

**B.E. AERO
R-2023
CURRICULUM
(CHOICE BASED CREDIT SYSTEM)**

RAJALAKSHMI ENGINEERING COLLEGE
(An Autonomous Institution Affiliated to Anna University Chennai)

DEPARTMENT OF AERONAUTICAL ENGINEERING
CBCS CURRICULUM AND SYLLABUS R-2023
B.E., AERONAUTICAL ENGINEERING

VISION

To provide excellent graduate education in Aeronautical Engineering and continuously support the community of aerospace professionals that will spearhead and strengthen the design and development of Aerospace related industries and institutions in India.

MISSION

- To impart quality exposure in theory and practical with proficiency, skill and humane values with the best of teaching and industrial expertise.
- To continuously strengthen the laboratory learning of students in tune with the best industry processes and practices.
- To ensure the updated knowledge and skill sets of students in emerging technologies.
- To provide the students the right ambience and opportunities to develop into creative, talented and globally competent Aero professionals.
- To promote research and development activities in the sphere of aeronautics for the benefit of the society.

Program Educational Objectives (PEOs)

1. Our graduates have the ability to apply knowledge across the disciplines and in emerging areas of Aerospace Engineering for higher studies, research, employability and product development.
2. Our graduates have the communication skills, sense of responsibility to protect the environment and ethical conduct towards their profession and commitment to serve the society.
3. Our graduates possess academic excellence, managerial skills, leadership qualities and understand the need for lifelong learning for a successful professional career.

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.
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.

Programme Specific Outcome (PSOs)

A graduate of the Aeronautical Engineering program will

1. Develop deep working knowledge to solve complex problems in aerodynamics, propulsion, structures and flight mechanics
2. Demonstrate the problem-solving ability and hands-on skills to enter careers in the design, manufacturing, testing, or maintenance of aeronautical systems.
3. Be equipped to use CAE packages and simulation language skills to solve practical, design and analysis problems.

**CBCS CURRICULUM AND SYLLABUS
B.E. AERONAUTICAL ENGINEERING
REGULATION 2023
CURRICULUM**

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS23111	Technical Communication - I	HS	2	2	0	0	2
2	MA23112	Algebra and Calculus	BS	4	3	1	0	4
3	PH23131	Physics of Materials	BS	5	3	0	2	4
4	GE23111	Engineering Graphics	ES	4	2	2	0	4
5	GE23117	தமிழர் மரபு / Heritage of Tamils	HS	1	1	0	0	1
6	EE23133	Basic Electrical and Electronics Engineering	BE	5	3	0	2	4
7	MC23112	Environmental Science and Engineering (Non-Credit Course)	MC	3	3	0	0	0
8	GE23121	Engineering Practices Lab (Civil and Mechanical)	ES	2	0	0	2	1
TOTAL				26	17	3	6	20

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS23221/ HS23222	Technical Communication II / English For Professional Competence	HS	2	0	0	2	1
2	MA23212	Differential Equation and Complex variables	BS	4	3	1	0	4
3	CY23233	Engineering Chemistry	BS	5	3	0	2	4
4	GE23211	Engineering Mechanics	BE	3	2	1	0	3
5	AE23211	Fundamentals of Aerospace Engineering	PC	3	3	0	0	3
6	GE23233	Problem Solving and Python Programming	BE	6	2	0	4	4
7	GE23217	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	1	0	0	1
8	MC23111	Indian Constitution and Freedom Movement (Non-Credit Course)	MC	3	3	0	0	0
9	GE23122	Engineering Practices Lab (Electrical and Electronics)	ES	2	0	0	2	1
TOTAL				29	17	2	10	21

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MA23311	Transforms and Applied Partial Differential Equations	BS	4	3	1	0	4
2	AE23331	Solid Mechanics	PC	5	2	1	2	4
3	AE23332	Fluid Mechanics and Fluid Machinery	PC	5	2	1	2	4
4	AE23333	Aero Engineering Thermodynamics	PC	5	2	1	2	4
5	CS23422	Python Programming for Machine Learning	BE	4	0	0	4	2
6		Open elective - I	OE	3	3	0	0	3
7	AE23321	Computer Aided Modeling Laboratory	PC	4	0	0	4	2
TOTAL				30	12	4	14	23

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MA23432	Statistics and Numerical Methods	BS	4	3	0	2	4
2	AE23411	Aircraft Structures - I	PC	3	2	1	0	3
3	AE23412	Control Engineering	PC	3	3	0	0	3
4	AE23431	Incompressible Aerodynamics	PC	5	2	1	2	4
5	AE23432	Aircraft Materials and Processes	PC	5	3	0	2	4
6	AE23433	Aircraft Systems and Instruments	PC	5	3	0	2	4
7	GE23327	Soft Skills – 1	EEC	2	0	0	2	1
8		Value Added Program – I [#]	EEC	2	0	0	2	1 [#]
TOTAL				27	16	2	10	23

[#]credit not to consider for CGPA

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	AE23511	Aircraft Propulsion	PC	3	2	1	0	3
2	AE23512	Compressible Aerodynamics	PC	3	2	1	0	3
3	AE23513	Flight Dynamics	PC	3	2	1	0	3
4	AE23531	Aircraft Structures - II	PC	5	2	1	2	4
5		Professional Elective – I	PE	3	3	0	0	3
6		Open Elective – II	OE	3	3	0	0	3
7	GE23427	Soft Skills – II	EEC	2	0	0	2	1
8	AE23521	Airframe and Aero Engine Laboratory	PC	4	0	0	4	2
9	AE23621	Summer Internship	II	-	-	-	-	1
TOTAL				26	14	4	8	23

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	AE23611	Rocket Propulsion	PC	3	2	1	0	3
	AE23612	Composite Materials and Structures	PC	3	3	0	0	3
2	AE23631	Flight Vehicle Design	PC	5	3	0	2	4
3	AE23632	Innovation and Design Thinking for Engineers	EEC	3	1	0	2	2
4		Professional Elective – II	PE	3	3	0	0	3
5	AE23621	Artificial Intelligence and Machine Learning for Aeronautical Engineering	BE	4	0	0	4	2
6	AE23622	Jet propulsion Laboratory	PC	4	0	0	4	2
7	AE23623	Computational Simulation Laboratory	PC	4	0	0	4	2
8	GE23627	Problem Solving Techniques	EEC	2	0	0	2	1
TOTAL				31	12	1	18	22

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	AE23731	Avionics	PC	5	3	0	2	4
2	GE23311	Fundamentals of Management for Engineers	HS	3	3	0	0	3
3		Professional Elective – III	PE	3	3	0	0	3
4		Professional Elective – IV	PE	3	3	0	0	3
5		Professional Elective – V	PE	3	3	0	0	3
6	AE23721	Project Work Phase-1	EEC	4	0	0	4	2
7		Value Added Program – II [#]	EEC	2	0	0	2	1
TOTAL				21	15	0	6	18

#credit not to consider for CGPA

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1		Professional Elective VI	PE	3	3	0	0	3
2	AE23821	Project Work Phase II	EEC	16	0	0	16	8
TOTAL				19	3	0	16	11

CREDIT DISTRIBUTION – SEMESTER WISE

SEMESTER	NO. OF CREDITS
I	20
II	21
III	23
IV	23
V	23
VI	22
VII	18
VIII	11
TOTAL	161

VERTICALS for PROFESSIONAL ELECTIVES and HONOURS

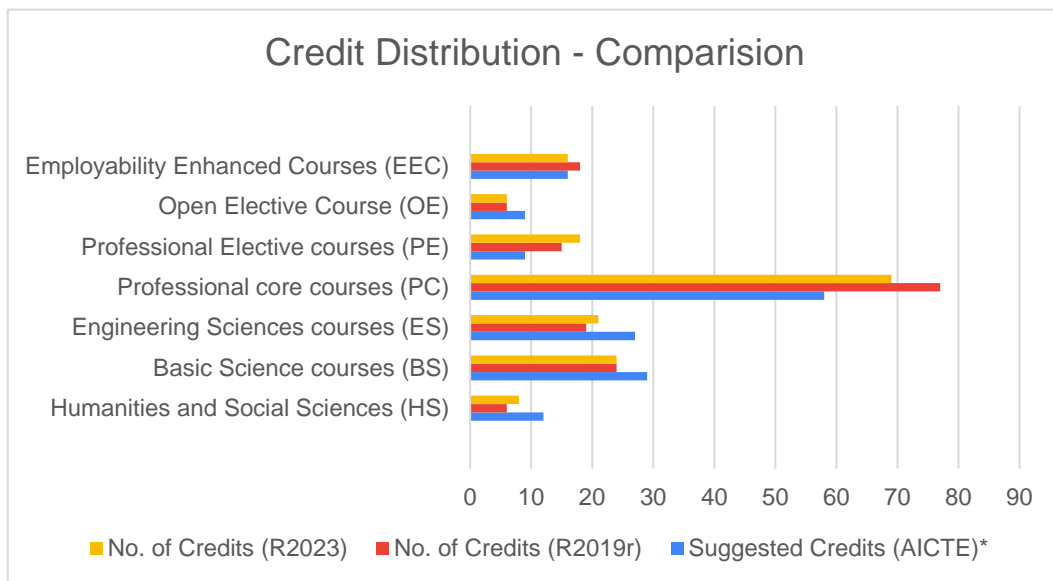
Semester	VERTICAL 1	VERTICAL 2	VERTICAL 3	VERTICAL 4	DIVERSIFIED COURSES
	Aerodynamics	Propulsion	Structures And Materials	Avionics and Drone Technology	
V	Applied Aerodynamics	Heat Transfer	Theory of Elasticity	Introduction to UAV Systems	Space Mechanics
	Launch Vehicle Aerodynamics	Design of Gas Turbine Engine components	Finite Element Methods	Communication systems	Civil Aviation Requirements
VI	Computational Aerodynamics	Advanced Propulsion Systems	Introduction to Vibrations	Drone Computing Systems	Astrophysics
	Experimental Aerodynamics	Combustion and Flames	Experimental stress Analysis	Navigation Systems	Aero Engine Maintenance and Repair
VII	Missile Aerodynamics	Combustion in Aerospace Vehicles	Fatigue and Fracture	Embedded Systems in UAV	Aircraft General Engineering and Maintenance Practices
	Hypersonic Aerodynamics	Numerical Heat transfer	Aeroelasticity	Aerospace Guidance and Control	Air Traffic Control and Planning
	Helicopter Theory	Turbo Machines	Dynamic Behaviour of Materials	Image Processing Techniques for UAV	Total Quality Management
	Introduction to Aeroacoustics	Spray Theory	Failure Analysis and NDT Techniques	Payloads and Sensors	Airframe Repair and Maintenance
VIII	Turbulence modeling in Fluid Flows	High-temperature Gas Dynamics	Theory of Plates and Shells	Drone Safety rules & Regulations	Entrepreneurship Development
	Boundary Layer Theory	Refrigeration and Cryogenics	Modern Manufacturing Processes	Robotics and Control	Mechanics of Machines

Note: The highlighted courses can't be opted for honours degree.

