equipment and components

(For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings - 15 Sets.
2. Plumbing vice (fitted to work bench) – 15 Nos.
3. Carpentry vice (fitted to work bench) - 15 Nos.
4. Standard woodworking tools - 15 Sets.
5. Models of industrial trusses, door joints, furniture joints - 5 each
6. Power Tools: (a) Rotary Hammer - 1 No. (b) Circular Saw - 1 No. (c) Electric Planer - 1 No.
(d) Hand Drilling Machine - 1 No. (e) Jigsaw - 1 No. (f) Cutoff Machine – 1 No.

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MECHANICAL

1. Arc welding transformer with cables and holders - 5 Nos.
2. Welding booth with exhaust facility - 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. - 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit - 1 No.
5. Centre lathe - 5 Nos.
6. Standard Sheet metal working tools – 2 sets
7. Study-purpose items: centrifugal pump, air-conditioner – 1 each.

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Subject Code	Subject Name	Category	L	T	P	C
MC23112	ENVIRONMENTAL SCIENCE AND ENGINEERING	MC	3	0	0	0
Common to B.E. /B.Tech all branches except CSBS						

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
<ul style="list-style-type: none"> • 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		

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- 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.

Text Book(s):
1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publisher, 2018.
3. 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. Gorchani, '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
1. For downloading text/reference books the weblink is given below can be used http://libgen.rs/

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
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	-	-	-
MC23112.3	-	-	3	1	-	2	3	2	1	-	1	2	-	-	-
MC23112.4	-	1	2	1	1	3	3	2	1	1	1	2	-	-	-
MC23112.5	-	1	2	-	-	2	2	2	1	2	2	2	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SEMESTER II

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						

Objectives:
<ul style="list-style-type: none"> To facilitate students to improve their vocabulary for a better communication
<ul style="list-style-type: none"> To enable learners to understand and reproduce language
<ul style="list-style-type: none"> To aid students to write technical reports in a convincing manner
<ul style="list-style-type: none"> To expose students to different sentence structures
<ul style="list-style-type: none"> 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., Reading: Practice of chunking – breaking up reading materials Speaking: Mini presentation on some topic Writing: Minutes of the meeting Grammar: Correction of Errors Vocabulary: Advanced vocabulary – fixing appropriate words in the given context.		
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
<ul style="list-style-type: none"> use the acquired language skills to comprehend various types of language contents
<ul style="list-style-type: none"> evaluate different texts and write effective technical content
<ul style="list-style-type: none"> use appropriate sentence structures to convey their thoughts in varied contexts
<ul style="list-style-type: none"> present their concepts and ideas in an effective manner

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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	PSO 1	PSO 2	PSO 3
HS23221.1	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-
HS23221.2	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221.3	-	2	-	1	-	-	-	-	-	3	-	-	-	-	-
HS23221.4	-	-	-	1	-	-	-	-	2	3	-	-	-	-	-
HS23221.5	-	-	-	1	-	-	-	-	2	2	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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		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
<p>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.</p>		
UNIT-II	PRODUCTIVE SKILLS	6
<p>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</p>		
UNIT-III	ENGLISH FOR COMPETITIVE EXAMS	6
<p>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.</p>		

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UNIT-IV	CORPORATE SKILLS	6
<p>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</p>		
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		
<ul style="list-style-type: none"> • 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 		

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	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course 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:						
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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.

Text Book(s):	
1.	Grewal B.S., “ Higher Engineering Mathematics ”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Veerarajan. T, Engineering Mathematics –II, Mc Graw Hill Education, 2018.
3.	Erwin Kreyszig," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
4.	Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, 4th Edition, New Delhi, 2011.
5.	Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, 5 th Edition, New Delhi, 2017.

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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	-	-
MA23212.2	3	2	1	-	-	-	-	-	-	-	-	1	1	-	-
MA23212.3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
MA23212.4	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
MA23212.5	3	2	1	-	-	-	-	-	-	-	-	1	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Subject Code	Subject Name	Category	L	T	P	C
GE23211	Engineering Mechanics (Common to Mech, Aero, Auto, Civil and MCT)	ES	2	1	0	3
Objectives: The students can be able to						
•	To understand the basics of mechanics and apply the concept of equilibrium of system of forces.					
•	To understand the concept of equilibrium and to solve problems of rigid bodies.					
•	To learn about the centroid and centre of gravity of objects and moment of inertia					
•	To learn the basic concepts of friction.					
•	To learn the concepts in kinematics and kinetics of rigid bodies in plane motion.					

