DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

PERAMBALUR - 621212

REGULATIONS–2023

CHOICE BASED CREDIT SYSTEM

B.E. AERONAUTICAL ENGINEERING

CURRICULUM & SYLLABI

DEPARTMENT OF AERONAUTICAL ENGINEERING

(Applicable to students admitted from the Academic year 2023 – 2024 and subsequently under Choice Based Credit System)

VISION MISSION OF THE INSTITUTUION

Vision:

An active and committed centre of advanced learning focused on research and training in the fields of Engineering, Technology and Management to serve the nation better.

Mission:

- To develop eminent scholar with a lifelong follow up of global standards by offering UG,PG and Doctoral Programmes.
- To pursue Professional and Career growth by collaborating mutually beneficial partnership with industries and higher institutes of research.
- To promote sustained research and training with emphasis on human values and leadership qualities.
- To contribute solutions for the need based issues of our society by proper ways and means as dutiful citizen.

DEPARTMENT OF AERONAUTICAL ENGINEERING

About the Department

Department of Aeronautical Engineering is making great efforts in imparting knowledge and skill to meet the aircraft industry expectation . The department offers theory and lab works as per current trends through the qualified faculty and staff. Aeronautical Engineering department started functioning since 2006.The department has well equipped laboratory facilities and faculty to prepare the students to meet future requirement in the field of aviation.

Vision:

- To develop a global environment for quality education, research and training in the field of Aeronautical engineering

Mission:

- To improve educational quality through industry-institutional interaction in teaching, learning, and research.
- To create opportunities for career growth, and higher education ventures.
- To establish the facility for research and training activities and instill human values, leadership qualities.
- To implement innovations in the field of aeronautical engineering that can benefit society

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	Graduates of the programme will be excellent in fields of research, product development, higher education, and employment.
PEO 2	Graduates of the programme will be able to excel in design, analytical thinking, and problem solving.
PEO 3	Graduates of the programme will have commitment to serving society, a sense of duty to preserve the environment, and moral behaviors in their career.

PROGRAM OUTCOMES (POs)

PO	Graduate Attribute
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation ofdata, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources,and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequentresponsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1	Design and analyze aircraft structures, systems, and components using advanced engineering principles and tools
PSO 2	Apply knowledge of aerodynamics, propulsion, and flight mechanics to optimize aircraft performance, including range, speed, and fuel efficiency

PEO's – PO's & PSO's MAPPING:

PEO	**PO**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
I.	3	3	3	3	2	-	-	-	-	1	1	-	3	2
II.	3	3	3	2	3	2	1	2	-	1	2	2	3	2
III.	1	2	3	-	-	3	3	3	3	3	2	3	-	2

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE (AUTONOMOUS), PERAMBALUR – 621 212

B.E. AERONAUTICAL ENGINEERING

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	IP3151	Induction Programme	-	-	-	-	-	0
2	U23HST11	Communicative English	HSMC	3	0	0	3	3
3	U23MAT12	Matrices and Calculus	BSC	3	1	0	4	4
4	U23PHT13	Physics for Engineers and Technologists	BSC	3	0	0	3	3
5	U23CYT14	Chemistry for Engineering and Technology	BSC	3	0	0	3	3
6	U23GET16	Engineering graphics	ESC	2	0	4	4	4
7	U23GE3252	தமிழர் மரபு /Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICAL								
8	U23BSP11	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
9	U23HSP12	English Laboratory	HSMC	0	0	2	2	1
10	U23GEP14	Engineering Practices Laboratory	ESC	0	0	4	4	2
			Total	**19**	**02**	**10**	**28**	**23**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23HST21	Professional English	HSMC	2	0	0	2	2
2	U23MAT22	Statistics and Numerical methods	BSC	3	1	0	4	4
3	U23GET15	Problem Solving and Python Programming	ESC	3	0	0	3	3
4	U23PHT23	Applied Material Science	BSC	3	0	0	3	3
5	U23EET23	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
6		NCC Credit Course Level 1	-	2	0	0	2*	2*
7	U23GE3252	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSMC	1	0	0	1	1
PRACTICAL								
8	U23EEP22	Basic Electrical and Electronics Engineering laboratory	ESC	0	0	4	4	2
9	U23HSP22	Communication Laboratory	EEC	0	0	4	4	2

10	U23GEP13	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
			Total	**17**	**1**	**12**	**28**	**22**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23MAT31	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2	U23AET31	Aero Engineering Thermodynamics	PCC	3	0	0	3	3
3	U23AET32	Solid Mechanics	PCC	3	1	0	4	4
4	U23MET32	Fluid Mechanics and Machinery	ESC	3	0	0	3	3
5	U23AET34	Elements of Aeronautical Engineering	PCC	3	0	0	3	3
6	U23GET41	Environmental Sciences and Sustainability	BSC	3	0	0	2	2
PRACTICAL								
7	U23AEP31	Thermodynamics and Strength of Materials Laboratory	PCC	0	0	4	4	2
8	U23AEP32	Fluid Mechanics and Machinery Laboratory	PCC	0	0	4	4	2
			Total	**17**	**01**	**8**	**27**	**23**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23MAT41	Vector Calculus and Complex Functions	BSC	3	1	0	4	4
2	U23AET41	Low speed Aerodynamics	PCC	3	1	0	4	4
3	U23AET42	Air Breathing Propulsion	PCC	3	0	0	3	3
4	U23AET43	Aircraft Structures - I	PCC	3	0	0	3	3
5	U23AET44	Mechanics of Machines	PCC	3	0	0	3	3
6	U23AET45	Aircraft Systems and Instruments	PCC	3	0	0	3	3
PRACTICAL								
7	U23AEP41	Aerodynamics Laboratory	PCC	0	0	4	2	2
8	U23AEP42	Propulsion Laboratory	PCC	0	0	4	2	2
9	U23AEP43	Aircraft Systems Laboratory	PCC	0	0	4	2	2
			Total	**18**	**02**	**12**	**26**	**26**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AET51	Aircraft structures - II	PCC	3	0	0	3	3
2	U23AET52	High Speed Aerodynamics	PCC	3	0	0	3	3
3	U23AET53	Flight Dynamics	PCC	3	1	0	4	4
4	U23AET54	Rocket Propulsion	PCC	3	0	0	3	3
5		Professional Elective I	PEC	3	0	0	3	3
PRACTICAL								
8	U23AEP51	Aircraft Structures Laboratory	PCC	0	0	4	4	2
9	U23AEP52	Artificial Intelligence and Machine Learning for Aeronautical Engineering	PCC	0	0	4	4	2
10	U23AEP33	Professional Development	EEC	0	0	2	2	1
			Total	**15**	**01**	**10**	**26**	**21**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AET61	Drone Technology	PCC	3	0	0	3	3
2		Open Elective- I	OEC	3	0	0	3	3
3		Professional Elective II	PEC	3	0	0	3	3
4		Professional Elective III	PEC	3	0	0	3	3
5	U23GET61	Human Values and Ethics	HSMC	3	0	0	3	3
PRACTICAL								
6	U23AEP61	Aircraft Design Project	PCC	0	0	4	4	2
7	U23AEP62	Design of Drone and flight Stimulation Laboratory	PCC	0	0	4	4	2
8	U23AEP63	Aero Engine and Airframe Laboratory	PCC	0	0	4	4	2
			Total	**15**	**0**	**12**	**27**	**21**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AET71	Composite Materials and Structures	PCC	3	0	0	3	3
2	U23AET72	Avionics	PCC	3	0	0	3	3
3		Elective-Management	HSMC	3	0	0	3	3
4		Professional Elective IV	PEC	3	0	0	3	3
5		Open Elective- II	OEC	3	0	0	3	3
PRACTICAL								
6	U23AEP71	Flight Integartion Systems and Control Laboratory	PCC	0	0	4	4	2
7	U23AEP72	Computer Aided Modelling and Stimulation Laboratory	PCC	0	0	4	4	2
8	U23AEP73	Industrial Training	EEC	0	0	2	2	1
			Total	**15**	**0**	**10**	**25**	**20**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Professional Elective V	PEC	3	0	0	3	3
2		Professional Elective VI	PEC	3	0	0	3	3
PRACTICAL								
3	U23AEP81	Project Work	EEC	0	0	12	12	6
			Total	**6**	**0**	**12**	**18**	**12**

ELECTIVE MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23GET71	Principles of Management		3	0	0	3	3
2	U23GET72	Total Quality Management		3	0	0	3	3
3	U23GET73	Engineering Economics and Financial Accounting		3	0	0	3	3
4	U23GET74	Human Resource Management		3	0	0	3	3
5	U23GET75	Knowledge Management		3	0	0	3	3
6	U23GET76	Industrial Management		3	0	0	3	3

VERTICALS – I COMPUTATIONAL ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEV11	Numerical Methods in Fluid Dynamics	PEC	3	0	0	3	3
2	U23AEV12	Computational Heat Transfer	PEC	3	0	0	3	3
3	U23AEV13	Finite Element Method	PEC	3	0	0	3	3
4	U23AEV14	Computational Fluid Dynamics	PEC	3	0	0	3	3
5	U23AEV15	Computer Aided Design And Analysis	PEC	3	0	0	3	3
6	U23AEV16	Grid Generation Techniques	PEC	3	0	0	3	3

VERTICALS – II AERODYNAMICS AND PROPULSION

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEV21	Experimental Aerodynamics	PEC	3	0	0	3	3
2	U23AEV22	Aerodynamics of Drones	PEC	3	0	0	3	3
3	U23AEV23	Industrial Aerodynamics	PEC	3	0	0	3	3
4	U23AEV24	Rocket launch vehicles	PEC	3	3	3	3	3
5	U23AEV25	Advanced Propulsion Systems	PEC	3	0	0	3	3
6	U23AEV26	Hypersonic Aerodynamics	PEC	3	0	0	3	3

VERTICALS – III AEROSPACE STRUCTURES

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEV31	Fatigue and Fracture Mechanics	PEC	3	0	0	3	3
2	U23AEV32	Experimental Stress Analysis	PEC	3	0	0	3	3
3	U23AEV33	Theory of Elasticity	PEC	3	0	0	3	3
4	U23AEV34	Additive Manufacturing	PEC	3	0	0	3	3
5	U23AEV35	Non-Destructive Testing and Evaluation	PEC	3	0	0	3	3
6	U23AEV36	Aerospace Materials	PEC	3	0	0	3	3