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

Sl. No	Category	Suggested Credits (AICTE)*	No. of Credits (R2019r)	No. of Credits (R2023)	% Distribution (R2023)
1	Humanities and Social Sciences including Management courses (HS)	12	6	8	4.9
2	Basic Science courses (BS)	29	24	24	14.9
3	Engineering Sciences courses including 3 programming subjects (ES)	27	19	21	13.0
4	Professional core courses (PC)	58	77	70	43.5
5	Professional Elective courses (PE)	9	15	18	11.1
6	Open Elective Course (OE)	9	6	6	3.7
7	Employability Enhanced Courses (EEC)	16	18	16	9.9
8	Mandatory Courses (MC) [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	0	0	0	0

*AICTE model curriculum (aicte-india.org)



TENTATIVE LIST OF VAP COURSES

S. No	Semester	Title of VAP (tentative)
1	IV	Aircraft Component Drawing
2	VII	RC Plane Modeling

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: Short Narratives and Skimming Passages.
Speaking: Introducing Oneself, Narrating a Story / Incident.
Writing: Sequential Writing (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

SUGGESTED ACTIVITIES

- Ice breaker
- Just A Minute
- Shipwreck
- Hot seat
- Vocabulary building
- Chinese whispers
- Case study

SUGGESTED EVALUATION METHODS

- 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)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
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 AERO, AUTO, MECH, MCT, R&A, CIVIL, BIOTECH, FOODTECH, CHEM						

Objectives:

- To gain knowledge in using matrix algebra techniques and the concepts of rank and nature of the matrix.
- To understand the techniques by numerical way of solving matrix Problems.
- To understand the techniques of analysing the data and apply the concept of correlation and regression in real life problems.
- To understand the techniques of calculus those are applied in the Engineering problems.
- To understand the techniques of Integration those are applied 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 STATISTICS

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 $y = ax^2 + bx + c$.

UNIT-III FUNCTIONSOFFSEVERALVARIABLES

12

Partialdifferentiation–Totalderivative–Changeofvariables–Jacobians–Partialdifferentiationofimplicitfunctions– Taylor’sseriesforfunctionsoftwovariables–Maximaandminimaoffunctionsoftwovariables–Lagrange’s method of undetermined multipliers.

UNIT-IV 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-V MULTIPLEINTEGRAL

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.

Total Contact Hours:60**Course Outcomes:**

On completion of the course students will be able to:

- Apply the concept of Eigenvalues and eigenvectors, diagonalization of a matrix for solving problems and numerical way of solving matrix problems
- Apply the concept of analysis of data, correlation and regression in real life situation.
- Analyse, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.
- Evaluate area and volume using single integration and numerical integration
- Evaluate surface area and volume using multiple integrals.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Activity Based Learning (Correlation and Regression using online calculator.)
- Implementation of small module (<https://www.wolframalpha.com/calculators/eigenvalue-calculator>)

SUGGESTED EVALUATION METHODS

Tutorial problems
Assignment problems
Quizzes

Class Presentation/Discussion

Text Book(s):

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.
<http://library.lol/main/753072EA7A0A4404C0C70587330B28AB>
2. T Veerarajan ,Fundamentals of Mathematical Statistics , yesdee publications, 2017.
<http://library.lol/main/7400A01CB4E5D8CD7DA0631EE34A25D6>
3. T Veerarajan, Engineering Mathematics –I , Mc Graw Hill Education, 2018.
<http://library.lol/main/7B66D2FA0CB50B3C37369267355677B8>

Reference Books(s) / Web links:

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt.Ltd, New Delhi, 2016.
2. Gupta S.C. and Kapoor V.K."Fundamentals of Mathematical Statistics", Sultan and Sons.
3. Erwin Kreyszig , " Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23112.1	3	2	1	-	-	-	-	-	-	-	1	-	1	-	-
MA23112.2	3	2	-	1	-	-	-	-	-	-	1	1	1	-	-
MA23112.3	2	2	-	-	-	-	-	-	-	-	1	1	-	-	-
MA23112.4	3	3	1	-	-	-	-	-	-	-	1	1	1	-	-
MA23112.5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	2.6	2.2	1	1	-	-	-	-	-	-	1	1	1	-	-

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:

- 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 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 –diamond structure - polymorphism and allotropy–graphite structure - Miller indices – determination of d-space–crystal growth techniques–solution growth –melt growth- Czochralski and Bridgmann- crystal defects.

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 ADVANCED MATERIALS & TESTING

9

Metallic glasses – preparation, properties and applications - Ceramics – types, manufacturing methods and properties – 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–hydrothermal method–properties–applications - Tensile strength – Hardness – Fatigue - Impact strength – Creep - Fracture – types of fracture.

UNIT-V 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.

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 and rigidity modulus of a wire by Torsional pendulum.
- 3 Determination of Young’s modulus of given beam by cantilever method
- 4 Determination of Velocity of ultrasound and compressibility of given liquid – Ultrasonic interferometer
- 5 Find the wavelength of Laser and particle size of given powder.
- 6 Study the Hysteresis loss of ferromagnetic material by B-H curve experiment
- 7 Determination of Thermal conductivity of a bad conductor – Lee’s Disc method.
- 8 Study the solar cell parameters.
- 9 Find the thickness of a given thin wire – Air wedge method
- 10 Determination of viscosity of the given liquid using Poiseuille’s method.

Contact Hours : 30**Total Contact Hours : 75**

Course Outcomes:

On completion of the course, the students will be able to

- apply the elastic nature of materials and determine the elastic moduli of different materials.
- apply the basic knowledge of crystal structure in solids.
- analyze and measure the properties of alloys.
- analyze various material testing methods and use them in suitable applications.
- understand the concepts of heat transfer in various applications.

Suggested Activities

- Problem solving sessions

Suggested Evaluation Methods

- Quizzes
- Class Presentation / Discussion

Text Book(s):

- 1 Bhattacharya, D.K. & Poonam, T. “*Engineering Physics*”. Oxford University Press, 2018.
- 2 Gaur, R.K. & Gupta, S.L. “*Engineering Physics*”. Dhanpat Rai Publishers, 2018.
- 3 Raghavan, V. “*Physical Metallurgy: Principles and Practice*”. PHI Learning, 2019.

Reference Books(s) / Web links:

- 1 Balasubramaniam, R. “*Callister's Materials Science and Engineering*”. Wiley India Pvt. Ltd., 2017
- 2 Resnick, R., Halliday, D., & Walker, J. “*Principles of Physics*”, Wiley India Pvt., 2018.
- 3 Raghavan, V. “*Materials Science and Engineering : A First course*”. 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PH23131.1	3	3	2	-	-	-	-	-	-	-	-	-	1	1	-
PH23131.2	3	3	2	-	-	-	-	-	-	-	-	1	1	-	-
PH23131.3	3	3	2	-	-	-	-	-	-	-	-	1	1	1	-
PH23131.4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
PH23131.5	3	2	2	-	-	-	-	-	-	-	-	1	1	1	-
Average	3	2.6	1.8	-	-	-	-	-	-	-	-	1	1	1	-

GE 23111

ENGINEERING GRAPHICS

Category	L	T	P	C
ES	2	2	0	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 these skills 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 FREE HAND SKETCH**8**

Curves used in engineering practices: Conics–Construction of ellipse, parabola and hyperbola by eccentricity method– Construction of cycloids, Construction of involutes of square and circle drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT-II PROJECTION OF POINTS, LINES AND PLANE SURFACE**9**

Orthographic projection- principles-Principal planes- projection of points. First angle projection - Projection of straight lines 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**9**

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.

UNIT-IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**9**

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of the section.

Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT-V ISOMETRIC AND PERSPECTIVE PROJECTIONS**9**

Principles of isometric projection–isometric scale–Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders and cones.

Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Total Contact Hours : 45

Course Outcomes: After learning the course, the students should be able

- To construct different plane curves and free hand sketching of multiple views from pictorial objects.
- To comprehend the theory of projection and to draw the basic views related to projection of points, lines and planes
- To draw the projection of solids in different views
- To draw the projection of Sectioned solids and development of surfaces of solids
- To visualize and prepare Isometric and 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 Natrajan 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 Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

- 3 Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2017.
- 4 Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill Publishing Company Limited, New Delhi, 2018.

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
GE23111.1	2	1	2	1	1	1	1	1	1	1	2	2	2	2	3
GE23111.2	2	1	2	1	1	1	1	1	1	1	2	2	2	2	3
GE23111.3	2	1	2	1	1	1	1	1	1	1	2	2	2	2	3
GE23111.4	1	1	2	1	1	1	1	1	1	1	2	2	2	2	3
GE23111.5	2	1	2	1	1	1	1	1	1	1	2	2	2	2	3
Average	1.8	1	2	1	1	1	1	1	1	1	2	2	2	2	3

Subject Code
GE23117

தமிழர மரபு / Heritage of Tamils
Common to all branches of B.E / B.Tech programmes

Category L T P C
HS 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 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 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, கையெழுத்துப்படிிகள் - 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. பொருநை - 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 (Lab oriented Theory Courses)	Category	L	T	P	C
EE23133	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (COMMON TO AERO, CSE, CHEM, CIVIL, FT AND IT)	ES	3	0	2	4

Objectives:

- To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.
- To impart knowledge on the analysis of AC circuits
- To expose the principles of electrical machines and electronic devices.
- To teach the concepts of different types of electrical measuring instruments and transducers.
- To experimentally analyze the electrical circuits and machines, electronic devices and transducers.

UNIT-I DC CIRCUITS

9

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff 's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT-II AC CIRCUITS

9

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations series resonance. Three phase balanced circuits, voltage and current relations in star and delta connections

UNIT-III ELECTRICAL MACHINES

9

Construction, Principles of operation of DC machines, Single phase Transformers, Synchronous machines, Single phase induction motors.

UNIT-IV ELECTRONIC DEVICES & CIRCUITS

9

Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction diode–Forward and Reverse Bias – Bipolar Junction Transistor – Common Emitter characteristics –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier.

UNIT-V MEASUREMENTS & INSTRUMENTATION

9

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Piezoelectric, - Classification of instruments - PMMC and MI Ammeters and Voltmeters – Digital Storage Oscilloscope.

Contact Hours : 45**List of Experiments**

- 1 Verification of Kirchhoff's Laws.
- 2 Load test on DC Shunt Motor.
- 3 Load test on Single phase Transformer.
- 4 Load test on Single phase Induction motor.
- 5 Characteristics of P-N junction Diode.
- 6 Characteristics of CE based NPN Transistor.
- 7 Characteristics of LVDT, RTD and Thermistor.

Contact Hours : 30**Total Contact Hours : 75****Course Outcomes:**

On completion of the course, the students will be able to

- analyse DC and AC circuits and apply circuit theorems.
- calculate the power and power factor in AC circuits
- understand the principles of electrical machines.
- comprehend the principles of different types of electronic devices, electrical measuring instruments and transducers.
- experimentally analyze the electric circuits, electrical machines, electronic devices, and transducers.

Suggested Activities

- Problem solving sessions.