UNIT-I	STATICS OF PARTICLES	9
Introduction – Units and Dimensions – Laws of Mechanics – Lami’s theorem, Parallelogram and triangular Law of forces – Resolution of forces – Vector operations of forces - Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.		
UNIT-II	EQUILIBRIUM OF RIGID BODIES	9
Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in and three dimensions (class room lecture only) – (Descriptive treatment only)		
UNIT-III	PROPERTIES OF SURFACES AND SOLIDS	12
Centroids - First moment of area – Second moment of area and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.		
UNIT-IV	DYNAMICS OF PARTICLES	7
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton’s laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.		

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UNIT-V	FRICITION AND RIGID BODY DYNAMICS	8
Friction force – Laws of sliding friction - Characteristics of dry friction – equilibrium analysis of simple systems with sliding friction –wedge friction, Ladder friction, Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.		
Total Contact Hours		: 45

Course Outcomes: Upon completion of this course, the students will be able to:	
CO1	Analyze the forces in the system and to understand vectorial and scalar representation of forces and moments
CO2	Study about the rigid body in equilibrium and to analyze the problems in engineering systems using the concept of static equilibrium
CO3	Determine the properties of surfaces and solids by means of finding centroid, centre of gravity and moment of inertia.
CO4	Solve problems involving kinematics and kinetics of rigid bodies in plane motion.
CO5	Solve problems involving frictional phenomena in machines by understanding the concept of friction and the effects by the laws of friction
Text Books:	
1	Beer, F.P and Johnston Jr. E.R, Cornwell and Sanghi ., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 12 th Edition, McGraw-Hill Publishing company, New Delhi (2018).
2	Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3 rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

Reference Books(s) / Web links:	
1	Meriam J.L. and Kraige L.G., “Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, 7 th Edition, Wiley India, 2018.
2	Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 14 th Edition, Pearson Education 2017.
3	Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics” 4 th Edition, Pearson Education 2006.
4	Bhavikatti S S, Engineering Mechanics, New Age International Publishers, 2016
5	Vela Murali, “Engineering Mechanics”, Oxford University Press 2010
6	Palanichamy M S, Nagan S, Elango P, Engineering Mechanics: Dynamics, Tata McGraw-Hill Publishing Company Limited, 2004

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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 - பாண்டங்களில் 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 குழுமித் 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. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை - 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.

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Subject Code	Subject Name	Category	L	T	P	C
CY23233	ENGINEERING CHEMISTRY	BS	3	0	2	4
Common to B.E. – AERONAUTICAL, AUTOMOBILE, MECHANICAL and CIVIL						

Objectives:
<ul style="list-style-type: none"> ● To understand the types of corrosion and its prevention ● To develop an understanding of the basic concepts of phase rule and its applications ● To provide a brief outline of polymers and composites in mechanical sciences ● To interpret the different types of batteries and fuel cells ● To provide an insight on nanomaterials and lubricants

UNIT-I	CORROSION SCIENCE AND CONTROL	9
<p>Corrosion: Introduction- chemical and electrochemical theory of corrosion- types of corrosion-galvanic, differential aeration (waterline and pitting) and stress corrosion (caustic embrittlement)- corrosion penetration rate (CPR). Corrosion control: Cathodic protection- Metallic coatings- Electroplating- electroplating of chromium (hard and decorative)- Electroless plating-electroless plating of nickel- Chemical conversion coatings-Organic coatings-paints-constituents-functions - special paints.</p>		
UNIT-II	PHASE RULE AND THERMAL ANALYSIS	9
<p>Phase rule - Introduction, definition of terms - phase, components and degree of freedom - phase diagram- one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system. Alloys - significance of alloying - heat treatment of steel. Thermal analysis - Thermogravimetric analysis- Differential thermal analysis- Differential scanning calorimetry-instrumentation (block diagram) and applications.</p>		
UNIT-III	POLYMERS AND COMPOSITES	9
<p>Plastics - Types-preparation, properties and uses of Teflon, polycarbonate and PMMA Rubbers - Types-vulcanization-synthetic rubber-Buna N rubber, Butyl rubber. Composite Materials - Introduction-Types– MMC, CMC and PMC-Fiber-Reinforced composites-preparation, properties, and applications.</p>		
UNIT-IV	FUELS AND ENERGY STORAGE DEVICES	9
<p>Fuels - Introduction, calorific value- numerical problems GCV and NCV-Green fuels-Introduction, synthesis and applications of power alcohol and biodiesel-High energy fuels-Production of hydrogen by electrolysis of water and its advantages. Energy devices - Electrode potential-electrochemical series - construction, working and applications of lead acid battery, Lithium-ion battery-Fuel Cell-Hydrogen-Oxygen (H₂-O₂) fuel cell, proton exchange membrane and solid oxide fuel cells.</p>		
UNIT-V	NANOMATERIALS AND LUBRICANTS	9
<p>Nanomaterials - Introduction, size-dependent properties - Synthesis of Nanomaterials-sol-gel, precipitation, hydrothermal and solvothermal methods - Carbon based nano materials - Introduction to CNT, Graphene and Fullerenes- synthesis, properties and applications of CNT. Lubricants: Classification- properties of lubricants- mechanism of lubrication- additives to lubricants- solid lubricants (graphite and MoS₂).</p>		
Total Contact Hours:45		