VERTICALS – IV AVIONICS AND DRONE TECHNOLOGY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEV41	Airbrone radar system	PEC	3	0	0	3	3
2	U23AEV42	Control system and Engineering	PEC	3	0	0	3	3
3	U23AEV43	Guidance and Control	PEC	3	0	0	3	3
4	U23AEV44	Navigation and Communication System	PEC	3	0	0	3	3
5	U23AEV45	Payloads and sensors for UAVs	PEC	3	0	0	3	3
6	U23AEV46	UAV operational and Industrial Aspects	PEC	3	0	0	3	3

VERTICALS – V AIRCRAFT MAINTENANCE

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEV51	Airframe Maintenance and Repair	PEC	3	0	0	3	3
2	U23AEV52	Aircraft General Engineering and Maintenance Practices	PEC	3	0	0	3	3
3	U23AEV53	Civil Aviation Regulations	PEC	3	0	0	3	3
4	U23AEV54	Aircraft Engine Maintenance and Repair	PEC	3	0	0	3	3
5	U23AEV55	Air Traffic Control	PEC	3	0	0	3	3
6	U23AEV56	Airport Management	PEC	3	0	0	3	3

VERTICALS – VI DIVERSIFIED COURSES GROUP 1

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEV61	Design of Gas Turbine Engine Components	PEC	3	0	0	3	3
2	U23AEV62	Vibration and Aero Elasticity	PEC	3	0	0	3	3
3	U23AEV63	Manufacturing Process	PEC	3	0	0	3	3
4	U23AEV64	Turbo Machines	PEC	3	0	0	3	3
5	U23AEV65	Helicopter Theory	PEC	3	0	0	3	3
6	U23AEV66	Smart Materials and Structures	PEC	3	0	0	3	3

VERTICALS – VII DIVERSIFIED COURSES GROUP 2

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEV71	Boundary Layer Theory	PEC	3	0	0	3	3
2	U23AEV72	Theory of Elasticity	PEC	3	0	0	3	3
3	U23AEV73	Structural Dynamics	PEC	3	0	0	3	3
4	U23AEV74	Heat Transfer	PEC	3	0	0	3	3
5	U23AEV75	Airport Engineering	PEC	3	0	0	3	3
6	U23AEV76	Advanced Vehicle Engineering	PEC	3	0	0	3	3

OPEN ELECTIVE I & II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEO11	Artificial Intelligence and Machine Learning Fundamentals	OEC	3	0	0	3	3
2	U23AEO12	IoT Concepts and Applications	OEC	3	0	0	3	3
3	U23AEO13	Data Science Fundamentals	OEC	3	0	0	3	3
4	U23AEO14	Augmented and Virtual Reality	OEC	3	0	0	3	3

OPEN ELECTIVE III & IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	U23AEO21	English for Competitive Examinations	OEC	3	0	0	3	3
2	U23AEO22	NGOs and Sustainable Development	OEC	3	0	0	3	3
3	U23AEO23	Democracy and Good Governance	OEC	3	0	0	3	3
4	U23AEO24	Lean Concepts, Tools and Practices	OEC	3	0	0	3	3
5	U23AEO25	Renewable Energy Technologies	OEC	3	0	0	3	3
6	U23AEO26	Applied Design Thinking	OEC	3	0	0	3	3
7	U23AEO27	Reverse Engineering	OEC	3	0	0	3	3
8	U23AEO28	Sustainable Manufacturing	OEC	3	0	0	3	3
9	U23AEO29	Electric and Hybrid Vehicle	OEC	3	0	0	3	3
10	U23AEO30	Space Engineering	OEC	3	0	0	3	3
11	U23AEO31	Industrial Management	OEC	3	0	0	3	3
12	U23AEO32	Quality Engineering	OEC	3	0	0	3	3
13	U23AEO33	Fire Safety Engineering	OEC	3	0	0	3	3
14	U23AEO34	Introduction to non-destructive testing	OEC	3	0	0	3	3
15	U23AEO35	Mechatronics	OEC	3	0	0	3	3
16	U23AEO36	Foundation of Robotics	OEC	3	0	0	3	3
17	U23AEO37	Remote Sensing Concepts	OEC	3	0	0	3	3
18	U23AEO38	Urban Agriculture	OEC	3	0	0	3	3
19	U23AEO39	Drinking Water Supply and Treatment	OEC	3	0	0	3	3
20	U23AEO40	Electric Vehicle Technology	OEC	3	0	0	3	3
21	U23AEO41	Introduction to PLC Programming	OEC	3	0	0	3	3
22	U23AEO42	Nano Technology	OEC	3	0	0	3	3
23	U23AEO43	Functional Materials	OEC	3	0	0	3	3
24	U23AEO44	Biomedical Instrumentation	OEC	3	0	0	3	3
25	U23AEO45	Traditional Indian Foods	OEC	3	0	0	3	3
26	U23AEO46	Introduction to food processing	OEC	3	0	0	3	3
27	U23AEO47	IPR for Pharma Industry	OEC	3	0	0	3	3
28	U23AEO48	Basics of Textile Finishing	OEC	3	0	0	3	3
29	U23AEO49	Industrial Engineering for Garment Industry	OEC	3	0	0	3	3
30	U23AEO50	Basics of Textile Manufacture	OEC	3	0	0	3	3
31	U23AEO51	Introduction to Petroleum Refining	OEC	3	0	0	3	3
32	U23AEO52	And Petrochemicals	OEC	3	0	0	3	3
33	U23AEO53	Energy Conservation and Management	OEC	3	0	0	3	3
34	U23AEO54	Basics of Plastics	OEC	3	0	0	3	3
35	U23AEO55	Processing	OEC	3	0	0	3	3
36	U23AEO56	Signals and Systems	OEC	3	0	0	3	3

37	U23AEO57	Fundamentals of Electric Devices and Circuits	OEC	3	0	0	3	3
38	U23AEO58	Foundation Skills in integrated product Development	OEC	3	0	0	3	3
39	U23AEO59	Assistive Technology	OEC	3	0	0	3	3
40	U23AEO60	Operations Research	OEC	3	0	0	3	3
41	U23AEO61	Algebra and Number Theory	OEC	3	0	0	3	3
42	U23AEO62	Linear Algebra	OEC	3	0	0	3	3
43	U23AEO63	Basics of Microbial Technology	OEC	3	0	0	3	3
44	U23AEO64	Basics of Biomolecules	OEC	3	0	0	3	3

SUMMARY

SL. NO.	Subject Area	Credits per semester								Credits Total	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities and Social Sciences	5	3	-	-	-	3	3	-	14	8.33
2	Basic Sciences	12	7	6	4	-	-	-	-	29	17.26
3	Engineering Sciences	6	10	3	-	-	-	-	-	19	11.31
4	Professional Core	-	-	14	22	17	9	10	-	72	42.86
5	Professional Elective	-	-	-	-	3	6	3	6	18	10.71
6	Open Elective	-	-	-	-	-	3	3	-	6	3.57
7	Employability Enhancement Courses	-	2	-	-	1		1	6	10	5.95
	Total	**23**	**22**	**23**	**26**	**21**	**21**	**20**	**12**	**168**	**100**

SEMESTER-1

U23HST11 **COMMUNICATIVE ENGLISH** **L T P C**

(COMMON TO ALL B.E./ B.TECH. PROGRAMMES) **3 0 0 3**

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To enhance students listening ability for academic and Professional purposes.
2. To learn to use basic grammatical structures in suitable contexts
3. To help students acquire the ability to speak effectively in English in real -life situations.
4. To help learners use language effectively in professional contexts.
5. To develop student's ability to read and write complex texts, summaries, articles, definitions, Paragraph user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 9

Define communication. Kinds of communication. Quintessential of communication in technical progression. Key characteristics of an effective communicator- listening, attitude modification, way of response with appropriate language, tone modulation.

Listening- Listening to TV news, Guest lectures. Speaking- Answering the Questions.

Reading - Reading brochures and technical magazines (technical context), telephone messages / social media messages relevant to technical contexts and emails, **Writing**-Reading comprehension, Parts of Speech.

UNIT II READING QUEST 9

Listening- listening and responding to video lectures/talks. **Speaking-** Day today conversations. **Reading** –Edison of India-GD Naidu "The Great Inventor". **Writing-** Emails / Informal Letters - Inviting, Congratulating & Thanking, Punctuations.

UNIT III LANGUAGE RESOURCE GROWS CRITICAL JUDGEMENT 9

Listening- listening to specific task-focused audio tracks. Speaking- summary of Robert Frost "Stopping by woods on a snowy evening". Reading – Reading advertisements, gadget reviews; user manuals. Writing – Essay Writing: Analytical essay: Narrative Essay, Developing Hints, Usage of tenses in sentence formation. Voices.

UNIT IV LANGUAGE IN LIFE SKILL 9

Listening- Listening to speech of Great Scholars. Speaking- mechanics of presentation. **Reading** – Newspaper articles, power point presentation. **Writing** – Checklist, Jumbled Sentences-Rearrange the sentences in correct order, WH-Questions-Form questions by using statements, Prefixes and Suffixes.

UNITV IMPROVING SPEAKING &READING 9

Listening- listening to situational based dialogues; **Speaking-** Stating intention to do something- Expressing opinion-asking people to repeat themselves**. Reading** – Summary of O.Henry's "The last Leaf". **Writing** – Dialogue Writing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

- **CO1 :** Remember appropriate words in a situational conversation.
- **CO2 :** Gain understanding of basic grammatical structures and use them in right context.
- **CO3 :** Read and infer the denotative and connotative meanings of technical texts.
- **CO4 :** Write Dialogue, Letter and paragraphs on various topics.
- **CO5 :** Make the students prepare effective notes for main sources available.

CO6 : Enhance them to give operational talk.

TEXT BOOKS:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition).
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
3. The Gift of the Magi by O.Henry, McClure,Philips and company.

REFERENCE BOOKS:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5 Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

U23MAT12 **MATRICES AND CALCULUS**

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2. To familiarize the students with differential calculus.
3. To familiarize the student with functions of several variables
4. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
5. To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems

UNIT I MATRICES **12**

Introduction – Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley Hamilton theorem – Diagonalization of the matrices by Orthogonal Transformations – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS **12**

Limit of a function – Continuity – Derivatives – Differentiation rules – Implicit differentiation – Logarithmic differentiation – Maxima and Minima of functions of one variable.