Suggested Evaluation Methods

- Quizzes
- Class Presentation / Discussion

Text Book(s):

- 1 J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K.Kataria & Sons Publications, 2002.
- 2 Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Schaum Series and Systems", Schaum's Outlines, Tata McGrawHill, Indian. 5th Edition, 2017
- 3 Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008

Reference Books(s) / Web links:

- 1 Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
- 2 John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
- 3 Allan S Moris, "Measurement and Instrumentation Principles", Elsevier, First Indian Edition, 2006
- 4 Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
- 5 A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
- 6 D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint, 2016
- 7 <https://nptel.ac.in/courses/108108076>

Lab Equipment Required:

Sl. No.	Name of the Equipment	Quantity Required (For a batch of 30 students)
1. Verification of ohms and Kirchhoff's Laws		
	1. DC Regulated Power supply (0 - 30 V variable)	1
	2. Bread Board	1
	3. Resistors	As per Circuit diagram
	4. Multimeter	As Required
	5. Connecting wires	
2. Load test on DC Shunt Motor.		
	1. Ammeter MC (0-20A)	1
	2. Voltmeter MC (0-300)V	1
	3. Tachometer	1
	4. Field Rheostat 500 Ω , 1.5 A	1
	5. Connecting wires	As Required
3. Load Test on Induction Motor		
	1. Ammeter MI (0-20A)	1
	2. Voltmeter MI (0-300)V	1
	3. Wattmeter – 300V, 30 A	1
	4. Tachometer – Digital	1
	5. Connecting Wires	As Required
	6. Single phase Induction motor	
4. Load test on Single phase Transformer		
	1. Ammeter (0-30) A, (0-5) A	1
	2. Voltmeter (0-150)V, (0-300)V	1
	3. Wattmeter – 300V, 5A, UPF	1
	4. Autotransformer	1
	5. Single phase Transformer	1
	6. Connecting Wires	As Required
5. Characteristics of PN and Zener Diodes		
	1. PN Diode (IN4007), Zener diode (6.8V, 1A)	1
	2. Resistor 1 K Ω , 100 Ω	1
	3. Bread Board	1
	4. DC Regulated Power supply (0 - 30 V variable)	1
	5. Multimeter	1
	6. Connecting wires	As Required

6. Characteristics of BJT

- | | |
|---|-------------|
| 1. Transistor (BC107) | 1 |
| 2. Resistors- 1k Ω , 470K Ω , 1M Ω | 1 |
| 3. Bread Board | 1 |
| 4. DC Regulated Power supply (0 - 30 V variable) | 1 |
| 5. Multimeter | 1 |
| 6. Connecting wires | As Required |

7. Measurement of displacement of LVDT, RTD and Thermistor

- | | |
|---------------|---|
| 1. LVDT Kit | 1 |
| 2. RTD | 1 |
| 3. Thermistor | 1 |
| 4. Multimeter | 1 |

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE23133.1	3	3	3	3	-	3	1	1	2	1	1	1	1	1	2
EE23133.2	3	3	3	3	-	3	1	1	2	1	1	1	1	1	2
EE23133.3	3	3	3	3	-	3	1	1	2	1	1	1	2	2	2
EE23133.4	3	3	3	3	-	3	1	1	2	1	1	1	1	2	2
EE23133.5	3	3	3	3	-	3	1	1	2	1	1	1	2	2	-
Average	3	3	3	3	-	3	1	1	2	1	1	1	1	2	2

Subject Code
MC23112

Subject Name (Theory course)
ENVIRONMENTAL SCIENCE AND ENGINEERING

Category	L	T	P	C
MC/BS	3	0	0	0

Objectives:

- 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 develop skills to solve environmental degradation issues.

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-wastewater recycling and 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:Treatment Methods – neutralization, oxidation reduction, precipitation, solidification, stabilization, incineration and final disposal E-waste-definition-sources-effects on human health and environment- E-waste management- recovery of metals-Role of E-waste management within the initiatives of the Govt. of India- Swachh Bharat Mission-soil contamination and leaching of contaminants into groundwater.

UNIT-IV Sustainable Development

9

Sustainable development- concept-dimensions-sustainable development goals-Value Education- Gender equality- Poverty-Hunger-Famine-Natural Hazards management- -Twelve principles of green chemistry, Green technology-definition, importance, factors affecting green technology- Cleaner development mechanism, role of industry; reuse, reduce and recycle, raw material substitution; wealth from waste; 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 Law and Policy- Objectives; Polluter pays principle, Precautionary principle; The Water and Air Acts with amendments-The Environment (Protection) Act (EPA) 1986; Role of Information technology in environment and human health.

Course Outcomes:

On completion of the course, the students will be able to

- 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 Books:

- 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 Publishers, 2018.
- 3 Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi

Reference Books

- 1 R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. Edition 2010.
- 2 Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
- 3 Fowler B, Electronic Waste – 1 st Edition (Toxicology and Public Health Issues), 2017Elsevier

Web links:

- 1 https://onlinecourses.nptel.ac.in/noc19_ge22/
- 2 [NPTEL](#)
- 3 <https://news.mit.edu/2013/ewaste-mit>

Suggested activities

1. Case studies presentation

Method of evaluation

1. Classroom presentations on case studies (or) Site visits, instead of CAT-I (or)CAT-II or CAT III

CO/PO- PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
MC23112.1	3	2	3	2	1	3	3	2	1	1	1	2	1	1	1
MC23112.2	3	2	3	2	1	3	3	2	1	1	2	2	1	1	1
MC23112.3	3	2	3	1	1	3	3	2	1	1	1	1	1	1	1
MC23112.4	3	2	3	1	2	2	3	2	2	2	1	2	1	1	1
MC23112.5	3	2	2	1	1	2	3	1	1	2	1	1	-	-	1
Average	3	2	2.8	1.4	1.2	2.6	3	1.8	1.2	1.4	1.2	1.6	1	1	1

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE23117	ENGINEERING PRACTICES LABORATORY – 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.

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
GE23117.1	3	3	3	3	3	1	1	-	2	1	3	3	2	2	3
GE23117.2	3	3	3	3	2	2	2	-	2	1	3	3	1	2	2
GE23117.3	3	3	3	3	3	1	1	-	2	1	3	3	2	2	2
GE23117.4	3	3	2	2	2	1	1	-	2	1	3	3	1	2	2
GE23117.5	3	3	2	2	2	1	1	-	2	1	3	3	2	2	2
Average	3	3	2.6	2.6	2.6	1.2	1.2	-	2	1	3	3	1.4	2	2.2

SEMESTER II

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
HS23221	TECHNICAL COMMUNICATION II	Theory	0	0	2	1
Common to all branches of B.E/B. Tech programmes –Second Semester						

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.,**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

- 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

- Story Lines
- One truth and two lies
- Hang Man
- Pictionary
- Word Scramble
- Case study

SUGGESTED EVALUATION METHODS

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

Text Book(s):

1. Raymond Murphy, "Intermediate English Grammar," Second Edition, Cambridge University Press, 2018
2. Meenakshi Raman & Sangeeta Sharma, "Technical Communication" Third Edition, Oxford University Press, 2015
3. 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

CO/PO-PSO	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	-	-	-	-	-

Course Code	Course Title	Category	L	T	P	C
HS23222	ENGLISH FOR PROFESSIONAL COMPETENCE	HS	0	0	2	1

Common to all branches of II sem. B.E./ B.Tech. programmes

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

Textbook(s):

- 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.

CO/PO-PSO	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	-	-	-

Course Code	Course Title	Category	L	T	P	C
MA23212	DIFFERENTIAL EQUATION AND COMPLEX VARIABLES	BS	3	1	0	4
Common to II Sem. B.E. –AERO, AUTO, BME, CIVIL, EEE, ECE, MECH, MCT, Robotics and Automation and B. Tech. - BIOTECH, FOODTECH. & CHEM						

Objectives:

- To handle practical problems arising in the field of engineering and technology using differential equations.
- To solve problems using the concept of Vectors calculus, Complex analysis, Laplace transforms.

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 – Singular integrals - 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- Classification of PDE.

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 various techniques in solving ordinary differential equations.
- Develop skills to solve different types of partial differential equations.
- Use Laplace transform and inverse transform techniques in solving differential equations.
- Use the concept of Gradient, divergence and curl to evaluate line, surface and volume integrals.
- Use the concept of Analytic functions, conformal mapping and complex integration for solving Engineering problems.

SUGGESTED ACTIVITIES

Problem solving sessions.

Activity Based Learning (<https://www.geogebra.org/?lang=en>)

SUGGESTED EVALUATION METHODS

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

Text Book(s):

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2015.
2. Veerarajan. T, Engineering Mathematics –II, Mc Graw Hill Education, 2018.
3. <http://library.lol/main/67F2BE1AE06780C5A5BC684EB23A18F7>

Reference Books(s) / Web links:

1. Ramana. B.V., "Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. <http://library.lol/main/753072EA7A0A4404C0C70587330B28AB>
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, 4th Edition 2012.
5. T Veerarajan, Transforms and Partial Differential Equations, Third Edition, 2018.

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

Subject Code	Subject Name (Theory Laboratory embedded course)	Category	L	T	P	C
CY23233	ENGINEERING CHEMISTRY (Common to B.E. – AERONAUTICAL, AUTOMOBILE, MECH and CIVIL ENGG.)	BS	3	0	2	4

Objectives:

- 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

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.

UNIT-II PHASE RULE AND THERMAL ANALYSIS 9

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

UNIT-III POLYMERS AND COMPOSITES 9

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

UNIT-IV FUELS AND ENERGY STORAGE DEVICES 9

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 (H_2-O_2) fuel cell, proton exchange membrane and solid oxide fuel cells.

UNIT-V NANOMATERIALS AND LUBRICANTS 9

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 MoS_2)

Total Contact Hours:45

Description of the Experiments

Total Contact Hours:15

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

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

CY23233.1: explain and the fundamental concepts of corrosion, its control and surface modification methods such as electroplating and electroless plating

CY23233.2: apply the concept of phase rule in alloying and predict its thermal properties

CY23233.3: identify the different types of plastics and composite materials of industrial importance

CY23233.4: categorize the types of fuels and the energy storage devices

CY23233.5: synthesize nanomaterials for modern engineering and technology

SUGGESTED ACTIVITIES

Electroplating of desired metal on substrate.
Synthesis of biodiesel

SUGGESTED EVALUATION METHODS

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

Textbook(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

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>

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

SUGGESTED EVALUATION METHODS

- Experiment based viva
- Quizzes

Web links for virtual lab (if any)

<https://drive.google.com/drive/folders/1k8g7fGRJ0DI8FpbjQYg4l5jS1U9qIXnJ>

CO/PO-PSO	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	-
Average	2.4	1	1.4	-	-	0.4	0.6	-	-	-	-	1	-	1.6	-

Subject Code
GE 23211

ENGINEERING MECHANICS
(Common to Mech, Aero, Auto Civil and MCT)

Category	L	T	P	C
ES	2	1	0	3

Objectives:

- To understand the basics of mechanics and apply the concept of equilibrium to solve problems of concurrent forces.
- To understand the concept of equilibrium and to solve problems of rigid bodies.
- To learn about the center of gravity and moment of inertia of surfaces and solids.
- 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 – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – 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 three dimensions – (Descriptive treatment only)

UNIT-III PROPERTIES OF SURFACES AND SOLIDS

9

Centroids 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

9

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.

UNIT-V FRICTION AND RIGID BODY DYNAMICS

9

Friction force – Laws of sliding 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: On the successful completion of the course, students will be able to

- GE 23211.1 Comprehend and analysis the forces in the system.
- GE 23211.2 Solve problems in engineering systems using the concept of static equilibrium.
- GE 23211.3 Determine the centroid of objects such as areas and volumes, center of mass of body and moment of inertia of composite areas.
- GE 23211.4 Solve problems involving kinematics and kinetics of rigid bodies in plane motion.
- GE 23211.5 Solve problems involving frictional phenomena in machines.

Text Book (s):

- 1 Beer, F.P and Johnston Jr. E.R, Cornwell and Sanghi ., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 11th Edition, McGraw-Hill Publishing company, New Delhi (2017).
Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
- 2

Reference Books(s) / Web links:

- 1 Meriam J.L. and Kraige L.G., “Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, Wiley India, 2017.
- 2 Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education 2010.
- 3 Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics” 4th Edition, Pearson Education 2006.
- 4 S S Bhavikatti, Engineering Mechanics, New Age International Publishers, 2016
- 5 Vela Murali, “Engineering Mechanics”, Oxford University Press (2010)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
GE 23211.1	3	2	2	2	1	1	-	-	-	-	-	1	3	2	3
GE 23211.2	3	2	2	2	1	1	-	-	-	-	-	1	3	2	3
GE 23211.3	3	2	2	2	1	1	-	-	-	-	-	1	3	2	3
GE 23211.4	3	2	2	2	1	1	-	-	-	-	-	1	3	2	3
GE 23211.5	3	2	2	2	1	1	-	-	-	-	-	1	3	2	3
Average	3	2	2	2	1	1	-	-	-	-	-	1	3	2	3

Subject Code	Subject Name	Category	L	T	P	C
AE23211	FUNDAMENTALS OF AEROSPACE ENGINEERING	PC	3	0	0	3

Objectives:

- To introduce the concepts and evolution of flight.
- To understand different types of flying vehicles.
- To introduce basic aerodynamics, structural elements and propulsion of aircrafts
- To introduce the fundamental space mechanics.