Description of the Experiments	Total Contact Hours:30
1.	Estimation of the acid by pH metry
2.	Determination of corrosion rate on mild steel by weight loss method
3.	Estimation of mixture of acids by conductometry
4.	Estimation of extent of corrosion of Iron pieces by potentiometry
5.	Determination of flash and fire points of lubricating oil
6.	Determination of cloud and pour points of lubricating oil
7.	Determination of molecular weight of a polymer by viscometry method
8.	Synthesis of nanomaterials by simple precipitation method
9.	Determination of phase change temperature of a solid
10.	Determination of strength of an acid in Pb acid battery
11.	Synthesis of biodiesel
12.	Determination of acid value of biofuel

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Course Outcomes:

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

- Explain and the fundamental concepts of corrosion, its control and surface modification methods such as electroplating and electroless plating
- Apply the concept of phase rule in alloying and predict its thermal properties
- Identify the different types of plastics and composite materials of industrial importance
- Categorize the types of fuels and the energy storage devices
- Synthesize nanomaterials for modern engineering and technology

Text Book(s):

1. P. C. Jain and Monika Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. O.G.Palanna, "Engineering Chemistry", McGraw Hill Education (India) Pvt, Ltd, New Delhi, 2nd Edition, 2017.
3. Shikha Agarwal "Engineering Chemistry-Fundamentals and applications", Cambridge University Press, New Delhi, 2019

Reference Books(s)

- Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
- A Text Book Engineering Chemistry, Sunita Rattan, S.K. Kataria & Sons, 1st 2018
- A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd. 2011
- PradeepT, "A Text Book of Nanoscience and Nanotechnology", Tata McGraw Hill, New Delhi, 2012
- Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co

Lab equipment required:

S. No	Name of the Equipment	Quantity Required
1.	Conductivity meter	10
2.	Potentiometer	10
3	pH meter	10
4	Magnetic stirrer with hot plate	1
5	Flash and Fire point apparatus	2
6	Cloud and pour point apparatus	2

Weblinks

- <http://libgen.rs/>
- <https://nptel.ac.in/courses/104/103/104103019/>
- <https://ndl.iitkgp.ac.in/>
- <https://www.youtube.com/watch?v=j5Hml6KN4TI>
- <https://www.youtube.com/watch?v=1xWBPZnEJk8>

Web links for virtual lab (if any)