UNIT III MULTIVARIABLE CALCULUS **12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative –Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRAL AND THEIR APPLICATIONS **12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V ORDINARY DIFFERENTIAL EQUATIONS **12**

Higher order linear differential equations with constant coefficients– Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients – Method of undetermined coefficients.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Use the matrix algebra methods for solving practical problems.

CO2 : Use both the limit definition and rules of differentiation to differentiate functions.

CO3: Apply differential calculus tools in solving various application problems.

CO4: Able to use differential calculus ideas on several variable functions.

CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.

CO6: Solve the ordinary differential equations using different techniques for that model engineering problems.

TEXT BOOKS:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal. B.S., "Higher Engineering Mathematics",Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6 , 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCE BOOKS:

1. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt.,Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition,2016.
3. Narayanan. S. and Manica vachagom Pillai. T. K.,"Calculus" Volume I and II, S.Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt.Ltd, New Delhi, 2016
5. Thomas. G. B., Hass. J, and Weir. M.D,"Thomas Calculus", 14th Edition, Pearson India, 2018.

U23PHT13	PHYSICS FOR ENGINEERS AND TECHNOLOGISTS (COMMON TO ALL B.E./ B.TECH. PROGRAMMES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To make the students to gain the knowledge in elastics and plastic nature of the materials in the presence and absence of load.
2. To understand the students to know the application of the sound waves in different fields.
3. To motivate the students towards the applications of photo electric phenomena.
4. To know the physical principle of LASER, the working of LASER applications.
5. To understand the propagation of light in optical fibers and its applications.

UNIT I ELASTICITY 9

Introduction- Elasticity - plasticity– Hooke's law - relationship between three Modulii of elasticity (Qualitative) – stress & strain diagram and its uses -Poisson's ratio - factors affecting elasticity - twisting ouple of wire - Torsion Pendulum: theory and experiment.

Beam: Internal bending moment – Cantilever: theory and experiment – Young's Modulus: uniform and non – uniform bending (Qualitative) – I-shaped girders- advantages and applications.

UNIT II ULTRASONICS 9

Introduction – classification of sound- properties of infrasonic, audible and ultrasonics - production: Magnetostriction and Piezoelectric methods – determination of velocity of sound in liquid (Acoustic Grating Method) – general applications – industrial application: Non - Destructive Testing: pulse echo system through transmission and reflection modes. ultrasonic scanning methods – medical application: sonogram.

UNIT III MODERN PHYSICS 9

Introduction –Black Body Radiation – Classical and Quantum Laws of Black Body Radiation - Photon and its Properties - Wave Particle Duality and Matter waves – De - Broglie Wavelength - Schrodinger's Time Independent and Time Dependent Wave Equations - Physical Significance of The Wave Function. Application: Particle in One Dimensional Box - Normalization Process – Photo Electric Effect – Laws Governing the Photoelectric Effect – Einstein's Formula - Derivation – Applications: Solar Cell – Solar Water Heater – Photo resistor (LDR).

UNIT IV LASERS 9

Lasers: Introduction - Properties of Laser-Spontaneous and Stimulated Emission Process - Einstein's Theory of Matter Radiation Interaction & A and B Coefficients; Amplification of Light By Population Inversion – Pumping Methods - Types of Lasers: Solid-State Laser (Homo And Hetero Junction Semiconductor Lasers), Gas Laser (CO_2), Applications: Laser Cutting and Welding, LIDAR and Barcode Scanner.

UNIT V FIBER OPTICS AND APPLICATIONS 9

Optical Fiber: Structure - advantages- Principle [TIR]–Propagation Phenomena in optical fiber - Expression For Acceptance Angle and Numerical Aperture – Relation between Refractive Index of Core, Numerical Aperture and Fractional Index Change – Fabrication: Double Crucible Method - Types: Material, Mode, Refractive Index - Applications: Optical Fiber Communication System – fiber optic sensors (Displacement and pressure sensors) – Medical Endoscope.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Differentiate the elastic and plastic nature of the materials.

CO2 : Know the experimental techniques in both production and applications of ultrasonic waves.

CO3: Gain knowledge in the basics of quantum mechanics concepts.

CO4: Develop new devices based on LASER source.

CO5: Understand the advantages of optical fiber than metal wire.

CO6: Demonstrate the some useful experiments based on optical fibre

TEXT BOOKS:

1. Dr. P.Mani, "Engineering Physics", Dhanam Publications, 2013.
2. Dr. G. Senthilkumar, "Engineering Physics", VRB Publishers, 2017.
3. K. Thyagarajan, Ajoy Ghatak, "Lasers Fundamentals and Applications" II nd Edition, Springer, 2010.
4. D.K. Bhattacharya, Poonam Tandon," Engineering Physics", Oxford HED Publishers, 2017.

REFERENCE BOOKS:

1. Marikani, "Engineering Physics", PHI, New Delhi, 2013.
2. Bhattacharya & Bhaskaran, "Engineering Physics", Oxford Publications, 2012.
3. R Murugeshan, Kiruthiga, Sivaprasath S, "Modern Physics", Chand Publishing, 2021.
4. S. Rajivgandhi & A. Ravikumar, " Engineering Physics I", RK Publications, 2023
5. Sathyaprakash, "Quantum Mechanics", Pragati Prakashan, Meerut, 2016.

U23CYT14	CHEMISTRY FOR ENGINEERING & TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To inculcate sound understanding of water quality parameters and water treatment techniques.
2. Impart knowledge on the basic principles and preparatory methods of nanomaterial.
3. To introduce the basic concepts and applications of phase rule and composites.
4. To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
5. To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I Water Treatment 9

Water: Sources , impurities, Parameters. Types of water Hardness of water -types – expression of hardness – units – Estimation of hardness of water by EDTA. Desalination - Reverse Osmosis. Boiler troubles: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process.

UNIT II Electro and Nano chemistry 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf by Poggendorff's compensation principle. Single electrode potential – Nernst equation – reference electrodes -types–Calomel electrode - electrolysis of water.

Nanomaterials: Basics of Nano Chemistry: Distinction between molecules, nanomaterials and bulkmaterials. Preparation of nanomaterials- laser ablation method and Chemical Vapour Deposition (CVD). Application of Nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III Phase Rule and Composites 9

Phase rule terms with examples. water system; Reduced phase rule Two component system: lead-silver system – Composites, Need, Constitution: Matrix materials, Applications and Reinforcement and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV Fuels & Combustion 9

Fuels –Classification-Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO_2 emission and carbon foot print.

UNITV Energy Sources and Storage devices 9

Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy;

Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; Electric vehicles-working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.

CO2 : Apply the basic knowledge of Corrosion and various electrodes.

CO3: Know the economically and new methods of synthesis nano materials.

CO4: Apply the knowledge of phase rule and composites for material selection requirements.

CO5: Understand the concepts ofsuitable fuels for engineering processes and applications.

CO6: Have the knowledgeof different forms of energy resources and apply them for suitable applicationsin energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
4. J.Manivel , "Engineering Chemistry" R.K.Publishers, 1st Edition 2022.

REFERENCE BOOKS:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.

U23GET16	ENGINEERING GRAPHICS	L	T	P	C
		2	0	4	4

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing national standards related to technical drawings.
3. Develop proficiency in 2D drafting using drawing tools.
4. Learn sectional views and assembly drawing techniques.
5. Enhance visualization skills for improved problem-solving and communication in engineering.

UNIT I PLANE CURVES AND ORTHOGRAPHIC PROJECTION 6+12

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimension. Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – 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 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method (polygonal and circular surfaces) inclined to both the planes.

UNIT III PROJECTION OF SOLIDS 6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids 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 6+12

Sectioning of above 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 section. Development of lateral surfaces of simple solids – Prisms, pyramids cylinders and cones.

UNITV ISOMETRIC PROJECTION 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions-Perspective Projection.

TOTAL: 30+40=90 PERIODS

COURSE OUTCOMES:

At the end ofthe course thestudentswouldbeableto

CO1 : Identify the significance of graphics in engineering applications.

CO2 : Project straight lines inclined to both principal planes and determine true lengths and inclinations.

CO3: Apply orthographic projection techniques to project solids.

CO4: Apply the principles of development to prisms, pyramids, cylinders, and cones.
CO5: Combine two solid objects in simple vertical positions using isometric projection.
CO6: Utilize the isometric scale effectively.

TEXT BOOKS:

1. Natrajan K.V., ―A text book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., ―Engineering Graphics‖, New Age International (P) Limited, 2008

REFERENCE BOOKS:

1. Bhatt N.D. and Panchal V.M., ―Engineering Drawing‖, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., ―Engineering Drawing‖, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., ―Engineering Drawing‖ (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. andDuff,John M., ―Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, ―Engineering Graphics‖, Oxford University, Press, New Delhi, 2015.

U23GE3152	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNITV CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

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) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

U23BSP11	PHYSICS AND CHEMISTRY LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To learn the proper use of various kinds of physics laboratory equipment.
2. To learn how data can be collected, presented and interpreted in a clear and concise manner.
3. To learn problem solving skills related to physics principles and interpretation of experimental data.
4. To determine error in experimental measurements and techniques used to minimize such error.
5. To make the student as an active participant in each part of all lab exercises.
6. To inculcate experimental skills to test basic understanding of water quality parameters, as, acidity, alkalinity, chloride.
7. To Induce the students to analyze the hardness of water
8. To induce the students to familiarize with electro analytical techniques such as, pH metry, conductometry in the determination of impurities in aqueous solutions.

LIST OF EXPERIMENTS

1. Torsion pendulum - Determination of rigidity modulus of wire and moment of inertia of regular disc.
2. Non - Uniform bending–Determination of Young's modulus.
3. Laser – (i) Determination of the wavelength of the laser using grating.
   (ii) Determination of size of the particles using laser source.
4. Air wedge – Determination of thickness of a thin sheet/wire.
5. Determination of Band gap of a semiconductor using PN junction kit.
6. To study the V-I Characteristics of Light Dependent Resistor (LDR).
7. Determination of types and amount of alkalinity in water sample.
8. Determination of total, temporary & permanent hardness of water by EDTA method.
9. Determination of chloride content of water sample by Argentometric method.
10. Determination of strength of given hydrochloric acid using pH meter.
11. Determination of strength of acids in a mixture of acids using conductivity meter.
12. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Torsion pendulum set up (Metal Disc, Symmetrical Mass(2x100g), Stop Clock, Screw Gauge)	**5**
2.	Non – Uniform bending set up (Travelling Microscope, Knife Edges, Weight Hanger with Mass(5x50g), Screw Gauge, Vernier Caliper, Meter Scale)	**5**
3.	Laser set up (Semiconductor Laser, Screen, Grating Stand, Wooden Stand With Meter Scale)	**5**
4.	Air wedge (Air Wedge Set Up, Travelling Microscope, Sodium Vapour Lamp, Transformer)	**5**

5.	Band gap of a semiconductor (PN Junction Kit, Thermometer, Heater, Beaker, Oil)	**5**
6.	Light Dependent Resistor (Power Suppy, Voltmeter, Ammeter, LDR, Bulb, Resistors)	**5**
7.	PH meter	**5**
8.	Conductivity meter	**10**
9.	Common Apparatus(Pipette, Burette, Conical Flask, Porcelain tile, Dropper)	**15**

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Understand the functioning of various physics laboratory equipment.