UNIT-I AIRCRAFT CONFIGURATIONS**9**

History of flight-different types of flight vehicles, classification, components and functions of typical transport aircraft, three view diagram, helicopter and UAV parts and functions. Physical properties and structure of the atmosphere, ISA, temperature, pressure and altitude relationships,

UNIT-II BASICS OF AERODYNAMICS**10**

Newton's law of motions applied to aeronautics - aerofoil and wing geometry, NACA series airfoils, generation of lift, Mach number and ranges, aerodynamic center, pressure coefficients, aspect ratio, types of drag- induced drag, lift and drag curves, sweepback on wing, basics of pitot tube.

UNIT-III AIRPLANE STRUCTURES AND MATERIALS**9**

General types of construction, monocoque and semi-monocoque, typical wing and fuselage structure. metallic and non-metallic materials, use of aluminium alloy, magnesium alloy, titanium, stainless steel, plastics, composite materials and smart structures, applications.

UNIT-IV POWER PLANTS**10**

Classification of propulsive engines -basics about piston, turbojet, turboprop and turbofan - use of propeller and jets for thrust production -equations, principles of operation of rocket, types of rockets and typical applications, exploration into space- India.

UNIT-V BASICS OF SPACE MECHANICS**7**

Keplar laws, equation, two body problem, fundamentals of orbital mechanics, orbital elements. Orbital transfers, space environment-atmosphere, radiation and magnetic field, space debris.

Total Contact Hours : 45**Course Outcomes:**

On completion of the course students will be able to

- AE23211.1 Identify the component of aircraft
- AE23211.2 Develop the knowledge on basic aerodynamics
- AE23211.3 Identify suitable materials for aircraft structure
- AE23211.4 Analyze the different types of power plants used in aircraft propulsion.
- AE23211.5 Understanding the basics of space mechanics

Text Books:

- Anderson, J.D., "Introduction to Flight", Tata McGraw-Hill, 2010..

Reference Books / Web links:

- Kermode, A.C., "Mechanics of Flight", Pearson Education; 11th edition
- Kermode, A.C., "Flight without Formula", Pearson Education; 5th edition

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23211.1	2	1	1	1	1	2	0	0	0	0	0	0	3	1	0
AE23211.2	3	2	1	3	1	0	0	1	0	0	1	2	3	1	1
AE23211.3	3	2	2	1	0	0	1	1	0	0	0	2	3	1	0
AE23211.4	3	1	2	1	0	1	1	0.5	0	0	0	2	3	1	0
AE23211.5	3	2	1	0	0	2	3	1	0	0	0	3	2	0	0
Average	2.8	1.6	1.4	1.4	1	1.67	1.67	0.87	0	0	1	2.25	2.8	1	1

Subject Code GE23233	Subject Name (Laboratory Course) PROBLEM SOLVING AND PYTHON PROGRAMMING (With effect from 2021 batch onwards) Common to all branches of B.E / B.Tech programmes (Except – CSE, CSBS, CSD, IT, AI/ML)	Category ES	L 2	T 0	P 4	C 4
--------------------------------	---	-----------------------	---------------	---------------	---------------	---------------

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 Demo on Python IDLE / Anaconda distribution.
3. Experiments based on Variables, Datatypes 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 Python 3, 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 Python 3.2, NetworkTheory 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 ProblemSolving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

Platform Needed:

Python 3 interpreter for Windows/Linux

CO - PO – PSO matrices of course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
GE23233.1	2	2	2	2	1	-	-	-	1	1	1	1	3	3	-
GE23233.2	2	1	1	1	1	-	-	-	-	-	1	1	3	2	-
GE23233.3	1	1	2	1	2	-	-	-	-	-	1	1	2	3	2
GE23233.4	2	2	3	2	2	-	-	-	-	-	2	1	2	2	2
GE23233.5	2	2	3	2	3	-	-	-	-	-	2	1	2	2	2
Average	1.8	1.6	2.2	1.6	1.8	-	-	-	1	1	1.4	1	2.4	2.4	2

Subject Code
GE23217தமிழ்நாடு தொழில்நுட்பமும் / Tamils and Technology
Common to all branches of B.E / B.Tech programmesCategory L T P C
HS 1 0 0 1**அலகு I நெசவு மற்றும் பாணைத் தொழில்நுட்பம்: 3**

சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் 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 குழுமித் தாம்பின் 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. 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
MC23111	INDIAN CONSTITUTION AND FREEDOM MOVEMENT	MC	3	0	0	0

Objectives: To inculcate the values enshrined in the Indian constitution.

- To create a sense of responsible and active citizenship.
- To know about Constitutional and Non- Constitutional bodies.
- To understand sacrifices made by the freedom fighters.

UNIT-I INTRODUCTION: Historical Background – 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. Constitution’ meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy. 9

UNIT-II Structure and Function of Central Government: Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. 9

UNIT-III Structure And Function Of State Government And Local Body: 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. 9

UNIT-IV Constitutional Functions and Bodies: Indian Federal System – Center – 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. 9

UNIT-V Indian Freedom Movement: 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. 9

Total Contact Hours : 45

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

- MC23111.1** Understand the functions of the Indian government.
MC23111.2 Understand and abide the rules of the Indian constitution.
MC23111.3 Gain knowledge on functions of state Government and Local bodies.
MC23111.4 Gain Knowledge on constitution functions and role of constitutional bodies and non-constitutional bodies.
MC23111.5 Understand the sacrifices made by freedom fighters during freedom movement.

Text Book (s):

- 1 Durga Das Basu, “Introduction to the Constitution of India “, Lexis Nexis, New Delhi., 21st ed 2013.
- 2 Bipan Chandra, History of Modern India, Orient Black Swan, 2009.
- 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.2nd ed, 2014.
- 5 P K Agarwal and K N Chaturvedi , Prabhat Prakashan, New Delhi, 1st 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.

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

Subject Code
GE23122

Subject Name
ENGINEERING PRACTICES LAB- ELECTRICAL AND ELECTRONICS

Category **L T P C**
ES 0 0 2 1

Objectives:

- To provide hands-on experience on various basic engineering practices in Electrical Engineering.
- To impart hands-on experience on various basic engineering practices in Electronics Engineering.

List of Experiments**A. ELECTRICAL ENGINEERING PRACTICE**

- 1 Residential house wiring using switches, fuse, indicator, 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 resistance to earth of electrical equipment.
- 6 Study of Ceiling Fan and Iron Box

B. ELECTRONICS ENGINEERING PRACTICE

- 1 Study of electronic components and equipment's – Resistor, colour coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
 - (a) Study of Multimeter
 - (b) Testing of electronic components.
- 2 Study of logic gates AND, OR, EXOR and NOT.
- 3 Generation of Clock Signals.
- 4 Soldering practice – Components Devices and Circuits – Using general purpose PCB.
- 5 Measurement of ripple factor of HWR and FWR.

Total Contact Hours : 30

Course Outcomes:

On completion of the course, the students will be able to

- fabricate the electrical circuits
- construct the house wiring circuits
- fabricate the electronic circuits
- verify the truth table of logic gates
- design the AC-DC converter using diodes and passive components

SUGGESTED EVALUATION METHODS

- Experiment based Viva

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE23122.1	3	3	3	2	-	-	2	-	3	2	-	3	1	2	1
GE23122.2	3	3	2	2	-	-	2	-	3	2	-	3	1	2	1
GE23122.3	3	3	3	2	-	-	2	-	3	2	-	3	1	2	1
GE23122.4	3	3	3	2	-	-		-	3	2	-	3	1	1	1
GE23122.5	3	3	3	2	-	-		-	3	2	-	3	1	2	1
Average	3	3	2.67	2	-	-	2	-	3	2	-	3	1	2	1

SEMESTER III

Course Code	Course Title	Category	L	T	P	C
MA23311	TRANSFORMS AND APPLIED PARTIAL DIFFERENTIAL EQUATIONS	BS	3	1	0	4
Common to III sem. B.E. - AERO, MCT, R&A and B.Tech. – BT, FT and CHEM						

Objectives:

- To express Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- To show continuous function arising in wave and heat propagation, signals and systems using Fourier Transforms.
- To obtain solution of one dimensional wave equation with finite difference techniques.
- To solve one and two dimensional heat flow equations using finite difference methods and numerical techniques.
- To make use of Z-transform to illustrate discrete function arising in wave and heat propagation, signals and systems.

UNIT-I FOURIER SERIES**12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.

UNIT-II FOURIER TRANSFORMS**12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application to boundary value problems.

UNIT-III WAVE EQUATION**12**

Solution of one dimensional wave equation - Finite difference techniques for the solution for PDE- One Dimensional Wave Equation by Explicit method

UNIT-IV HEAT EQUATION**12**

One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges)- Numerical computation :One dimensional heat flow equation by implicit and explicit methods

UNIT-V Z-TRANSFORMS**12**

Z- transforms - Elementary properties – Inverse Z - transform (using residues) - Formation of difference equations – Solution of difference equations using Z- transform.

Total Contact Hours: 60**Course Outcomes:**

On completion of the course, students will be able to

- Demonstrate Fourier series to study the behaviour of periodic functions and their applications in engineering problems such as system communications, digital signal processing and field theory.
- Apply the shifting theorems, Fourier integral theorems, Inverse Fourier sine and cosine transforms appropriate problems in engineering and technology.
- Evaluate solution of one dimensional wave equation arising in various field of engineering using finite difference techniques.
- Apply the numerical techniques of differentiation to solution of heat flow equations arising in various branches of engineering.
- Use Z-transform to illustrate discrete function arising in wave and heat propagation, signals and systems.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Activity Based Learning
- Online MATLAB session can be implemented

SUGGESTED EVALUATION METHODS

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

Text Books:

- 1 Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2015.
- 2 Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt.Ltd.,New Delhi, Second reprint, 2012.
- 3 Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2014.
- 4 Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
- 5 P. Kandasamy, K. Gunavathy, Thilagavathy., "Engineering Mathematics Transforms and Partial Differential Equations", S.Chand & Company, 2002.

Reference Books / Web links:

- 1 N. Subramaniam, K. S. Ramaswami ., "Transforms and Partial Differential Equations", Pearson Education, 2018.
- 2 Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
- 3 Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
- 4 Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), 7th Edition, New Delhi, 2009.
- 5 Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi, 2012. <https://drspmaths.files.wordpress.com/2020/01/advanced-engineering-mathematics-peter-v-o-neil.pdf>

COs / POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23311.1	3	3	3	2	1	-	-	-	-	-	-	1	2	1	2
MA23311.2	3	3	3	2	1	-	-	-	-	-	-	1	2	1	2
MA23311.3	3	3	3	3	2	-	-	-	-	-	-	2	1	2	2
MA23311.4	3	3	2	3	2	-	-	-	-	-	-	2	1	-	1
MA23311.5	2	3	2	-	-	-	-	-	-	-	-	-	1	1	-
Average	2.8	3	2.6	2.5	1.5	-	-	-	-	-	-	1.5	1.4	1.3	2

Subject Code
AE23331

Subject Name
SOLID MECHANICS

Category	L	T	P	C
PC	2	1	2	4

Objectives:

- Understand the theoretical basis about the stress, strain and elastic modulus concepts in various components
- Assess shear stresses, bending moments and stress variation through mathematical models of beams subjected to axial load, transverse load, couples and combination of loads.
- Understand the principles underlying in the deflection of solid structural member such as a beam subjected to different types of loads.
- Apply the basic mechanical principles to solve practical problems related to springs and shafts subjected to axial load, torsion, bending, transverse shear and combined loading.
- Analyze the state of stress and strain at any point in a member.