<https://drive.google.com/drive/folders/1k8e7fGRJ0DI8FPbiOYg4I5jS1U9qIXnJ>

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CY23233.1	2	1	1	-	-	1	2	-	-	-	-	1	-	2	-
CY23233.2	3	1	1	-	-	-	-	-	-	-	-	1	-	1	-
CY23233.3	2	1	2	-	-	-	-	-	-	-	-	1	-	2	-
CY23233.4	2	1	1	-	-	-	-	-	-	-	-	1	-	1	-
CY23233.5	3	1	2	-	-	1	1	-	-	-	-	1	-	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EE23132	BASIC ELECTRICAL ENGINEERING	ES	3	0	2	4
Objectives:						
• To provide knowledge on the analysis of DC circuits.						
• To teach methods of analysis of AC circuits.						
• To impart knowledge on principles of operation of electrical machines.						
• To teach the basics of electrical safety measures.						
• To provide hands on experience on electric circuits and machines						
UNIT-I	DC CIRCUITS					9
Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's laws, Mesh and Nodal Analysis, Superposition, Thevenin's, Norton's Theorems and Maximum Power Transfer Theorem						
UNIT-II	AC CIRCUITS					9
Representation of sinusoidal waveforms, Power and Power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits.						
UNIT-III	DC MOTORS AND TRANSFORMERS					9
Construction, working and characteristics of DC motors. Construction, principle of operation of single-phase Transformer, EMF Equation.						
UNIT-IV	AC ROTATING MACHINES					9
Construction and basic working of three phase Alternators and Induction motors, Construction and Types of single-phase induction motors- Construction and basic working of Stepper motor, Permanent magnet Brushless Motor (PMBLDC) (Qualitative Treatment Only).						
UNIT-V	ELECTRICAL SAFETY MEASURES					9
Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection - Safety in the use of portable tools - Preventive maintenance- Types of earthing and its importance-Safety precautions for electrical appliances- National electrical Safety code - Indian electricity acts and rules						
Total Contact Hours						: 45
List of Experiments						
1	Kirchhoff's laws.					
2	Network theorems (Thevenin's , Norton's and Maximum Power Transfer Theorems)					
3	Determination of Impedance and Current in RL, RC and RLC series circuits					
4	Measurement of voltage and current in three phase balanced star & delta connected loads.					
5	Load test on DC shunt motor (Virtual Lab)					
6	Load test on single-phase transformer (Virtual Lab)					
7	Load test on three phase induction motor (Virtual Lab)					
8	Load test on Single phase induction motor.					
Contact Hours						: 30
Total Contact Hours						: 75
Course Outcomes:						
On completion of the course, the students will be able to						
• analyse DC circuits and apply circuit theorems.						
• calculate the power and power factor in AC circuits						
• comprehend the principles of electrical machines.						
• realise the electrical safety precautions.						
• experimentally analyze the electric circuits and machines.						
Suggested Activities						
• Problem solving sessions						
Suggested Evaluation methods						
• Quizzes						
• Class Presentation / Discussion						
Text Book(s):						
1	E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.					
2	J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K.Kataria& Sons Publications, 2010.					
3	K.Venkataratnam, —Special Electrical Machines, Universities Press (India) Private Limited, 2008.					
4	John Cadick, P.E. Mary Capelli-Schellpfeffer, M.D., M.P.A. Dennis K. Neitzel, C.P.E. "Al Winfield Electrical Safety Hand Book, fifth edition, The McGraw-Hill 2012					
Reference Books(s) / Web links:						

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1	Joseph A. Edminister, Mahmood, Nahri, “Electric Circuits” – Schaum Series and Systems”, Schaum’s Outlines, Tata McGrawHill, Indian. 5th Edition , 2017
2	D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3	D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
4	L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5	https://nptel.ac.in/courses/108108076
6	E G Janardanan, —Special Electrical Machines, Prentice Hall India Limited, 2013.
7	Maxwell Adams.J, “Electrical safety- a guide to the causes and prevention of electric hazards”,The Institution of Electric Engineers, 1994.

Lab Equipment Required

Sl. No.	Name of the equipment	Quantity Required (for batch of 30 students)
1.	<p style="text-align: center;">Verification of Kirchoff's Laws</p> <ol style="list-style-type: none"> 1. DC Regulated Power supply (0 - 30 V variable) 2. Bread Board 3. Resistors 4. Ammeter (0-50)mA 5. Voltmeter (0-30)V 6. Multimeter 7. Connecting wires 	<p>1 1 As per Circuit diagram 3 3 1 As Required</p>
2.	<p style="text-align: center;">Verification of Network Theorems (Thevenins and Nortons)</p> <ol style="list-style-type: none"> 1. DC Regulated Power supply (0 - 30 V variable) 2. Bread Board 3. Resistors 4. Ammeter (0-50)mA 5. Voltmeter (0-30)V 6. Multimeter 7. Connecting wires 	<p>1 1 As per Circuit diagram 1 1 1 As Required</p>
3.	<p style="text-align: center;">Determination of current and Impedance in RL, RC and RLC series circuit</p> <ol style="list-style-type: none"> 1. DC Regulated Power supply (0 - 30 V variable) 2. Resistors, Inductors and capacitors 3. Ammeter (0-50)mA 4. Voltmeter (0-30)V 5. Connecting wires 	<p>1 As per Circuit diagram 1 1 As Required</p>
4.	<p style="text-align: center;">Measurement of Voltage and Current in Three Phase Balanced Star and Delta Connected Loads</p> <ol style="list-style-type: none"> 1. Three phase star& delta connected load / Single phase load bank of suitable rating 2. Ammeter and Voltmeter 3. Connecting wires 	<p>3 As per Circuit diagram As Required</p>
5.	<p style="text-align: center;">Load test on DC Shunt Motor.</p> <ol style="list-style-type: none"> 1. Ammeter MC (0-20A) 2. Voltmeter MC (0-300)V 3. Tachometer 4. Field Rheostat 500 Ω, 1.5 A 5. Connecting wires 	<p>1 1 1 1 As Required</p>