CO2 : Observe and tabulate experimental data.

CO3: Solve problems individually and collaboratively.

CO4: Analyse the quality of water samples with respect to their acidity, alkalinity

CO5: Determine the amount of hardness in the water

CO6: Analyse quantitatively the impurities in solution by electro analytical techniques

U23HSP12 **ENGLISH LABORATORY** **L T P C**

(COMMON TO ALL B.E. / B.TECH. PROGRAMMES) **0 0 2 1**

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To improve the communicative competence of learners.
2. To help learners use language effectively in academic /work contexts.
3. To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
4. To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
5. To use language efficiently in expressing their opinions via various media.

LIST OF EXPERIMENTS

1 Listening for general information-specific details.
2 Conversation: Introduction to classmates.
3 Speaking - making telephone calls-Self Introduction.
4 Talking about current and temporary situations & permanent and regular situations.
5 Listening to podcasts, anecdotes / stories / event narration.
6 Event narration; documentaries and interviews with celebrities.
7 Events-Talking about current and temporary situations & permanent and regular situations.
8 Engaging in small talk.
9 Describing requirements and abilities- Picture description.
10 Discussing and making plans.
11 Talking about tasks- progress- positions -directions of movement.
12 Talking about travel preparations and transportation.
13 Listening to debates/ discussions.
14 Making prediction talking about a given topic.
15 Describing processes.

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Communication laboratory with sufficient computer systems	**30**
2.	Server	**1**
3.	Head phone	**30**
4.	Audio mixture	**1**
5.	Collar mike	**1**
6.	Television	**1**
7.	Speaker set with amplifier	**1**
8.	Power point projector and screen	**1**
9.	Cordless mike	**1**

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Identify and comprehend complex academic texts.

CO2 : Interpret accurately and fluently in formal and informal communicative contexts.

CO3: Demonstrate their opinions effectively in both oral and written medium of communication.

CO4: Plan travelogue and construct paragraphs on various aspects.

CO5: Develop journal reading skills and small talk.

CO6: Utilizing technical terms and making power point presentations.

U23GEL14 ENGINEERING PRACTICES LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common house hold wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts;
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.
5. Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.

GROUP – A (CIVIL AND MECHANICAL)

PART I CIVIL ENGINEERING PRACTICES PLUMBING WORK: 30

a. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b. Preparing plumbing line sketches.
c. Laying pipe connection to the suction side of a pump
d. Laying pipe connection to the delivery side of a pump.
e. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) Turning
b) Drilling
c) Tapping

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.

SHEET METAL WORK:

a) Making of a square tray

WOOD WORK:

a. Sawing,
b. Planing and
c. Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

PART II ELECTRICAL & ELECTRONICS 30

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 RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

ELECTRONICS

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.

4. Soldering practice – Components Devices and Circuits Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL = 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15Sets.
2. Carpentry vice (fitted to work bench) 15Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5each
5. Power Tools: (a) Rotary Hammer 2 Nos (b) Demolition Hammer 2 Nos (c) Circular Saw 2 Nos (d) Planer 2 Nos (e) Hand Drilling Machine 2 Nos (f) Jigsaw 2Nos

MECHANICAL

Arc welding transformer with cables and holders 5 Nos.

1. Welding booth with exhaust facility 5Nos.
2. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5Sets.
3. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2Nos.
4. Centre lathe 2Nos.
5. Hearth furnace, anvil and smithy tools 2Sets.
6. Moulding table, foundry tools 2Sets.
7. Power Tool: Angle Grinder 2Nos
8. Study-purpose items: centrifugal pump, air-conditioner One each

ELECTRICAL

1. Assorted electrical components for house wiring 15Sets
2. Electrical measuring instruments 10Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1No.
5. Power Tools:
   a) Range Finder 2Nos
   b) Digital Live-wire detector 2Nos

ELECTRONICS

1. Soldering guns 10Nos.
2. Assorted electronic components for making circuits 50Nos.
3. Small PCBs 10Nos.
4. Multimeters 10Nos.

Study purpose items: Telephone, FM radio, low-voltage power supply.

COURSE OUTCOMES:

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

CO1 : Draw pipe line plan; lay and connect various pipe fittings used in common household plumbingwork; Saw; plan; make joints in wood materials used in common household wood work.

CO2 : Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common

Household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components onPCB.

CO5: Apply fundamental engineering principles to analyze and solve real-world problems.

CO6: Demonstrate proficiency in using engineering tools and equipment.

SEMESTER-2

U23HST21	PROFESSIONAL COMMUNICATION (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To engage learners in meaningful language activities to improve their reading and writing skills.
2. To learn various reading strategies and apply in comprehending documents in professional context.
3. To help learners understand the purpose, audience, contexts of different types of writing.
4. To enable students write letters and reports effectively in formal and business situations.
5. To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I PREPARATORY DOCUMENTATIONS 9

Listening- Listening to formal conversations and Participating**. Speaking-** speaking about one's family. **Reading –** Summary of W.W Jacobs "The monkey's paw". **Writing –** Subject verb Agreement, Numerical -Adjectives, Kinds of sentences**,** Writing reviews (book / film), writing Instructions, Writing Recommendation.

UNIT II LECTURA ENRICHMENT AND PASSAGE COMPOSE 9

Listening- listening to lectures on academic topics; **Speaking-** Asking for and giving directions. **Reading -** Reading longer technical texts; **Writing -** Compound words, Homophones and Homonyms, Cause and Effect expressions. Essay Writing, Writing Letter to the Editor (complaint, acceptance, Requesting, Thanking).

UNIT III ANALYTICAL SKILL 9

Listening- Watching videos/documentaries and responding to questions based on them. **Speaking –**Speaking about ones favourite place**. Reading –** Summary of the poem – John keats "Ode to a Nightingale". **Writing-** Purpose statement, Extended Definitions. Writing Job/ Internship application – Cover letter & Resume.

UNIT IV REPORT WRITING 9

Listening- Listening to class room lectures/talks on engineering/technology. **Speaking–** Introduction to technical presentations. **Reading –** Newspaper articles; **Writing –** Comparative Adjectives Direct and Indirect speech**.** Report Writing- Fire Accident Report, Road Accident, Feasibility Report).

UNITV ENABLING LINGUA IDEALITY & INFORMATION 9

Listening- TED/Ink talks. **Speaking –** Making presentation on a given topic. **Reading –**Company profiles, Statement of Purpose, (SOP), **Writing –** Relative Clauses, If conditions, Cause and Effect. Chart Interpretations - Bar Chart, Pie Chart, Flow Chart & Tables.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Compare and contrast products and ideas in technical texts.

CO2 : Identify cause and effects in events, industrial processes through technical texts.

CO3 : Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.

CO4 : Motivate students to write reports and winning job applications.
CO5 : Recall and comprehend different discourses and genres of texts.
CO6 : Making the students to become virtuous presenters.

TEXT BOOKS:

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

U23MAT22	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. This course aims at providing the necessary basic concepts of a few statistical tools and give procedures for solving different kinds of problems occurring in engineering and technology.
2. To acquaint the knowledge of classifications of design of experiments in the field of agriculture.
3. To introduce the basic concepts of solving algebraic and transcendental equations.
4. To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
5. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 12

Introduction – Sampling distributions – Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 12

Introduction – Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigen Value of a matrices by power method and jacobi's method for Symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods : Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method for solving first order differential equations – Multi step methods : Milne's and Adams Bashforth predictor corrector methods for solving first order differential equations.

TOTAL:60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1 : Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO2 : Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO3: Solve the algebraic and transcendental equations.

CO4:	Understand the knowledge of numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO5:	Solve the ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
CO6:	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson , R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES BOOKS :

1. Burden,R.L and Faires, J.D, "Numerical Analysis”, 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi , 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis” Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons, New Delhi,12th Edition, 2020.
5. Spiegel.M.R.,Schiller.J. and Srinivasan. R.A., "Schaum’s Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

PROBLEM SOLVING AND PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To understand the basics of algorithmic problem solving
2. To learn to solve problems using Python conditionals and loops.
3. To define Python functions and use function calls to solve problems.
4. To use Python data structures - lists, tuples, dictionaries to represent complex data.
5. To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Develop algorithmic solutions to simple computational problems.
CO2 : Develop and execute simple Python programs
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions
CO5: Represent compound data using Python lists, tuples, dictionaries etc

CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and programming”, 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

U23PHT23	APPLIED MATERIALS SCIENCE (COMMON TO AERO, AS, MECH, ROBO, CIVIL PROGRAMMES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To make the students to understand the basics of crystallography and its importance in studying materials properties.
2. To understand the electrical properties of materials including free electron theory, applications.
3. To expand their knowledge in applications of magnetic and superconducting materials.
4. To instill knowledge on physics of semiconductors, determination of charge carriersand device applications.
5. To inculcate an idea of significance of new materials, nanostructures ensuing nano device applications.

UNIT I CONDENSED MATTER PHYSICS 9

Introduction - Lattice - Unit Cell - Seven Crystal Systems -Bravai's Lattices - Lattice Planes - Calculation of Number of Atoms per Unit Cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP Structures. Miller Indices – Derivation for Inter-Planar Spacing in terms of Miller Indices-Crystal Growth Techniques: Melt Growth Technique (Bridgman and Czochralski Techniques).

UNIT II CONDUCTING AND INSULATING MATERIALS 9

Conducting Materials: Classical Free Electron Theory: Postulates – Derivation of Electrical Conductivity and Thermal Conductivity- Derivation. Wiedemann-Franz Law and Its Verification-Merits and Demerits of Classical Free Electron Theory. Density of States – Carrier Concentration in Metals.