UNIT-I STRESS STRAIN RELATIONS**9**

Introduction – Stress-Strain Relation – Poisson's ratio – Elastic moduli - Composite bars – Temperature stresses - Theory of elasticity: Equilibrium and compatibility equations

UNIT-II STRESSES IN BEAMS**9**

Shear force and bending moment diagrams for statically determinate beam structures - bending and shear stress variation in beams of symmetric cross sections

UNIT-III DEFLECTION OF BEAMS**9**

Deflection of statically determinate beam structures - Double integration method – Macaulay's method

UNIT-IV TORSION – SPRINGS**9**

Torsion of solid and hollow circular shafts - Stresses in open and closed-coiled helical springs

UNIT-V BIAXIAL STRESSES**9**

Determination of principal stresses - Stresses in thin-walled pressure vessels – Combined loading of circular shaft with bending, torsion and axial loadings

Total Contact Hours : 45

List of Experiments

- 1 Tension test on a Metal / Composite specimen
- 2 Shear force and bending moment diagram using software packages
- 3 Determination of deflection of simply supported and cantilever beam using software packages.
- 4 Torsion test on mild steel rod
- 5 Deflection of open and closed coil helical springs.
- 6 Unsymmetrical bending of cantilever beam

Contact Hours : 15
Total Contact Hours : 60

Course Outcomes:

- AE23331.1 Design and conduct experiments on mechanical testing and also could analyze and interpret data
- AE23331.2 Apply shear force and bending moment diagrams to analyse the resistance offered by the beam and able to solve practical problems and through the software.
- AE23331.3 Apply computational skills to formulate and solve problems related to the deflections of beams subjected to mechanical loads.
- AE23331.4 Describe and recognize the behaviour of materials upon normal external loads on springs and shafts
- AE23331.5 Identify, formulate, and solve structural engineering problems.

SUGGESTED ACTIVITIES (if any) (UNIT/ Module Wise) – Could suggest topic

- **Case Study 1:** Analyze the stress distribution on the wing skin of an aircraft due to aerodynamic loads. Investigate the stress-strain behavior of composite materials used in aircraft construction.
- **Case Study 2:** Analyze the effect of temperature changes on the structural elements of an aircraft, such as engine mounts. Assess the stresses generated due to differential thermal expansion and contraction.
- **Case Study 3:** Calculate the deflection of aircraft wing components, such as ailerons or flaps, subjected to aerodynamic loads.
- **Case Study 4:** Analyze the torsional behavior of the engine shaft in an aircraft's propulsion system.
- **Case Study 5:** Study the stresses in landing gear springs, which absorb impact forces during landings. Calculate the stresses to ensure their durability and reliable performance.

SUGGESTED EVALUATION METHODS (if Any) (UNIT/ Module Wise) – could suggest topic

- Tutorial problems
- Assignment problems / Case study
- Quizzes
- Class Presentation/Discussion

Textbook(s):

1. Strength of Materials, R Subramanian, Oxford University Press, Third edition (2016). ISBN-10-9780199464739
2. Mechanics of Materials, Egor G. Popov, Pearson Education India; Second edition (2015), ISBN-10: 9789332559547
3. Mechanics of Materials, R C Hibbeler, Pearson Education, Tenth Edition (2022). ISBN-10-9354492258

Reference Books(s) / Web links:

- Srinath, L. S., Advanced Mechanics of Solids, 2nd ed., Tata McGraw-Hill (2003).
- Timoshenko and Gere, "Mechanics of Materials", Tata McGraw Hill, 1993.

Lab equipment required:

S. No	Name of the Equipment	Quantity Required	Remarks
1.	Universal Testing Machine – up to 50 KN load capacity	1	Expt. 1
2.	Computers with Python / MATLAB / Ansys installed packages	30	Expt. 2 & 3
3.	Torsion Testing Machine (60 NM Capacity)	1	Expt. 4
4.	Spring Testing Machine for tensile and compressive loads (2500 N)	1	Expt. 5
5.	Unsymmetrical bending set up	1	Expt. 6
6.	Dial gauge with dial stand	2	Expt. 6

CO-PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23331.1	2	3	2	1	1	0	-	-	-	-	-	1	2	2	-
AE23331.2	3	3	2	1	1	1	-	-	-	-	-	1	3	2	-
AE23331.3	3	3	3	2	1	1	-	-	-	-	-	1	3	2	-
AE23331.4	3	3	3	2	0	1	-	-	-	-	-	2	3	2	-
AE23331.5	3	3	3	2	0	1	-	-	-	-	-	2	3	1	-
Average	2.8	3	2.6	1.6	1	1	0	0	0	0	0	1.4	2.8	1.8	0

Subject Code	Subject Name	Category	L	T	P	C
AE23332	FLUID MECHANICS AND FLUID MACHINERY	PC	2	1	2	4

Objectives:

- To define Fluid properties commonly used in the analysis of fluid flow.
- To understand forces applied by fluids at rest or in rigid-body motion and to present conservation equations of fluid flow
- To imbibe fundamental principles of dimensional analysis and to introduce important methods of dimensional analysis
- To provide a general physical description of internal flow and introduce pressure drop correlations for pipe flow.
- To Apply dimensional analysis for preliminary design of turbomachinery

Unit I	Fluid Statics	9
---------------	----------------------	---

Introduction and Basic concepts – Properties of fluids- Pressure- Pressure measurement devices-Buoyancy and stability.

Unit -II	Fluid Kinematics and conservation equations.	9
-----------------	---	---

Lagrangian and Eulerian Description of fluid flow - Reynolds Transport Theorem –Continuity, Momentum, Bernoulli and Energy Equations

Unit -III	Dimensional Analysis and Modelling	9
------------------	---	---

Dimensional Homogeneity – Method of repeating variables- Buckingham Pi Theorem- Experimental Testing and Incomplete Similarity

Unit -IV	Flow in pipes	9
-----------------	----------------------	---

Overview of fluid flow in pipes and channels, Entrance Region-Laminar and Turbulent flow in pipes-Minor Losses – Pipes in parallel and in series– Orifice, Venturi and Nozzle Meters. Types of flow in open channels (uniform and non-uniform), Manning's equation.

Unit -V	Turbomachinery	9
----------------	-----------------------	---

Classification and Terminology – Hydrodynamic force of jets, Hydraulic Turbines- Euler's turbine equations -Francis, and Pelton Turbines - Turbine scaling laws.

Contact Hours : 45

List of Experiments

- 1 Determination of metacentric height [1]
- 2 Determination of the coefficient of discharge for given orifice and venturi meters [1, 3]
- 3 Experimental verification of Bernoulli's theorem [2]
- 4 Flow visualization studies on bluff bodies in a water table [3, 4]
- 5 Determination of friction factor for a given set of pipes [4]
- 6 Determination of performance curves for Pelton wheel turbine. [5]

Contact Hours : 15

Total Contact Hours : 60

Course Outcomes:

On completion of the course students will be able to

- AE23332.1** Define, Distinguish and Evaluate Fluid properties. And analyse the stability of floating and submerged bodies
- AE23332.2** Apply conservation principles to formulate governing equations for fluid flows.
- AE23332.3** Apply Bernoulli equation to solve fluid flow problems and Work with energy equation to determine turbine power output.
- AE23332.4** Calculate the major and minor losses associated with pipe flow in piping networks and Understand various velocity and flow rate measurement techniques
- AE23332.5** Apply dimensional analysis to design new hydraulic turbines that are geometrically similar to existing turbines.

Suggested Activities

Problem solving sessions

Flipped classroom – Comparing characteristics of each category of missiles

Suggested Evaluation Methods

Tutorial problems

Assignment problems

Quizzes

Class Presentation/Discussion

Textbook(s):

- 1 Yunus A. Cengel and John M. Cimbala. "Fluid Mechanics Fundamentals and Applications", McGraw Hill Edition 2006, Sixth Reprint 2009.

Reference Books:

- 1 Frank M White, "Fluid Mechanics", McGraw Hill, 9th Edition, 2022
- 2 Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, "Fluid Mechanics and Machinery", 10th ed., 2021.
- 3 Bruce R. Munson, Alric P. Rothmayer, Theodore H. Okiish, "Fundamentals of Fluid Mechanics", Wiley, 2017

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23332.1	3	3	-	-	2	-	-	-	-	-	-	1	2	2	1
AE23332.2	3	2	1	1	1	1	1	-	-	-	-	1	-	-	-
AE23332.3	3	3	2	1	-	1	1	-	-	-	-	-	2	2	-
AE23332.4	3	3	-	3	2	-	-	-	-	-	-	2	2	2	1
AE23332.5	3	3	2	1	-	1	1	-	-	-	-	1	2	2	-
Average	3	3	1.7	1.5	2	1	1	-	-	-	-	1.25	2	2	1

Subject Code
AE 23333

Subject Name (Integrated Course)
AERO ENGINEERING THERMODYNAMICS

Category L T P C
PC 2 1 2 4

Thermodynamics is the science of energy transfer and its effect on physical properties of the substances. This course deals with the thermodynamic laws and its applications, properties of pure substances and its applications and basics of heat transfer. Practical experiments are included in this course to make the subject understanding better.

Objectives:

- Introducing the basic concepts of systems and the application of first law of thermodynamics to open and closed systems.
- To make the students to understand the concept of second law of thermodynamics and entropy.
- To analyse the various forms of energy in flow and non-flow processes.
- To understand the various cycle performance and working of Brayton cycle.
- To make students analyse heat of combustion and heat transfer methods.

UNIT-I BASIC CONCEPTS OF THERMODYNAMIC SYSTEMS AND FIRST LAW 9

Concept of Continuum, Microscopic and Macroscopic Approach, Thermodynamic Systems, Boundaries of Systems, Properties of Thermodynamics Systems, State, Path, Process and Cycle, Heat and Work, Zeroth Law of Thermodynamics, Enthalpy and Internal energy, First Law of Thermodynamics - Applications to Closed and Open Systems, Numerical Problems.

UNIT-II SECOND LAW AND ENTROPY 9

Second Law of Thermodynamics – Kelvin Planck and Clausius Statements of Second Law. Reversibility and Irreversibility - Carnot Theorem - Carnot Cycle, Reversed Carnot Cycle, Efficiency, COP, Clausius Inequality, Concept of Entropy, Entropy of Ideal Gas, Principle of Increase Of Entropy, Numerical Problems

UNIT-III EXERGY 9

Basics – energy in non-flow processes: expressions for the energy of a closed system – equivalence between mechanical energy forms and exergy – flow of energy associated with heat flow – exergy consumption and entropy generation, Numerical Problems

UNIT-IV VAPOUR AND GAS POWER CYCLE 9

Thermodynamic properties of steam - Standard Rankine cycle, Air standard cycles - Otto, diesel and dual cycle – Brayton cycles with reheat and regeneration operations - PV, TS diagram - Thermal efficiency - mean effective pressure– Comparison of Ideal and real cycle - Numerical Problems.

UNIT-V REACTIVE SYSTEM AND HEAT TRANSFER 9

Reaction, Degree of reaction, law of Mass action, Fuel and combustion, Heat of formation, enthalpy of combustion, Heating value, Basic of Conduction, convective and radiation heat transfer, Steady heat conduction in plane, cylindrical and composite wall, Numerical Problems.

Contact Hours : 45

List of Experiments

- 1 Determination of specific heat of solid by Bomb calorimeter. [1,5]
- 2 Determine the COP of a Refrigeration unit.[2]
- 3 Study of gas turbine components and their functions.[4]
- 4 Determination of convective heat transfer coefficient during free and forced convection.[5]
- 5 Determination of thermal conductivity of a composite wall and a metal by Guarded hot plate method.[5]

Contact Hours : 15

Total Contact Hours : 60

Course Outcomes:

On completion of the course, the students will be able to

- AE23333.1 Apply first law of thermodynamics to solve problems related to open and closed systems.
- AE23333.2 Estimate the COP for both heat pump and refrigeration systems.
- AE23333.3 Analysis the exergy for the flow and non-flowing processes.
- AE23333.4 Demonstrate the working of piston engine and perform the thermodynamic analysis of various cycles.
- AE23333.5 Estimate the heating value of various fuels and rate of heat transfer of the given system.