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6.	Load test on Single phase Transformer 1. Ammeter (0-30) A, (0-5) A 2. Voltmeter (0-150)V, (0-300)V 3. Wattmeter – 300V, 5A, UPF 4. Autotransformer 5. Single phase Transformer 6. Connecting Wires	1 1 1 1 1 As Required
7.	Load Test on Three phase Induction Motor 1. Ammeter MI (0-20A) 2. Voltmeter MI (0-300)V 3. Wattmeter – 300V, 30 A 4. Tachometer – Digital 5. Three phase Induction motor 6. Connecting Wires	1 1 1 1 1 As Requir ed

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	-	3	1	1	2	1	1	1	-	-	1
CO 2	3	3	3	3	-	3	1	1	2	1	1	1	-	-	1
CO 3	3	3	3	3	-	3	1	1	2	1	1	1	-	-	1
CO 4	3	3	3	3	-	3	1	1	2	1	1	1	-	-	1
CO 5	3	3	3	3	-	3	3	1	2	1	1	1	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
GE23233	PROBLEM SOLVING AND PYTHON PROGRAMMING	ES	2	0	4	4

Objectives:

☞	To know the basics of algorithmic problems solving
☞	To develop Python programs with conditionals and loops
☞	To define Python functions and call them
☞	To use Python data structures--lists, tuples, dictionaries
☞	To do input/output with files in Python

UNIT-I	ALGORITHMIC PROBLEM SOLVING	6
Introduction to computers-characteristics-basic organization of a computer– algorithms-building blocks of algorithms (instructions / statements, state, control flow, functions)-notation (pseudo code, flow chart, programming language) - algorithmic problem solving - simple strategies for developing algorithms (iteration,recursion).		
UNIT-II	DATA, EXPRESSIONS, STATEMENTS AND CONTROL FLOW	6
Python interpreter and interactive mode - values and types - data types – variables – keywords – expressions and statements- python I/O - operators- precedenceof operators– comments. Conditionals:conditional(if)-alternative(if-else)-chained conditional (if- elif- else)–nested conditional.		
UNIT-III	CONTROL FLOW – II AND FUNCTIONS	7
Iteration: while – for - break – continue – pass. Illustrative programs: exchange the values of two variables- circulate the values of n variables-test for leap year. Function calls – type conversion– math function– composition- definition and use - flow of execution - parameters and arguments. Fruitful functions: return values – parameters - scope: local and global - recursion.		
UNIT-IV	STRINGS	5
Strings: string slices – immutability - string functions and methods – string comparison. Illustrative programs: square root– GCD– exponentiation-sum the array of numbers linear search- binary search.		

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UNIT-V	LISTS, TUPLES AND DICTIONARIES	6
Lists - list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists - listparameters. Tuples – immutable - tuple assignment - tuple as return value. Dictionaries: operations and methods– dictionaries and tuples– dictionaries and lists. Advanced list processing- list comprehension. Illustrative programs: Sorting.		
Contact Hours		: 30

List of Experiments		
1	Introduction to Python Programming and Python IDLE/Anaconda distribution.	
2	Experiments based on Variables, Data types and Operators in Python.	
3	Coding Standards and Formatting Output.	
4	Algorithmic Approach: Selection control structures.	
5	Algorithmic Approach: Iteration control structures.	
6	Experiments based on Strings and its operations.	
7	Experiments based on Lists and its operations.	
8	Experiments based on Tuples and its operations.	
9	Experiments based on Sets and its operations.	
10	Experiments based on Dictionary and its operations.	
11	Functions: Built-in functions.	
12	Searching techniques: Linear and Binary.	
13	Sorting techniques: Bubble and Merge Sort.	
Contact Hours		: 60
Total Contact Hours		: 90

Course Outcomes:	
On completion of the course, the 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.

TextBooks:	
1.	Allen B. Downey, Think Python:How to Think Like a Computer Scientist, Second edition,UpdatedforPython3, 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.

ReferenceBooks:	
1.	JohnVGutttag, 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)PrivateLtd.,2015.
4.	Kenneth A. Lambert, Fundamentals of Python: First Programs, CengageLearning,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.