Insulating Materials: Types of Polarization Mechanisms - Langevin- Debye Equation - Internal Field – Clausius - Mossotti Relation – Applications of Insulating Materials.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Magnetic Materials: Dia, Para and Ferromagnetic Materials and Its Properties – Ferromagnetic Domains – Wiess Theory of Ferromagnetism – Hysteresis - B-H Curve Studies – Soft and Hard Magnetic Materials- Applications.

Superconducting Materials: Properties – Type I and Type II Superconductors – London equations – Applications: Magnetic Levitated Train – Magnetic Resonance Imaging.

UNIT IV PHYSICS OF SEMICONDUCTOR 9

Introduction – Properties - Intrinsic Semiconductors – Energy Band Diagram – Direct and Indirect Band Gap Semiconductors – Carrier Concentration in Intrinsic Semiconductors – Extrinsic Semiconductors - Carrier Concentration in N-Type & P-Type Semiconductors – Variation of Carrier Concentration with Temperature – Carrier Transport in Semiconductors: Drift, Mobility and Diffusion – Hall Effect And Devices.

UNIT V MODERN ENGINEERING MATERIALS 9

Shape Memory Alloys – Structures – Properties – Applications. Metallic Glasses – Preparation and Applications. Ceramics – Types - Properties and Applications.

Nanomaterials – Types – Properties and Applications – Preparation Techniques: Electrodeposition – Pulsed Laser Deposition. CNT – Structure – Types – Properties – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Know basics of crystallography and its importance for varied materials properties.

CO2 : Familiarize with theories of electrical and thermal conduction is solids, basic quantummechanics, and energy bands.

CO3: Gain knowledge on the magnetic and superconductor properties of materials and theirapplications.

CO4: Acquire knowledge on basics of semiconductor physics and its applications in various devices.

CO5: Get knowledge on newly developed materials in micro and nano scale.

CO6: Understand the different structures of CNT in Nano range

TEXT BOOKS:

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2. Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley (India), 2007.
3. G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition),2009.
4. Dr. P. Mani, “Physics for Electronics Engineering” Dhanam Publications, 2017.
5. Dr. G. Senthilkumar, “Engineering Physics II” VRB Publishers, 2013.

REFERENCE BOOKS:

1. R.Balasubramaniam, Callister’s Materials Science and Engineering. Wiley (Indian Edition), 2014.
2. Wendelin Wright and Donald Askeland, Essentials of Materials Science and Engineering, CL Engineering, 2013.
3. S. Rajivgandhi, Dr. I. Cicil Ignatius & A. Ravikumar, “ Engineering Physics II”, RK Publications, 2023
4. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson, 2006.
5. Ben Rogers, Jesse Adams and Sumita Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2017.

U23EET23	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To introduce the basics of electric circuits and analysis
2. To impart knowledge in the basics of working principles and application of electrical machines
3. To introduce analog devices and their characteristics
4. To educate on the fundamental concepts of digital electronics
5. To introduce basic concepts of 8085 microprocessor.

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor

UNIT III ANALOG ELECTRONICS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon & Germanium – PN Junction Diodes, Zener Diode – Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions - SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNITV 8085 MICROPROCESSOR 9

Introduction to Microprocessor – Hardware Architecture, pinouts – Functional Building Block diagram-Instruction format –Addressing Modes-Memory Organization- I/O ports-Timing Diagram-Interrupts.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the working principle of electrical machines
CO3: Explain the applications of electrical machines
CO4: Analyze the characteristics of analog electronic devices
CO5: Explain the basic concepts of digital electronics
CO6: Explain the basic concepts of 8085 microprocessor

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020
2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.
3. Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., 2008.
4. James A .Svoboda, Richard C. Dorf, “Dorf’s Introduction to Electric Circuits”, Wiley, 2018.
5. Sunil Mathur &Jeebananda Panda, “Microprocessor and Microcontrollers”, PHI Learning Pvt. Ltd, 2016.

REFERENCE BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. Krishna Kant, “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.

U23GE3252	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads –Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

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)

U23EEP22	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. Using experimental methods to verify the Ohm's.
2. Analysing the behaviour of digital devices.
3. Conducting load tests on electrical machines.
4. Gaining practical experience in characterizing electronic devices.
5. Using 8085 microprocessor for Arithmetic operations

LIST OF EXPERIMENTS

1. Verification of ohms and Kirchhoff's Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator.
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Simple arithmetic operations: addition / subtraction / multiplication / division.
12. Programming with control instructions: (i) Ascending / Descending order, Maximum / Minimum of numbers. (ii) Programs using Rotate instructions. (iii) Hex / ASCII / BCD code conversions.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl. No.	Name of the Equipment	Quantity
1.	DC Regulated Power supply (0 - 30 V variable)	1
2.	DC shunt generator (0- 300V)	1
3.	Wattmeter – 300V, 30 A	1
4.	Single phase Induction motor	1
5.	PN Diodes and Zener diodes	As Required
6.	SCR, MOSFET and transistors	As Required
7.	IC 7400, 7402, 7404,7408,7432,7486	As Required
8.	Transistor	As Required
9.	Resistors	As Required
10.	Ammeter MC	As Required
11.	Voltmeter MC	As Required
12.	Rheostats	As Required
13.	Tachometer	As Required
14.	Connecting wires	As Required
15	8085 microprocessor kit	5

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Use experimental methods to verify the Ohm's Laws.

CO2 : Use experimental methods to verify the Kirchhoff's Laws.

CO3: Analyze experimentally the load characteristics of electrical machines.

CO4: Analyze the characteristics of basic electronic devices.
CO5: Analyze the behavior of digital devices.
CO6: Use microprocessor kit to verify the arithmetic operations

U23HSP22	COMMUNICATION LABORATORY (COMMON TO ALL B.E. / B.TECH. PROGRAMMES)	L	T	P	C
		0	0	2	2

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
2. To be able to communicate effectively through writing.
3. Encouraging plan designing and decision making.
4. Understanding and writing technical instruction.
5. To understand the value of letter writing with correct format.

LIST OF EXPERIMENTS:

1. Speaking-Role Play Exercises Based on Workplace Contexts.
2. Talking about competition.
3. Discussing progress toward goals-talking about experiences.
4. Discussing likes and dislikes.
5. Discussing feelings about experiences.
6. Discussing imaginary scenarios.
7. Writing short essays.
8. Speaking about the natural environment.
9. Describing communication system.
10. Describing position and movement- explaining rules.
11. Understanding technical instructions-Writing: writing instructions.
12. Speaking: describing things relatively-describing clothing.
13. Discussing safety issues (making recommendations) talking about electrical devices.
14. Describing controlling actions.
15. Writing a job application (Cover letter + Resume).

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1.	Communication laboratory with sufficient computer systems	**30**
2.	Server	**1**
3.	Head phone	**30**
4.	Audio mixture	**1**
5.	Collar mike	**1**
6.	Television	**1**
7.	Speaker set with amplifier	**1**
8.	Power point projector and screen	**1**
9.	Cordless mike	**1**

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1 : Distinguish their technical competency through language skill.

CO2 : Predict context effectively in-group discussions held in a formal / semi-formal discussions.

CO3: Understanding candidates' key characteristics.

CO4: Finding personality traits by sharing and comparing thoughts and ability.

CO5: Understanding the value of ethics.(rules and regulations).

CO6: Construct emails and effective job applications**.**

U23EEP22	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To understand the problem solving approaches.
2. To learn the basic programming constructs in Python.
3. To practice various computing strategies for Python-based solutions to real world problems
4. To use Python data structures - lists, tuples, dictionaries.
5. To do input/output with files in Python.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Develop algorithmic solutions to simple computational problems
CO2 : Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

SEMESTER-3

U23MAT31	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. To introduce the basic concepts of PDE for solving standard partial differential equations.
2. To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
3. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4. To acquaint the student with Fourier transform techniques used in wide variety of situations.
5. To enable the students to study the Laplace transforms and some applications to solve the differential equations.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients of both homogenous and non – homogenous type.

UNIT II FOURIER SERIES 12

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

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation — One dimensional equation of heat conduction — Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV 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.

UNIT V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals - Initial and final value theorems – Inverse transforms – Convolution theorem–Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to:

CO1 : Understand how to solve the given standard partial differential equations.

CO2 : Able to solve various types of partial differential equations.

CO3: Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.

CO4: Appreciate the physical significance of Fourier series techniques in solving One and two dimensional heat flow problems and one dimensional wave equations.

CO5: Understand the mathematical principles on transforms would provide them the ability to formulate and solve some of the physical problems of engineering.

CO6: Use the method of Laplace Transform to solve initial value problem for Linear differential equations with constant coefficients.

TEXT BOOKS:

1. Grewal B.S., “Higher Engineering Mathematics", 44thEdition, Khanna Publishers , New Delhi ,2018.
2. Kreyszig E, "Advanced Engineering Mathematics", 10th Edition, John Wiley,New Delhi,India,2016.

REFERENCES BOOKS :

1. Andrews. L.C and Shivamoggi .B, "Integral Transforms for Engineers "SPIE Press,1999.
2. Bali. N.P and Manish Goyal, "A Text book of Engineering Mathematics",10th Edition, Laxmi Publications Pvt. Ltd ,2015.
3. James. G., "Advanced Modern Engineering Mathematics", 4th Edition, Pears on Education, New Delhi,2016.
4. Narayanan. S.,Manicavachagom Pillay. T.K and Ramanaiah. G "Advanced Mathematics for Engineering Students",Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd,NewDelhi,2018.

U23AET32	AERO ENGINEERING THERMODYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. Aero Thermodynamics study includes quantitative analysis of machine and processes for transformation of energy and between work and heat.
2. Laws of thermodynamics would be able to quantify through measurement of related properties, to these energies and their interactions.
3. To develop basic concept of air cycle, gas turbine engines and heat transfer.
4. To understand the basic principles of propulsion system of aircraft.
5. Thermodynamics heat transfer process would be able to understand their practical applications and its problems.

UNIT I FUNDAMENTAL CONCEPT AND FIRST LAW 9

Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, internal energy, enthalpy, specific heat capacities and heat transfer, SFEE, application of SFEE to jet engine components, First law of thermodynamics, relation between pressure, volume and temperature for various processes, Zeroth law of thermodynamics.

UNIT II SECOND LAW AND ENTROPY 9

Second law of thermodynamics – Kelvin Planck and Clausius statements of second law-Reversibility and Irreversibility-Thermal reservoir-Carnot theorem-Carnot cycle-Reversed Carnot cycle-efficiency-COP-Thermodynamic temperature scale - Clausius inequality-Concept of entropy-Entropy change for various processes-Mixing of fluids.