SUGGESTED ACTIVITIES (if any) (UNIT/ Module Wise) – Could suggest topic

- Problem solving sessions
- Activity Based Learning
- Implementation of small module

SUGGESTED EVALUATION METHODS (if Any) (UNIT/ Module Wise) – could suggest topic

- Tutorial problems
- Assignment problems
- Quizzes
- Class Presentation/Discussion

TEXT BOOKS

1. Nag. P. K., “Engineering Thermodynamics”, 6th Edition, Tata McGraw-Hill, New Delhi, 2017.
2. Cengel, Y M. Boles and M. Kanoğlu, Thermodynamics - An Engineering Approach, Tata McGraw Hill, 9th Edition, 2019.

REFERENCE BOOKS(S) / WEB LINKS:

1. R.K.Rajput, “A text book of Engineering Thermodynamics”, Fifth Edition, Lakshmi Publications, New Delhi, 2016.
2. Rathakrishnan E., “Fundamentals of Engineering Thermodynamics”, 2nd Edition, Prentice-Hall India, 2006.
3. Holman.J.P., “Thermodynamics”, 3rd Edition, McGraw-Hill, 2007.

CO/PO- PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23333.1	3	3	2	3	1	2	1	-	-	1	2	-	3	3	1
AE23333.2	3	3	2	2	1	2	1	-	-	1	2	-	3	3	1
AE23333.3	3	1	2	2	1	1	1	-	-	1	2	-	3	3	1
AE23333.4	3	1	2	3	1	1	1	-	-	1	2	-	3	3	1
AE23333.5	3	3	3	3	1	2	1	-	-	1	2	2	3	3	3
Average	3	2.2	2.2	2.6	1	1.6	1	0	0	1	2	2	3	3	1.4

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
CS23422	PYTHON PROGRAMMING FOR MACHINE LEARNING (With effect from 2021 batch onwards) Common to all branches of B.E / B.Tech programmes (Except – CSE, CSBS, CSD, IT, AI/ML)	ES	0	0	4	2

Course Objectives:

- To understand the relationship of the data collected for decision making.
- To know the concept of principle components, factor analysis and cluster analysis for profiling and interpreting the data collected.
- To lay the foundation of machine learning and its practical applications.
- To develop self-learning algorithms using training data to classify or predict the outcome of future datasets.
- To prepare for real-time problem-solving in data science and machine learning.

List of Experiments

- NumPy Basics: Arrays and Vectorized Computation
- Getting Started with pandas
- Data Loading, Storage, and File Formats
- Data Cleaning and Preparation
- Data Wrangling: Join, Combine, and Reshape
- Plotting and Visualization
- Data Aggregation and Group Operations
- Time Series
- Supervised Learning
- Unsupervised Learning
- Representing Data and Engineering Features
- Model Evaluation and Improvement

Contact Hours : 75**Course Outcomes:**

On completion of the course, the students will be able to:

- Develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
- Use appropriate packages for analyzing and representing data.
- Analyze and perform an evaluation of learning algorithms and model selection.
- Compare the strengths and weaknesses of many popular machine learning approaches.
- Apply various machine learning algorithms in a range of real-world applications.

Textbooks:

- Wes McKinney, Python for Data Analysis - Data wrangling with pandas, Numpy, and ipython, Second Edition, O'ReillyMedia Inc, 2017.
- Andreas C. Müller and Sarah Guido, Introduction to Machine Learning with Python - A Guide for Data Scientists, First Edition, O'Reilly Media Inc, 2016.

Reference Books:

- Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media Inc, 2019.

Platform Needed:

Python 3 interpreter for Windows/Linux

CO - PO – PSO matrices of course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
CS23422.1	2	2	2	2	1	-	-	-	1	2	-	1	3	3	3
CS23422.2	2	2	1	1	2	-	-	-	-	-	-	1	2	1	3
CS23422.3	2	3	2	1	2	-	-	-	1	1	-	1	2	3	2
CS23422.4	1	1	1	-	1	-	-	-	-	1	1	-	1	2	3
CS23422.5	3	3	2	3	3	-	-	-	2	1	-	1	2	3	3
Average	2	2.2	1.6	1.75	1.8	-	-	-	1.33	1.25	1	1	2	2.4	2.8

Subject Code
AE23321

Subject Name (Laboratory Course)
COMPUTER AIDED MODELING LABORATORY

Category	L	T	P	C
PC	0	0	4	2

Prerequisite:

20 hrs practical session on 2D drawing & drafting using AutoCAD

Objectives:

- Use the CATIA software program to create drawings from scratch and to modify, manipulate, copy, delete and save drawings.
- Design simple and critical components using CATIA modeling software.
- Assemble and animate the three-dimensional complex parts.
- Design the surface model of critical shape components.
- Use the full range of CATIA commands and options and employ shortcuts and time- saving strategies to operate the program at a level of efficiency acceptable for employment as a CAD Engineer.

List of Experiments

- 1 Study of modeling software
- 2 Design and drafting of simple mechanical components.
- 3 Design and drafting of upper housing of a blower
- 4 Design and drafting of helical gear.
- 5 Drafting and assembly of universal coupling.
- 6 Drafting and assembly of plumber block
- 7 Study of surface modeling
- 8 Design and drafting of aircraft wing using surface modeler
- 9 Design and drafting of aircraft engine using surface modeler
- 10 Introduction to geometric dimensioning and tolerance
- 11 Mini Project

Total Contact Hours : 30

Course Outcomes:

AE23321.1	Exposure to computer aided design and drafting software	L2
AE23321.2	Learn part design and assembly by design	L6
AE23321.3	Learn to design aircraft components in catia workbench	L6
AE23321.4	Exposure to Geometric Dimensioning and Tolerance	L6
AE23321.5	Learn to draft design drawings	L6

SUGGESTED EVALUATION METHODS (if Any) (UNIT/ Module Wise) – could suggest topic**Direct**

1. Pre-or Post-experiment Test/Viva; Experimental Report for each Pre-or Post-experiment Test/Viva; Experimental Report
2. Mini Project

Indirect

Course-end survey

REFERENCE BOOKS:

1. http://www.ehu.eus/asignaturasKO/DibujoInd/Manuales/R12_manual_catia_v5.pdf
2. <http://www.engr.psu.edu/xinli/edsgn497k/TeaPotAssignment.pdf>
3. <http://file1.engineering.com/pdf/PartDesign.pdf>

CO-PO-PSO Mapping

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23321.1	3	2	3	1	3	1	-	1	2	1	1	3	3	2	1
AE23321.2	3	2	3	1	3	1	-	1	2	1	1	3	3	2	1
AE23321.3	3	2	3	1	3	1	-	1	2	1	1	3	3	2	1
AE23321.4	3	2	2	1	3	1	-	1	2	1	1	3	3	2	1
AE23321.5	3	2	2	1	3	1	-	1	2	1	1	3	3	2	1
Average	3	2	2.6	1	3	1	-	1	2	1	1	3	3	2	1

SEMESTER IV

Course Code	Course Title	Category	L	T	P	C
MA23432	STATISTICS AND NUMERICAL METHODS	BS	3	0	2	4
Common to IV sem. B.E. - AERO, MCT and R&A						

Objectives:

- To apply numerical methods to obtain approximate solutions to mathematical problems.
- To derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear equations, and the solution of differential equations.
- To analyse statistical experiments leading to reliability modelling and to identify reliability testing components for assessment of reliability in engineering design.
- To solve the problems those are faced in testing of a hypothesis with reference to the errors in decision making.
- To analyse the different mathematical models with the help of statistical designs and appropriate data and made valuable conclusions by proper evaluation.

UNIT-I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEM 9

Newton Raphson method – Secant method – Gauss Jordan method – Iterative method of Gauss Seidel –Eigen value of a matrix by Jacobi method for symmetric matrix.

UNIT-II INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Lagrange's interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration – Simpsons 1/3 rule – Gaussian three point quadrature.

UNIT-III RELIABILITY 9

Reliability Concepts: Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve - Failure Data Analysis: Hazard rate, failure density, Failure Rate, Mean Time To Failure (MTTF), MTBF, Reliability Functions - Reliability Hazard Models: Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model- Distribution functions and reliability analysis.

UNIT-IV STATISTICAL TESTING 9

Maximal Likelihood estimation – Parameters of Binomial and Poisson distribution - Tests of significance – Z test: Single mean, difference of means- Chi square - F test.

UNIT-V ANOVA 9

Design of Experiments - Completely randomized design – Randomized block design –Latin square design.

Total Contact Hours: 45

S.No	List of Experiment (using R Software)	Total Contact Hours: 30
1	Basic Functions in R and plotting	
2	Mathematical functions in R – Integration	
3	Control flow – Loops in R	
4	Probability Distributions using R- PDF, CDF for Binomial and Poisson.	
5	Testing of Hypothesis – Z, F and chi-square testing	
6	ANOVA – one way and two way	
7	Reliability – MTTF, MTBF	
8	Solution of equations – system of linear equations, Newton Raphson method	
9	Linear regression and cubic spline interpolation	
10	Reading , writing data in R and working with inbuilt data sets in R	

Course Outcomes:

on completion of the course, the students will be able to

- Demonstrate common numerical methods and used to obtain approximate solutions of linear and system of equations.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear equations, and the solution of differential equations.
- Illustrate the basic concepts and techniques of modern reliability engineering tools.
- Apply the different testing tools like t-test, F-test, chi-square test to analyse the relevant real life problems.
- Analyse the different mathematical models with the help of statistical designs and appropriate data and made valuable conclusions by proper evaluation.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Smart Class room sessions
- Activity Based Learning

SUGGESTED EVALUATION METHODS

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

Text Book(s):

4. Veerarajan T., 'Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks', Mc Graw Hill, 2016
5. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
6. Kandasamy P., Thilagavathi and K. Gunavathi., "Statistics and Numerical Methods", S. Chand & Company Ltd. (2010).
7. Sastry S.S, "Introductory Methods of Numerical Analysis", Prentice- Hall of India PVT. LTD., 4th edition, New Delhi, 2006.

Reference Books(s) / Web links:

- Johnson R.A., "Miller and Freund's Probability and Statistics for Engineers", 11th Edition, Pearson Education, Asia, 2011.
- Walpole R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
- Spiegel M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
- Grewal B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 9th Edition, Khanna.

PO-PSO/ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MA23432.1	2	2	1	-	-	-	-	-	-	-	1	-	1	1	-
MA23432.2	2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
MA23432.3	2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
MA23432.4	2	2	1	-	-	-	-	-	-	-	1	-	1	1	-
MA23432.5	2	2	2	-	-	-	-	-	-	-	1	-	1	1	-
Average	2	2	1.2	-	-	-	-	-	-	-	1	-	1	1	-

Subject Code
AE23411

Subject Name
AIRCRAFT STRUCTURES - I

Category **L T P C**
PC 2 1 0 3

Objectives:

- Understand and apply methods for analyzing plane trusses and indeterminate beams using principles of equilibrium and superposition.
- Comprehend the use of strain energy and Castigliano's theorem to determine deflections, reactions, and internal forces in structures.
- Analyze columns under various end conditions, comprehend buckling phenomena, and apply theories to beam-columns.
- Understand failure theories, predict material failure in different loading scenarios, and assess their applicability in structural analysis.
- To understand the fundamentals of Vibration Theory

UNIT-I STATICALLY DETERMINATE & INDETERMINATE STRUCTURES 10

Plane truss analysis – method of joints – method of sections – Principle of super position, Clapeyron's three moment equation and moment distribution method for indeterminate beams.