Plat form Needed:

Python3 interpreter for Windows/Linux

CO -PO-PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CS23232.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
CS23232.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
CS23232.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
CS23232.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
CS23232.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Subject Code	Subject Name	Category	L	T	P	C
GE23122	ENGINEERING PRACTICES - ELECTRICAL AND ELECTRONICS	ES	0	0	2	1
Objectives:						
<ul style="list-style-type: none"> To provide hands-on experience on various basic engineering practices in Electrical Engineering. To provide hands-on experience on various basic engineering practices in Electronics Engineering. 						
List of Experiments						
A. ELECTRICAL ENGINEERING PRACTICE						
1	Residential house wiring using switches, fuses, indicators, lamp and energy meter.					
2	Fluorescent lamp wiring.					
3	Stair case wiring.					
4	Measurement of electrical quantities – voltage, current, power & power factor in RL circuit.					
5	Measurement of earth resistance using Megger.					
6	Study of Ceiling Fan and Iron Box					
B. ELECTRONICS ENGINEERING PRACTICE						
1	Study of electronic components and equipment – Resistor, colour coding, measurement of AC signal parameters (peak-peak, rms period, frequency) using CRO/DSO.					
2	(a) Measurement of electrical quantities using Multimeter (b) Testing of electronic components.					
3	Study of logic gates : AND, OR, EXOR and NOT.					
4	Generation of Clock Signals.					
5	Soldering practice – Components Devices and Circuits – Using general purpose PCB.					
6	Measurement of ripple factor of Half-wave and Full-wave Rectifiers.					
					Total Contact Hours	: 30
Course Outcomes:						
On completion of the course, the students will be able to						
<ul style="list-style-type: none"> fabricate the basic electrical circuits implement the house wiring circuits fabricate the electronic circuits verify the truth table of logic gates design the Half-wave and Full-wave Rectifiers using diodes and passive components 						
SUGGESTED EVALUATION METHODS						
<ul style="list-style-type: none"> Experiment based Viva 						

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REFERENCE	
1	Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
2	Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
3	Jeyapooan T., Saravanapandian M. &Pranitha S., “Engineering Practices Lab Manual”,Vikas Publishing House Pvt.Ltd, 2006.
4	Rajendra Prasad A. &Sarma P.M.M.S., “Workshop Practice”, SreeSai Publication, 2002.

Lab Equipment Required:

S.	Name of the Equipment	Quantity Required
1	Residential house wiring using switches, fuse, indicator, lamp and energy	3 Nos
2	Fluorescent lamp wiring.	3 Nos
3	Stair case wiring	3 Nos
4	Measurement of electrical quantities – voltage, current, power & power	2 Nos
5	Study purpose items: Iron box, Ceiling fan.	2 each
6	Megger (250V/500V)	2 Nos.
7	Soldering guns	10 Nos.
8	Assorted electronic components for making circuits	50 Nos.
9	Small PCBs	10 Nos.
10	Multimeters	10 Nos.
11	Digital trainer kit	5 Nos.
12	CRO	8 Nos.
13	Transformer	8 Nos.
14	Function Generator	8 Nos.

COs/POs&PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	2	-	-	2	-	3	2	-	3	-	-	1
CO 2	3	3	2	2	-	-	2	-	3	2	-	3	-	-	1
CO 3	3	3	3	2	-	-	2	-	3	2	-	3	-	-	1
CO 4	3	3	3	2	-	-	-	-	3	2	-	3	-	-	1
CO 5	3	3	3	2	-	-	-	-	3	2	-	3	-	-	1

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC23111	INDIAN CONSTITUTION AND FREEDOM MOVEMENT	Theory	3	0	0	0
Common to all branches of B.E/B. Tech Programmes – First / Second/third Semester						

Objectives:

- To apprehend the sacrifices made by the freedom fighters.
- To inculcate the values enshrined in the Indian constitution.
- To instil 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.		

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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:

- appreciate the sacrifices made by freedom fighters during freedom movement.
- be responsible citizens and abide by the rules of the Indian constitution.
- be aware of the functions of the Indian government.
- be knowledgeable about the functions of the state Government and the Local bodies.
- apply the knowledge on constitutional functions and role of constitutional bodies and non-constitutional bodies.

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. 21sted 2013.
10. P K Agarwal and K N Chaturvedi ,PrabhatPrakashan, New Delhi, 1sted , 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.2nded, 2014.
5. Bipan Chandra, History of Modern India, Orient Black Swan, 2009.

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MC23111.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC23111.3	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
MC23111.4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
MC23111.5	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)