UNIT III AIR STANDARD CYCLES 8

Otto, Diesel, Dual, Ericsson, Atkinson, Stirling and Brayton cycles - air standard efficiency - mean effective pressure.

UNIT IV FUNDAMENTALS OF VAPOUR POWER CYCLES 9

Properties of pure substances – solid, liquid and vapour phases, phase rule, p-v, p-T, T-v, T-s, h-s diagrams, p-v-T surfaces, thermodynamic properties of steam - calculations of work done and heat transfer in non-flow and flow processes - standard Rankine cycle, Reheat and Regeneration cycle. Heat rate, Specific steam consumption, Tonne of refrigeration.

UNITV BASICS OF PROPULSION AND HEAT TRANSFER 10

Classification of jet engines - basic jet propulsion arrangement – Engine station number, thrust equation – Specific thrust, SFC, TSFC, specific impulse, actual cycles, isentropic efficiencies of jet engine components, polytropic efficiency, conduction in parallel, radial and composite wall, basics of convective and radiation heat transfer.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Relate laws of thermodynamics to jet engine components.

CO2 : Understands principle operation of piston engine and jet engines.

CO3: Identify efficient cycle of air and jet engines.

CO4: Illustrate condition of working medium.

CO5: Recognize and calculate heat transfer in complex systems involving several heat transfer mechanisms.

CO6: Analyse and solve the problems related to flow and non-flow process

TEXT BOOKS:

1. Nag.P.K. "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2013.
2. Radhakrishnan E.,"Fundamentals of Engineering Thermodynamics", Prentice-Hall India, 2010.
3. Yunus A. Cengel and Michael A. Boles, "Thermodynamics: An Engineering Approach" McGraw-Hill Science/Engineering/Math; 7thedition 2010.

REFERENCE BOOKS:

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Holman.J.P. "Thermodynamics", 3rd Edition, McGraw-Hill, 2007.
3. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
4. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006

U23AET32	SOLID MECHANICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. Ability to think, Analyse and solve Engineering Problems expected from the course.
2. Ability to understand stress and strain concepts related to deformable bodies.
3. To enable understanding of the behaviour and response of materials and to allow the student to carry out easy and moderate level structural analysis of basic structural members.
4. To familiarize with the different methods used for beam deflection analysis.
5. To impart knowledge to the students on how structural elements are sized and to enable the student to gain knowledge in how stresses are developed and distributed internally.

UNIT I CONCURRENT AND NON-CONCURRENT 12

Introduction, Concept of FBD, Coplanar Concurrent force system, Moments, Coplanar Non-Concurrent force system and Support Reactions – Application Problems

UNIT II SHEAR FORCE AND BENDING MOMENT, SECOND AREA MOMENT PROBLEMS 12

Analysis of Simple Truss, Shear Force and Bending Moment Diagrams, C.G. and M.I of Plane areas.

UNIT III AXIAL BAR AND MATERIAL MODULUS 12

Simple stress and Strain, Mechanical Properties of Materials, Statically Determinate Problems and Elastic Constants, Tension, Compression, and Shear, Elasticity, Plasticity and Creep, Hooke's Law. Allowable stresses.

UNIT IV BEAM BENDING AND TORSION 12

Axially loaded members, Statically indeterminate structures, Thermal effects, misfits, and Pre-strains. Torsion of circular bar, Transmission of power by circular shafts. Stresses in beams, Pure bending and Nonuniform bending, Design of beams for bending stresses,Shear stresses in beams of rectangular cross section.

UNITV STRESS TRANSFORMATION, DEFLECTION OF BEAM AND BUCKLING OF COLUMN 12

Plane stress, Principal stresses, Mohr's circle and Hooke's law for plane stresses. Spherical and Cylindrical pressure vessels. Deflection of beams, Column buckling.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Clear understanding of mechanical behaviour of materials.
CO2 : Knowledge of different structural members and load types.
CO3: Design members under axial loading.
CO4: Design member under torsion loading.
CO5: Calculate beams deflections
CO6: To gain knowledge in how stresses are developed and distributed internally

TEXT BOOKS:

1. Egor P Popov, Mechanics of Materials, Pearson, 2015
2. James M. Gere, Mechanics of Materials, Sixth Edition, Thomson Learning, 2004
3. Ferdinand Beer, E. Russell Johnston Jr., John Dewolf, David Mazurek, Mechanics of Materials, McGraw Hill Education,2014.
4. Russell C Hibbeler, Mechanics of Materials, Pearson, 2013

REFERENCE BOOKS:

1. William F. Riley, Leroy D. Sturges, Don H. Morris, Mechanics of Materials, John Wiley & Sons, 1998.
2. Advanced Mechanics of Materials, 6th Edition, authored by Arthur P. Boresi, Richard J. Schmidt, bearing ISBN: 978-81-947263-9-5, Published by Wiley India Pvt. Limited
3. Mechanics of Materials, 5th Edition, authored by Timothy A. Philpot, Jeffery S. Thomas, bearing ISBN: 978-1-119-85997-0, Published by Wiley India Pvt. Limited.

U23AET33	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. The properties of fluids and concept of control volume are studied
2. The applications of the conservation laws to flow through pipes are studied.
3. To understand the importance of dimensional analysis
4. To understand the importance of various types of flow in pumps.
5. To understand the importance of various types of flow in turbines

UNIT I FLUID PROPERTIESAND FLOW CHARACTERISTICS 9

Units and dimensions-Properties of fluids-mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity. Flow characteristics –concept to control volume-application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient-Laminar flow through circular conduits and circular annuli-Boundary layer concepts– types of boundary layer thickness–Darcy Weisbach equation–friction factor-Moody diagram- commercial pipes- minor losses–Flow through pipes in series and parallel.

UNIT III DIMENSIONALANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis–Similitude–types of similitude-Dimensionless parameters- application of dimensionless parameters–Model analysis.

UNIT IV PUMPS 9

Impact of jets- Euler's equation- Theory of roto-dynamic machines–various efficiencies–velocity components at entry and exit of the rotor-velocity triangles-Centrifugal pumps–working principle-work done by the impeller-performance curves-Reciprocating pump-working principle–Rotary pumps–classification.

UNITV TURBINES 9

Classification of turbines–heads and efficiencies–velocity triangles .Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines-working principles-workdone by water on the runner–draft tube. Specific speed-unit quantities– performance curves for turbines– governing of turbines.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Understand the properties and behaviour in static conditions. Also, to understand the conservation laws applicable to fluids and its application through fluid kinematics

and dynamics

CO2 : Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also, to understand the concept of boundary layer and its thickness on the flat solid surface.

CO3: Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies

CO4: Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps

CO5: Explain the working principles of various turbines and design the various types of turbines.

CO6: Determine the fluid pressure and use various devices for measuring fluid pressure

TEXT BOOKS:

1. Modi P.N. and Seth, S.M."Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2019 (22nd Paperback edition). ISBN: 978-81-89401-26-9.
2. R.K. Bansal." Fluid Mechanics and Hydraulic Machines" January 2018.
3. John. M. Cimbala Yunus A. Cengel." Fluid Mechanics: Fundamentals and Applications (4th edition", May 2019.

REFERENCE BOOKS:

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, "Fluid Mechanics and Machinery", 2011
4. Streeter, V. L. and WylieE.B.,"Fluid Mechanics",McGraw Hill Publishing Co.2010

U23AET34	ELEMENTS OF AERONAUTICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To acquire the knowledge on the Historical evaluation of Airplanes.
2. To learn the different component systems and function.
3. To know the concepts of basic properties and principles behind the flight.
4. To learn the basics of different structures & construction.
5. To learn the various types of power plants used in aircrafts.

UNIT I HISTORY OF FLIGHT 9

Balloon flight-ornithopter-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II AIRCRAFT CONFIGURATIONS AND ITS CONTROLS 9

Different types of flight vehicles, Classifications-Components of an airplane and their functions-Conventional control, powered control- Basic instruments for Flying-Typical systems for control actuation

UNIT III BASICS OF AERODYNAMICS 9

Physical Properties and structures of the Atmosphere, Temperature, pressure and altitude relationships, Newton's Law of Motions applied to Aeronautics-Evolution of lift, drag and moment. Aerofoils, Mach number, Manoeuvres.

UNIT IV BASICS OF AIRCRAFT STRUCTURES 9

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials. Stresses and Strains-Hooke's law- stress-strain diagrams-elastic Constants-Factor of Safety.

UNIT V BASICS OF PROPULSION 9

Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust Production - Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Illustrate the history of aircraft & developments over the years
CO2 : Ability to identify the types & classifications of components and control systems
CO3: Explain the basic concepts of flight & Physical properties of Atmosphere
CO4: Identify the types of fuselage and constructions.
CO5: Distinguish the types of Engines and explain the principles of Rocket
CO6: Understand the basic aircraft systems

TEXT BOOKS:

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015
2. E Rathakrishnan, “Introduction to Aerospace Engineering: Basic Principles of Flight”, John Wiley, NJ, 2021
3. Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004.

REFERENCE BOOKS:

1. Sadhu Singh, “Internal Combustion Engines and Gas Turbine”, SS Kataraia & Sons, 2015
2. Kermode, “Flight without Formulae”, Pitman; 4th revised edition 1989.

U23AET35	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
2. To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
3. To facilitate the understanding of global and Indian scenario of renewable and non renewable resources, causes of their degradation and measures to preserve them.
4. To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
5. To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change-Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNITV SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles

carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and technological change.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO2 : To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.

CO3: To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations

CO4: To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

CO5: To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

CO6: To explain the integrated themes and biodiversity, natural resources, pollution control and waste management

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning

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. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

U23AEP31	THERMODYNAMICS AND STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To have a practical exposure to the subject of thermodynamics principles.
2. To conduct experiments to find the effectiveness of parallel flow and counter flow heat exchangers.
3. To test the flash point and fire point of oil.
4. To have hands-on experience on various experiments related to solid mechanics
5. To test and quantify the mechanical properties of Engineering Materials.

LIST OF EXPERIMENTS

Thermodynamics Laboratory:

1. Determination of calorific value of a given fuel.
2. Free convective heat transfer from a flat plate
3. Determination of Effectiveness of parallel flow heat exchangers.
4. Forced convective heat transfer from a flat plate.
5. Determination of Effectiveness of a counter flow heat exchanger
6. Determination of Flash point and Fire point of the given oil.