UNIT-II ENERGY METHODS 9

Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorem – fictitious load and unit load methods – Applications to trusses, beams, and frames

UNIT-III COLUMNS 10

Columns with different end conditions – Euler's column curve – effect of initial curvature – columns with eccentricity – beam column.

UNIT-IV FAILURE THEORIES AND IT'S APPLICATIONS 7

Maximum principal stress theory – maximum principal strain theory – maximum shear stress theory – distortion energy theory – octahedral shear stress theory.

UNIT-V INTRODUCTION TO VIBRATIONS 9

Introduction to simple harmonic motion, D'Alembert's Principle, Energy Method, Rayleigh Method, free vibrations – damped free vibrations

Total Contact Hours : 45

Course Outcomes:

- | | |
|-----------|---|
| AE23411.1 | Analyse the statically determinate and indeterminate using the principle of iterative methods and theorem of three moments. |
| AE23411.2 | Make use of classical methods determine the deflections of beams, frames and arches |
| AE23411.3 | Understand the stability, Euler buckling load and problems in column design. |
| AE23411.4 | Analyse the failure of the brittle and ductile materials in comparison with simple mechanical tests. |
| AE23411.5 | Apply Newton's equation of motion and energy methods to model basic vibrating mechanical systems |

Textbook(s):

1. Mechanics of Materials, Pearson Education India; Second edition, ISBN-10 : 9789332559547
2. Strength of Materials by R Subramanian, Oxford University Press, Third edition (2016). ISBN-10-9780199464739
3. Srinath, L. S., Advanced Mechanics of Solids, 2nd ed., Tata McGraw-Hill (2003).

4. Mechanical Vibrations S.S. Rao Pearson Education Inc 4th Edition, 2003

Reference Books(s) / Web links:

1. Timoshenko and Gere, "Mechanics of Materials", Tata McGraw Hill, 1993.
2. Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", McGraw Hill, 1993.
3. Bruhn E F, "Analysis and Design of Flight Vehicle Structures", Tri-State Off-set Company, USA, 1985
4. Peery, D.J. and Azar, J.J., "Aircraft Structures", 2nd Edition, McGraw – Hill, N.Y, 1999.

CO- PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23411.1	3	2	2	3	2	0	-	-	-	2	-	1	2	2	-
AE23411.2	3	2	2	2	2	0	-	-	-	2	-	1	2	2	-
AE23411.3	3	2	1	2	2	1	-	-	-	2	-	1	2	2	-
AE23411.4	3	2	2	2	2	2	-	-	-	2	-	1	2	-	-
AE23411.5	3	2	2	2	2	1	-	-	-	2	-	1	2	2	-
Average	3	2	1.8	2.2	2	1.3	-	-	-	2	-	1	2	1.6	-

Subject Code
AE23412

Subject Name
CONTROL ENGINEERING

Category **L** **T** **P** **C**
PC **3** **0** **0** **3**

OBJECTIVES

- To introduce the mathematical modelling of systems, open loop and closed loop systems and analyses in time domain and frequency domain.
- To impart the knowledge on the concept of stability and various methods to analyze stability in both time and frequency domain.
- To introduce sampled data control system.
- To explain the concept of stability
- Analyzing digital controllers.

UNIT I INTRODUCTION 9

Simple pneumatic, hydraulic and thermal systems, Series and parallel system, Analogies, mechanical and electrical components, Development of flight control systems. Pixhawk 2.4.8 Flight controller

UNIT II OPEN AND CLOSED LOOP SYSTEMS 9

Feedback control systems – Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Procedure for convert block diagram to signal flow graph.

UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS 9

Laplace transformation, Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT IV CONCEPT OF STABILITY 9

Necessary and sufficient conditions, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, - Nyquist stability criterion-Concept and construction, frequency response.

UNIT V SAMPLED DATA SYSTEMS 9

Z-Transforms ,sampling and quantization,Introduction to digital control system, converters, sensors and Actuators,Digital Controllers and Digital PID controllers-Adaptive Control.

TOTAL: 45 PERIODS

TEXT BOOKS

1. OGATO, Modern Control Engineering, Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.
2. Azzo, J.J.D. and C.H. Houpis Feed back control system analysis and synthesis, McGraw-Hill international 3rs Edition, 1998.

REFERENCES

1. Kuo, B.C. "Automatic control systems", Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.
2. Houpis, C.H. and Lamont, G.B. "Digital control Systems", McGraw Hill Book co., U.S.A. 1995.
3. Naresh K Sinha, "Control Systems", New Age International Publishers, New Delhi, 1998.

SUGGESTED ACTIVITIES

- Problem solving sessions
- Activity Based Learning
- Mini Projects

SUGGESTED EVALUATION METHODS

- Assignment problems
- Quizzes
- Class Presentation/Discussion

Course Outcomes:

On completion of the course students will be able to

- AE23412.1** Apply mathematical knowledge to model the systems and analyse the frequency domain
- AE23412.2** Check the stability of both time and frequency domain.
- AE23412.3** Solve simple pneumatic, hydraulic, Mechanical and electrical component analogies-based problems
- AE23412.4** Solve the Block diagram representation of control systems, Reduction of block diagrams, Signal flow graph and problems based on it.
- AE23412.5** Explain the digital control system, Digital Controllers and Digital PID Controllers, Adaptive control.

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23412.1	3	1	-	-	-	-	-	-	-	-	-	1	3	2	1
AE23412.2	3	1	-	1	-	-	-	-	-	-	-	1	3	2	1
AE23412.3	3	1	2	1	2	-	-	-	-	-	-	1	3	2	1
AE23412.4	3	1	2	1	2	-	-	-	-	-	-	1	3	2	1
AE23412.5	3	1	-	-	-	-	-	-	-	-	-	1	3	2	1
Average	3	1	2	1	2	-	-	-	-	-	-	1	3	2	1

Subject Code	Subject Name	Category	L	T	P	C
AE23431	INCOMPRESSIBLE AERODYNAMICS	PC	2	1	2	4

Course Objectives:

- To introduce fundamental aerodynamic theories and aerodynamic characteristics of airfoils and wings
- To familiarize students with viscous flows

UNIT-I AERODYNAMIC FORCES AND MOMENTS**9**

Review of fundamental equations of fluid flows, Euler equation, Bernoulli's equation and applications. Streamlined and bluff-bodies. generation of lift, drag and moment, incompressible flows over airfoils, calculation of lift and drag from measured pressure distribution. Centre of pressure, aerodynamic centre and aerodynamic moment.

UNIT-II POTENTIAL FLOWS**9**

Vorticity, Stoke's theorem, streamline, stream function. Irrotational flow, potential function, equipotential lines, Potential flow equation, Elementary flows and their combinations. Kutta-Joukowski theorem.

UNIT-III AIRFOIL THEORY**9**

Low speed aerodynamic characteristics of symmetric and cambered airfoils. vortex sheet, Kutta condition, Kelvins circulation theorem and starting vortex, Classical thin airfoil theory - symmetric & cambered airfoils.

UNIT-IV WING THEORY**9**

Wing geometry and terminology, flow over wing, downwash, induced drag. Type of drag, Prandtl's lifting line theory and limitations. Lift distribution over wings: elliptical, rectangular, and trapezoidal. Effect of aspect ratio on lift distribution and induced drag. High lift devices.

UNIT-V LAMINAR BOUNDARY LAYERS**9**

Boundary layer equations for a steady, two-dimensional incompressible flow, boundary layer growth over a flat plate, Boundary layer properties, Blasius solution - self-similar solutions and other important results.

Total Hours : 45**TEXTBOOKS:**

- 1 Anderson, Jr., J.D., Fundamentals of Aerodynamics, McGraw-Hill Education; 7th edition, 2023

Reference Books:

- 1 E.L. Houghton, P.W. Carpenter, Steven H. Collicott, Daniel T. Valentine - Aerodynamics for Engineering Students-Butterworth-Heinemann, imprint of Elsevier, 2016
- 2 Bertin, J.J., Aerodynamics for Engineers, Sixth edition, Pearson Education, 2021
- 3 McCormick, B.W., Aerodynamics, Aeronautics, & Flight Mechanics, second edition, John Wiley, 1995

CASE STUDIES

1. Pressure Distribution Analysis on an Airfoil in a Wind Tunnel [1]
2. Flow Analysis Around a Cylinder Using Potential Flow Theory [2]
3. Comparative Analysis of Symmetric vs. Cambered Airfoils in Low-Speed Flight [3]
4. Aspect Ratio Influence on Wing Performance in Gliders [4]
5. Boundary Layer Development over a Flat Plate in Laminar Flow Conditions [5]

List of Experiments (Total Hours : 30)

1. Calibration of subsonic wind tunnel [1]
2. Flow visualization at low speeds (smoke, tuft and water channel). [2]
3. Pressure distribution over smooth and rough circular cylinders.[2]
4. Surface pressure distribution on a symmetrical airfoil at an angle of incidence and calculation of lift and pressure drag. [3]
5. Surface pressure distribution on a cambered airfoil at an angle of incidence and calculation of lift and pressure drag.[3]
6. Measurement of aerodynamic loads using wind tunnel force balance. [4]
7. Surface pressure distribution on an airfoil (infinite wing) with flap.[4]

TOTAL HOURS : 30**COURSE OUTCOMES:**

On completion of the course students will be able to

- AE23431.1 classify airfoils and label their nomenclature; apply governing equations to formulate necessary subsidiary equation in order to determine the aerodynamic forces
- AE23431.2 explain potential flow theories and solve their combinations.
- AE23431.3 estimate the aerodynamic characteristics of airfoils
- AE23431.4 estimate the aerodynamic characteristics of wings
- AE23431.5 formulate and solve boundary layer problems

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23431.1	3	2	2	1	1	-	-	-	1	1	1	1	3	2	1
AE23431.2	3	2	2	1	2	-	-	-	1	1	1	1	3	2	1
AE23431.3	3	2	2	1	2	-	-	-	1	1	1	1	3	2	1
AE23431.4	3	2	2	1	2	-	-	-	1	1	1	1	3	2	1
AE23431.5	3	2	2	-	2	2	2	1	1	1	1	1	3	2	1
Average	3	2	2	1	1.8	2	2	1	1	1	1	1	3	2	1

Subject Code	Subject Name	Category	L	T	P	C
AE23432	AIRCRAFT MATERIALS AND PROCESSES	PC	3	0	2	4

Objectives:

- To introduce different classes of missiles and rockets to students.
- To impart adequate knowledge on various airframe components of missiles and their functions to students.
- To give exposure to analyse the various forms of drag and its estimations to students.
- To make the students familiarize with the concepts of staging and stage separation methods.
- To make students learn the stability and control aspects of missiles.

UNIT-I FERROUS AND NON-FERROUS MATERIALS**9**

Ferrous materials: Steels: Plain and low carbon steels, various low alloy steels, aircraft steel specifications, corrosion and heat resistant steels, structural applications. Maraging Steels: Properties and Applications. Super Alloys: Use -Nickel base-Cobalt base- Iron base - Forging and Casting of Super alloys

Non-ferrous materials: Aluminum and its Alloys-Types and identification. Properties, Magnesium and its alloys - Cast and Wrought alloys - Aircraft application, features specification, fabrication problems, Special treatments. Titanium and its alloys - Applications, machining, heat treatment, Copper Alloys.

UNIT-II CASTING AND JOINING**9**

Casting types, types of core making, moulding tools- permanent moulding- pressure die casting, centrifugal casting.

Classification of welding processes. Principles of oxy acetylene gas welding, submerged arc welding, TIG – MIG, Laser beam welding, Electron beam welding, and defects in welding.

UNIT-III MACHINING**9**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

UNIT-IV CNC MACHINING AND ADVANCED MANUFACTURING**9**

Numerical Control machine tools – CNC types, Construction details, Special features, Machining centre – Tool magazines and transfer systems, Automatic tool changer – Part Programming Fundamentals – CNC and Manual part programming – Micro machining – Wafer manufacturing process, Rapid prototyping Technology: 3D Printing, Additive layer manufacturing –Rapid Manufacturing, applications and advancements.

UNIT-V INTRODUCTION TO COMPOSITES**9**

Introduction - Advantages and aerospace application of composite materials - reinforcements and matrices. Various open and closed mould processes, Manufacture of fibers, Types of resins, properties and application.

Total Contact Hours : 45**List of Experiments**

- 1 Preparation of welded butt joints using MIG welding
- 2 Preparation of welded Lap joints using TIG welding
- 3 Step turning, drilling and boring using Capstan / Turret lathe
- 4 Spur gear cutting in milling machine
- 5 CNC machining - part programming
- 6 CNC Machining- part programming
- 7 Study of 3D Printing technology.
- 8 Fabrication of a Composite Laminate using Glass fiber as per ASTM standard.

Contact Hours : 30**Total Contact Hours : 75****Course Outcomes:**

On completion of the course students will be able to

- AE23432.1 Distinguish ferrous and non-ferrous materials by correlating its applications.
- AE23432.2 Know the various casting and welding processes.
- AE23432.3 Use different machining process for component production.
- AE23432.4 Understand and carry out simple experiments in CNC machines and also have a knowledge on additive manufacturing.
- AE23432.5 understanding advantages and applications of composite materials in aerospace,

SUGGESTED ACTIVITIES

Flipped classroom – non-conventional machining process, 3D printing technology.
 Experimentation – gathering knowledge through experience in laboratory.
 Activity Based Learning

SUGGESTED EVALUATION METHODS

Assignment
 Quizzes
 Class Presentation/Discussion

Text Books:

- 1 Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005
- 2 Roy. A. Linberg, “Process and Materials of Manufacture”, PHI, 2000.

Reference Books / Web links:

- 1 Jain. R.K. and S.C. Gupta, “Production Technology”, Khanna Publishers. 16 th Edition, 2001
- 2 Serope Kalpajian, Steven R. Schmid, “Manufacturing Processes for Engineering Materials”, Fourth Edition, Pearson Education, Inc. 2007

Lab equipment required:

S. No	Name of the Equipment	Quantity Required	Remarks
1	Capstan / Turret lathe	1	
2	MIG welding machine	1	
3	TIG welding machine	1	
4	Milling machine	1	
5	Slotting machine	1	

Web links for virtual lab (if any)

- <http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/#>
- <https://3dp-dei.vlabs.ac.in/List%20of%20experiments.html>

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23432.1	2	1	3	2	3	1	1	2	1	1	1	1	3	1	1
AE23432.2	3	2	3	3	3	1	1	2	3	1	2	1	3	3	1
AE23432.3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
AE23432.4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AE23432.5	3	1	1	1	1	1	1	2	3	1	2	1	2	3	1
Avg.	2.4	1.2	1.8	1.6	1.8	1	1	1.6	1.8	1	1.4	1	2.2	1.8	1

Subject Code	Subject Name	Category	L	T	P	C
AE23433	AIRCRAFT SYSTEMS AND INSTRUMENTS	PC	3	0	2	4

Objectives:

- To impart knowledge of the aircraft modern control systems
- To apply knowledge on hydraulic and pneumatic systems for aircraft brake system.
- To gain knowledge on piston and jet engine of an aircraft.
- To impart knowledge on aircraft environment systems
- To gain knowledge on various instruments such as air data instruments, Gyroscope instruments and engine instruments

UNIT-I AIRPLANE CONTROL SYSTEMS 9

Basics of aircraft control surfaces -open loop control system-closed loop control system- fully powered flight controls – modern control systems – FBW and FBL systems –Fly by wireless flight control system- Displacement autopilot –lateral autopilot

UNIT-II AIRCRAFT SYSTEMS 9

Hydraulic systems and its components –Boeing 757 hydraulic systems – pneumatic systems– independent brake system - Power boost brake system- deboost valve-- landing gear systems- landing gear systems in flying boat, Drones systems- control-power-communication systems

UNIT-III ENGINE SYSTEMS 9

Typical fuel systems – piston and jet engines – components –Types of lubrication system– starting and ignition systems – piston and jet engines -FADEC

UNIT-IV AIRCONDITIONING AND PRESSURIZING SYSTEM 9

Basic air cycle systems – vapour cycle systems – cooling pack-Fire detection systems-fire protection systems-anti-icing system-deicing system.

UNIT-V AIRCRAFT INSTRUMENTS 9

Overview of Link- Flight simulator-Air data instruments–air speed indicators – Mach meters – altimeters – vertical speed indicator - gyroscopic instruments– turn and bank indicator, turn coordinator–engine instruments – tachometers - EGT-EPR-Electronic instrument -EADI –EHSL,Mach warning system,stall warning system, Artificial Intelligence systems in Aviation

TOTAL: 45 PERIODS**List of Experiments**

- 1 Aircraft “Jacking Up” procedure
- 2 Aircraft “Levelling” procedure
- 3 Control System “Rigging check” procedure
- 4 Aircraft “Symmetry Check” procedure
- 5 “Flow test” to assess of filter element clogging
- 6 “Pressure Test” To assess hydraulic External/Internal Leakage
- 7 “Functional Test” to adjust operating pressure
- 8 “Pressure Test” procedure on fuel system components
- 9 “Brake Torque Load Test” on wheel brake units
- 10 Maintenance and rectification of snags in hydraulic and fuel systems.

- 11 Identification of Ignition system in Cessna Aircraft.
- 12 Functional test of various instruments in Cessna aircraft

Contact Hours : 30
Total Contact Hours : 75

Course Outcomes:

On completion of the course students will be able to

- AE23433.1** Design and develop aircraft control system from primary and secondary control surfaces.
AE23433.2 Acquires knowledge on hydraulic and pneumatic systems of aircraft
AE23433.3 Understands piston and jet engine fuel and lubrication systems
AE23433.4 Understands the aircraft environment systems
AE23433.5 Identify flight and engine instruments

SUGGESTED ACTIVITIES

Problem solving sessions
 Activity Based Learning
 Implementation of small module

SUGGESTED EVALUATION METHODS

Assignment problems
 Quizzes
 Class Presentation/Discussion

Textbook(s):

1. Kroes, Watkins and Delp, "Aircraft Maintenance and Repair", Tata McGraw Hill, (2010).

Reference Books(s) / Web links:

1. Pallet, E.H.J, "Aircraft Instruments & Principles", Pitman & Co (1993).
2. Kroes and Wild, "Aircraft Power plants", Tata McGraw Hill (2010).
3. Instrument Flying Handbook: FAA-H-8083-15B, Sky Pony Press; Clr Csm edition, (2017).

CO/PO- PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
AE23433.1	3	2	2	1	1	-	-	-	1	1	1	1	3	2	1
AE23433.2	3	2	2	1	2	-	-	-	1	1	1	1	3	2	1
AE23433.3	3	2	2	1	2	-	-	-	1	1	1	1	3	2	1
AE23433.4	3	2	2	1	2	-	-	-	1	1	1	1	3	2	1
AE23433.5	3	2	2	-	2	2	2	1	1	1	1	1	3	2	1
Average	3	2	2	1	1.8	2	2	1	1	1	1	1	3	2	1

Subject Code
GE23327

Subject Name
SOFT SKILLS - I

Category **L** **T** **P** **C**
EEC **0** **0** **2** **1**

Program Learning Goals:

This program will help our students to build confidence and improve their English communication in order to face the corporate world as well as providing them with opportunities to grow within an organisation.

Course Objectives:

The major course objectives are:

- a. To help students break out of shyness.
- b. To build confidence
- c. To enhance English communication skills.
- d. To encourage students' creative thinking to help them frame their own opinions,

Learning and Teaching Strategy:

The program is completely student centric where the focus is on activities led by students which include role plays, discussions, debates other games as well. These activities would be supplemented by interactive use of technology and brief trainer input.

Week	Activity Name	Description	Objective
1	Introduction	The trainer and the college facilitator talk to the students about the course and in turn the students introduce themselves.	To set expectations about the course and the students are made aware of the rules and regulations involved in this program
2	If I ruled the world	This is a quick and useful game by getting students to form a circle and provide their point of view. Each student then repeats what the other has said and comes up with their own opinion.	The aim of this activity is to for students to get to know each other and also develop their listening skills as well as learning how to agree and disagree politely.
3	Picture Narrating	This activity is based on several sequential pictures. Students are asked to tell the story taking place in the sequential pictures by paying attention to the criteria provided by the teacher as a rubric. Rubrics can include the vocabulary or structures they need to use while narrating.	The aim of this activity is to make the students develop creative way of thinking.
4	Brainstorming	On a given topic, students can produce ideas in a limited time. Depending on the context, either individual or group brainstorming is effective and learners generate ideas quickly and freely. The good characteristics of brainstorming are that the students are not criticized for their ideas so students will be open to sharing new ideas.	The activity aims at making the students speak freely without the fear of being criticized. It also encourages students to come up with their own opinions.

5	Debate	Is competition necessary in regards to the learning process?	The aim of this activity is to develop the students ability to debate and think out of the box
6	Short Talks	Here the students are given topics for which they take one minute to prepare and two minutes to speak. They can write down points but can't read them out they can only use it as a reference.	The activity aims at breaking the students' shyness and encouraging them to standup in front of the class and speak. It also aims at creating awareness that they are restricted for time so they only speak points that are relevant and important.
7	Debate	Will posting students' grades on bulletin boards publicly motivate them to perform better or is it humiliating?	This activity aims at enhancing the students unbiased thought process when it comes to exams and grades as well as develop their skills to debate
8	The Art of diplomacy	The facilitator proceeds to share multiple concepts of conversation and helps the participants to identify the various methods of being diplomatic and how do deal with misinformation.	The aim of the lesson is to provide an opportunity for the participants to learn about body language and choosing the appropriate words for conversation.
9	Debate	Are humans too dependent on computers?	The aim of this activity is to test the students debating skills and thought process with a topic that affects everybody in daily life.
10	Story Completion	The teacher starts to tell a story but after 2 sentences he/she asks students to work in groups to create the rest of the story which includes the plot and the ending.	This activity aims at building their narrating skills as well as their creativity and ability to work in a team.
11	Role play debate	Students scrutinize different points of view or perspectives related to an issue. For example, a debate about the question "Should students be required to wear uniforms at school?" might yield a range of opinions. Those might include views expressed by a student (or perhaps two students – one representing each side of the issue), a parent, a school principal, a police officer, a teacher, the owner of a clothing store, and others.	The aim of this activity is to get students to speak based on other people's perspective instead of their own. The students take the role of various characters and debate accordingly.
12	I Couldn't Disagree More	This is a game where students practice rebuttal techniques where one student provides a thought or an idea and the other students starts with the phrase I couldn't disagree more and continues with his opinion	The aim of this activity is to improve general communication skills and confidence.
	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits	The aim is to do both give feedback to students as well as obtain feedback on the course from them.

Course Learning Outcome:

On successful completion of the course, students should be able to:

1. Be more confident
2. Speak in front of a large audience
3. Be better creative thinkers
4. Be spontaneous
5. Know the importance of communicating in English.

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE23327.1	-	-	-	-	-	-	-	-	1	3	-	1	-	1	2
GE23327.2	1	-	-	-	-	-	1	-	1	3	1	1	-	1	2
GE23327.3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	1
GE23327.4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
GE23327.5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	2
Average	1	0	0	0	0	0	1	0	1	3	1	1	0	1	1.75