Strength of Materials Laboratory:

7. Tension Test
8. Testing of springs
9. Impact test, Charpy model
10. Deflection of Beams
11. Hardness test.
12. Fatigue test for Elastomers

Any 10 experiments will be conducted from above 12 experiments

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1	Bomb Calorimeter	1
2	Parallel and counter flow heat exchanger test rig	1
3	Flash point apparatus.	1
4	Convective heat transfer	1
5	Universal Tensile Testing machine	1
6	Spring Testing Machine for tensile and compressive loads	1
7	Brinell Hardness Testing Machine	1
8	Rockwell Hardness Testing Machine	1
9	Torsion Testing Machine	1
10	Impact Testing Machine	1

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Test and quantify the mechanical properties of Engineering Materials

CO2 : Acquire knowledge on bending properties of beams.
CO3: Estimate the performance of heat exchangers.
CO4: Apply principles of convective heat transfer characteristics to practical systems.
CO5: Acquire Knowledge on ignition aspects of fuels and thermal properties of fuels.
CO6: Ability to characteristic materials

U23AEP32	FLUID MECHANICS AND MACHINERY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To have practical exposure on pressure measuring instruments
2. To learn about the practical application of Bernoulli's theorem
3. To have a practical knowledge about the Venturimeter and its applications
4. To learn practically about the laminar flow characteristics
5. To have a hands-on experience on the determination of various performance parameters of a centrifugal pump.

LIST OF EXPERIMENTS

Thermodynamics Laboratory:

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Operate fluid flow equipment and instrumentation.

CO2 : Analyze data using fluid mechanics principles and experimentation methods.

CO3: Determine the coefficient of discharge for various flow measurement devices.

CO4: Calculate flow characteristics such as Reynolds number, friction factor from laboratory measurements.

CO5: Analyze the performance characteristics of hydraulic pumps.

CO6: Analyze the performance characteristics of hydraulic turbines

SEMESTER -4

U23MAT41 VECTOR CALCULUS AND COMPLEX FUNCTIONS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
2. To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
3. To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
4. To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
5. To understand about higher order linear differential equations.

UNIT I VECTOR CALCULUS 9

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT II ANALYTIC FUNCTION 9

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w= z+c, az, 1/z, z^2$- Bilinear transformation.

UNIT III COMPLEX INTEGRATION 9

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT IV LAPLACE TRANSFORMS 9

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

UNITV ORDINARY DIFFERENTIAL EQUATIONS 9

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Evaluate real and complex integrals using the Cauchy integral formula and the residue

theorem

CO2 : Appreciate how complex methods can be used to prove some important theoretical results.

CO3: Evaluate line, surface and volume integrals in simple coordinate systems.

CO4: Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities.

CO5: Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.

CO6: To impart the knowledge on higher order linear differential equations

TEXT BOOKS:

1. Erwin Kreyszig," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal B.S., "Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCE BOOKS:

1. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics ", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

U23AET41	LOW SPEED AERODYNAMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To introduce the concepts of mass, momentum and energy conservation relating to aerodynamics
2. To introduce the Navier Stroke equations and its application
3. To make the student understand the concept of vorticity, irrotationality, theory of airfoil and wing sections.
4. To introduce the basics of viscous flow
5. To make the student to understand the different boundary layers and Blasius Solution

UNIT I INTRODUCTION TO LOW-SPEED FLOW 9

Euler equation, incompressible Bernoulli's equation. circulation and vorticity, green's lemma and Stoke's theorem, barotropic flow, kelvin's theorem, streamline, stream function, irrotational flow, potential function, Equipotential lines, elementary flows and their combinations.

UNIT II TWO DIMENSIONAL INVISCID INCOMPRESSIBLE FLOW 9

Ideal Flow over a circular cylinder, D'Alembert's Paradox, Magnus effect, Kutta Joukowski's Theorem, Starting Vortex, Kutta condition, Real flow over smooth and rough cylinder.

UNIT III AIRFOIL THEORY 8

Cauchy-Riemann relations, Complex Potential, Methodology of Conformal Transformation, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications.

UNIT IV SUBSONIC WING THEORY 9

Vortex Filament, Biot – Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations

UNIT V INTRODUCTION TO LAMINAR AND TURBULENT FLOW 10

Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady, two dimensional incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, Blasius solution, Basics of Turbulent flow, Prandtl's mixing length hypothesis, Free shear layers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Apply the basics physics for low-speed flows

CO2 : Apply the concept of 2D, inviscid incompressible flows in low-speed aerodynamics.

CO3: Solve lift generation problems using aerofoil theories.

CO4: Make use of lifting line theory for solving flow properties.

CO5: Solve the boundary layer equations for a steady, two-dimensional incompressible flow

CO6: Solve the properties of turbulent flow.

TEXT BOOKS:

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw Hill Book Co., 2010
2. Houghton, E.L., and Caruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.
3. E Rathakrishnan, “Theoretical Aerodynamics”, John Wiley, NJ, 2013

REFERENCE BOOKS:

1. Clancey, L J.," Aerodynamics", Pitman, 1986
2. John J Bertin., "Aerodynamics for Engineers", Pearson Education Inc, 2002
3. Kuethe, A.M and Chow, C.Y, “Foundations of Aerodynamics”, Fifth Edition, John Wiley & Sons, 2000.
4. Milne Thomson, L.H., "Theoretical Aerodynamics", Macmillan, 1985

U23AET42	AIR BREATHING PROPULSION	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To establish fundamental approach and application of jet engine components.
2. To learn about the analysis of flow phenomenon and estimation of thrust developed by jet engine.
3. To introduce about the application of various equations in Gas Turbine Engines.
4. To learn the concepts of jet engine combustion chambers
5. To acquire knowledge on compressors and turbines.

UNIT I PRINCIPLES OF AIR BREATHING ENGINES 12

Illustration of working gas turbine cycle – Thrust equation – Factors affecting thrust – Methods of thrust augmentation – Engine performance parameters – Performance analysis of turboprop, turbofan and turbojet.

UNIT II JET ENGINE INTAKES AND EXHAUST NOZZLES 12

Ram effect, Internal flow and Stall in subsonic inlets – relation between minimum area ratio and eternal deceleration ratio – diffuser performance – modes of operation - supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – real flow through nozzles and nozzle efficiency – losses in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal.

UNIT III JET ENGINE COMBUSTION CHAMBERS 12

Chemistry of combustion, Combustion equations, Combustion process, classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization, Cooling process, Materials, Aircraft fuels, HHV, LHV, Orsat apparatus

UNIT IV JET ENGINE COMPRESSORS 12

Euler's turbo machinery equation, Principle operation of centrifugal compressor, Principle operation of axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction – free vortex and constant reaction designs of axial flow compressor – performance parameters axial flow compressors– stage efficiency.

UNITV JET ENGINE TURBINES 12

Principle of operation of axial flow turbines– limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – degree of reaction – constant nozzle angle designs – performance parameters of axial flow turbine– turbine blade cooling methods – stage efficiency calculations – basic blade profile design considerations – matching of compressor and turbine

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Apply ideal and actual cycle analysis of a gas turbine engine to relate thrust and fuel consumption.

CO2: Acquire knowledge on the operation of subsonic, supersonic inlets and their operating characteristics.

CO3: Explain the nozzle performance of the engine

CO4: Illustrate the combustion process and fuels used on combustion.
CO5: Understanding the workings of multistage compressor or turbine, and use velocity triangles.
CO6: Understand the working and performance characteristics of the turbines.

TEXT BOOKS:

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Pearson education (2009)
2. V.Ganesan "Gas Turbines" Tata McGraw-Hill Education Pvt. Ltd., 2010
3. Ahmed F. El – Sayed, "Aircraft Propulsion and Gas turbine engines", CRC Press Taylor and Francis group, Second Edition 2017

REFERENCE BOOKS:

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Pearson Education Canada; 6th edition, 2008.
2. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2nd edition 2014
3. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
4. "Rolls Royce Jet Engine", Rolls Royce; 4th revised edition, 1986

U23AET43	AIRCRAFT STRUCTURES-I	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To provide the students an understanding on the linear static analysis of determinate and indeterminate aircraft structural components.
2. To provide the students an understanding on energy methods to statically determinate and indeterminate structures
3. To make the students to Create a structure to carry the given load
4. To make the students to Calculate the response of statically indeterminate structures under various loading conditions.
5. To provide the design process using different failure theories

UNIT I STATICALLY DETERMINATE & INDETERMINATE STRUCTURES 9

Plane truss analysis – method of joints – method of sections – method of shear – 3-D trusses – principle of super position, Clapeyron's 3 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 theorems and their applications. Energy theorems – dummy load & unit load methods – energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses.

UNIT III COLUMNS 9

Euler's column curve – inelastic buckling – effect of initial curvature – Southwell plot – columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – stresses in beam columns.

UNIT IV FAILURE THEORIES 9

Ductile and brittle materials – maximum principal stress theory - maximum principal strain theory - maximum shear stress theory - distortion energy theory – octahedral shear stress theory.

UNITV INDUCED STRESSES 9

Thermal stresses – impact loading – Fatigue – Creep - Stress Relaxation

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Explain the method to analyse the linear static analysis of determinate and indeterminate aircraft structural components

CO2 : Apply the energy methods to determine the reactions of structure

CO3: Analyse the column structure with different end condition.

CO4: Design the component using different theories of failure.

CO5: Create a structure to carry the given load by considering effect of induced stresses

CO6: understanding on the linear static analysis of determinate and indeterminate aircraft structural components

TEXT BOOKS:

1. Mechanics of Materials' by James M. Gere & Barry J Goodno, cengage Learning Custom Publishing; 8th edition, 2012.
2. Megson T M G, `Aircraft Structures for Engineering students' Butterworth-Heinemann publisher, 5th edition, 2012
3. N.C. Pandya, C.S. Shah, "Elements of Machine Design", Charotar Publishing House, 15th edition, 2009.

REFERENCE BOOKS:

1. Bruhn E F, 'Analysis and Design of Flight Vehicle Structures', Tri-State Off-set Company, USA, 1985
2. Donaldson, B.K., 'Analysis of Aircraft Structures - An Introduction' Cambridge University Press publishers, 2 nd edition, 2008
3. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999.

U23AET44	MECHANICS OF MACHINES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To understand the principles in the formation of mechanisms and their kinematics.
2. To learn the basic concepts of toothed gearing and kinematics of gear trains.
3. To study the effect of friction in different machine elements.
4. To analyse the forces and torque acting on simple mechanical systems
5. To understand the importance of balancing and vibration

UNIT I KINEMATIC ANALYSIS IN SIMPLE MECHANISMS AND CAMS 9

Mechanisms – Terminology and definitions – kinematics inversions and analysis of 4 bar and slide crank chain – velocity and acceleration polygons – cams – classifications – displacement diagrams - layout of plate cam profiles

UNIT II TOOTHED GEARING AND GEAR TRAINS 9

Gear terminology – law of toothed gearing – involute gearing – Gear tooth action - Interference and undercutting – gear trains – parallel axis gear trains – epicyclic gear trains.

UNIT III FRICTION ASPECTS IN MACHINE COMPONENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt drives – Friction aspects in brakes

UNIT IV STATIC AND DYNAMIC FORCE ANALYSIS 9

Applied and Constrained Forces – Free body diagrams – Static equilibrium conditions – Static Force analysis in simple mechanisms – Dynamic Force Analysis in simple machine members – Inertia Forces and Inertia Torque – D'Alembert's principle.

UNIT V BALANCING OF ROTATING MASSES AND VIBRATION 9

Static and Dynamic balancing – Balancing of revolving masses – Balancing machines – Free vibrations – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Forced vibration – harmonic Forcing – Vibration isolation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Design the linkages and the cam mechanisms for specified output motions.

CO2 : Determine the gear parameters of toothed gearing and speeds of gear trains in various applications.

CO3: Evaluate the frictional torque in screw threads, clutches, brakes and belt drives.

CO4: Determine the forces on members of mechanisms during static and dynamic equilibrium conditions.

CO5: Determine the balancing masses on rotating machineries and the natural frequencies of free and forced vibratory systems

CO6: understand the importance of balancing and vibration

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.
2. Shigley J.E., Pennock G.R and Uicker J.J., ―Theory of Machines and Mechanisms‖, Oxford University Press, 2003

REFERENCE BOOKS:

1. Cleghorn. W. L., Nikolai Dechev, "Mechanisms of Machines", Oxford University Press, 2015
2. Rao.J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt.Ltd.,2006.
3. Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 2014
4. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2009.
5. Thomas Bevan, "The Theory of Machines", Pearson Education Ltd., 2010

U23AET45	AIRCRAFT SYSTEMS AND INSTRUMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To impart knowledge of the hydraulic and pneumatic systems components
2. To Study the types of instruments and its operation including navigational instruments.
3. Acquire the knowledge of essential systems of safe aircraft operation.
4. To learn the concepts of display systems
5. To study the various engine systems in aircraft

UNIT I AIRCRAFT SYSTEMS 9

Hydraulic systems – Study of typical systems – components – Hydraulic systems controllers – Modes of operation – Pneumatic systems – Working principles – Typical Pneumatic Power system – Brake system – Components, Landing Gear Systems – Classification – Shock absorbers – Retractive mechanism.

UNIT II AIRPLANE CONTROL SYSTEMS 9

Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – operating principles – Modern control systems – Digital fly by wire systems – Auto pilot system.

UNIT III ENGINE SYSTEMS 9

Piston and Jet Engines- Fuel systems – Components - Multi-engine fuel systems, lubricating systems – Starting and Ignition systems.

UNIT IV AIRCONDITIONING AND PRESSURIZING SYSTEM 9

Basic Air Cycle systems – Vapour Cycle Systems, Boot-strap air cycle system – Evaporative vapour cycle systems – Evaporation air cycle systems – Oxygen systems – Fire extinguishing system and smoke detection system, Deicing and anti-icing system

UNITV AIRCRAFT INSTRUMENTS 9

Flight Instruments and Navigation Instruments – Accelerometers, Air speed Indicators – Mach Meters – Altimeters - Gyroscopic Instruments– Principles and operation – Study of various types of engine instruments – Tachometers – Temperature and Pressure gauges.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Demonstrate the ability to design a various system using pneumatic and hydraulic components.

CO2 : Keep abreast knowledge on various flight control system and its recent advancements.

CO3: Demonstrate the fundamental understanding of the operation of engine auxiliary systems.

CO4: To understand the various cabin comfort system used in aircraft modern display systems.

CO5: Describe the principle behind the operation of various vital parameter displays and its uses in effective conduct of the flight.

CO6: Describe the inspection procedure and troubleshooting on aircraft

TEXT BOOKS:

1. Mekinley, J.L. and R.D. Bent, Aircraft Power Plants, McGraw Hill, 1993
2. Pallet, E.H.J. Aircraft Instruments & Principles, Pitman & Co, 1993.
3. Irwin Treager, 'Aircraft Gas Turbine Engine Technology', Third Edition, McGraw Hill, 1997
4. Ian Moir and Allan Seabridge, 'Aircraft Systems – Mechanical, electrical and avionics subsystems integration', Second Edition, Professional Engineering Publishing Limited, 2001.

REFERENCE BOOKS:

1. Handbooks of Airframe and Power plant Mechanics, US dept. of Transportation, Federal, Aviation Administration, the English Book Store, New Delhi, 1995.
2. McKinley, J.L. and Bent R.D. Aircraft Maintenance & Repair, McGraw Hill, 1993.
3. Teager, S, "Aircraft Gas Turbine technology, McGraw Hill 1997.

U23AEP41	AERODYNAMICS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To make the students familiarize with the calibration procedures of subsonic and supersonic wind tunnel operations.
2. To enable the students, observe the pressure distribution over the various aerodynamics models.
3. To give students exposure to determine the various kinds of aerodynamic forces and moments acting on the floating bodies.
4. To make the students to learn the principles of various flow visualization techniques to observe the flow patterns of aerodynamic bodies.
5. To make students familiarize with the concept of drag estimation

LIST OF EXPERIMENTS

Thermodynamics Laboratory:

1. Calibration of a subsonic Wind tunnel.
2. Determination of lift for the given airfoil section
3. Pressure distribution over a smooth circular cylinder.
4. Pressure distribution over a rough circular cylinder.
5. Pressure distribution over a symmetric aerofoil.
6. Pressure distribution over a cambered aerofoil.
7. Force measurement using wind tunnel balancing set up.
8. Flow over a flat plate at different angles of incidence.
9. Flow visualization studies in low speed flows over cylinders.
10. Flow visualization studies in low speed flows over airfoil with different angle of incidence.
11. Calibration of Supersonic Wind Tunnel.
12. Flow visualization studies in Supersonic flows.

Any 10 experiments will be conducted from above 12 experiments

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1	Subsonic Wind tunnel	1
2	Models (aerofoil, rough and smooth cylinder, flat plate)	2
3	Angle of incidence changing mechanism	1
4	Multi tube Manometer	1
5	Pitot-Static Tubes	1
6	Cylinder models (Rough and Smooth)	2
7	Wind Tunnel balances (3 or 6 components)	1
8	Smoke Generator	1

9	Water flow channel	1

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 : Calibrate both low speed and high speed experimental facilities.

CO2 : Identify variation in flow physics due to geometrical modifications and orientations.

CO3: Estimate the various forces and moments acting on aerodynamics bodies.

CO4: Demonstrates the different aspect flow patterns of the aerodynamic bodies.

CO5: Predict and analyse various forms of drag and their contributions.

CO6: Explain the viscous interaction in Various flows

U23AEP33	AIRCRAFT SYSTEM LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To train the students "ON HAND" experience in maintenance of various air frame systems in aircraft and rectification of common snags.
2. To enable the studnts to understand the performance characteristics of various aircraft engine control systems.
3. To train the students , Demonstrate the operation of aircraft and engine system
4. To make students familiarize in the inspection procedure and troubleshooting on aircraft.
5. To make the students to learn the construction and working principle of conventional aircraft systems

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.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1	Serviceable aircraft with all above systems	1
2	Hydraulic Jacks (Screw Jack)	5
3	Trestle adjustable	5
4	Spirit Level	2
5	Levelling Boards	2
6	Cable Tensiometer	1
7	Adjustable Spirit Level	1
8	Plumb Bob	1

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1: Perform ground handling procedure for aircraft maintenance.

CO2 : Carry out alignment and symmetry of aircraft.

CO3: Check the pressure variation in aircraft systems

CO4: Test the functions of aircraft systems and maintenance of various air frame systems.
CO5: Identify the problems occurrence and rectifications.
CO6: Recognizes performance of brake and torque produce

		L	T	P	C
U23AEP32	**PROPULSION LABORATORY**	**0**	**0**	**4**	**2**

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To determine the flow behaviour of free and wall jets.
2. To visualize the shock pattern in supersonic flow.
3. To provide an idea of wall pressure distribution on inlets and nozzles
4. To perform testing on compressor blades and basic knowledge on cold flow studies.
5. To develop the ability to analyze and interpret the experimental data using software

LIST OF EXPERIMENTS

1. Study of aircraft piston & gas turbine engines
2. Velocity profile of free jet and wall jet
3. Conduct the performance test on a propeller.
4. Wall pressure measurements of subsonic diffusers
5. Measure the pressure variation on an aero engine compressor
6. Cascade testing of compressor and turbine blades.
7. Flame stabilization studies using conical and hemispherical flame holders.
8. Measurement of burning velocity of Pre-mixed Flame
9. Performance test of a Reaction turbine.
10. Wall Pressure measurements of nozzle.
11. Conduct the performance test on Ramjet
12. Velocity and pressure measurements high speed jets.
13. Flow visualization of supersonic flow.

Any 10 experiments will be conducted from above 13 experiments

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl no	Name of the Equipment	Quantity
1	Jet engine	1
2	Piston engine	1
3	Propeller blade	1
4	Compressor blade set	
5	Turbine blade set	
6	Hemispherical & Conical flame holder model	1
7	Ramjet facility	1
8	Convergent and C-D nozzle model	1
9	High speed Jet facility with compressor and storage tank	1
10	Supersonic Wind tunnel with Pressure scanner, Schlieren, and high-resolution CCD camera flow visualization	1

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 :	Explain the basic fundamental concepts in jet propulsion and hands on experience on jet engine
CO2 :	Analysis the performance of the propeller
CO3:	Measure the wall pressure of the engine components
CO4:	Understand the flame stabilization and Propagation of Pre-mixed Flame
CO5:	Get practical exposures on flow visualization techniques pertaining to supersonic flows.
CO6:	Demonstrate the fundamental concepts of low speed and high-speed jets and experimental techniques pertain to measurements.